As veterinary practices have become more modern, sophisticated and technologically advanced, so has our ability to perform veterinary dentistry to a much higher level than was ever thought possible. Through specialization of the profession and a wider availability of these specialists, we are able to offer our clients’ referrals for more advanced care to board certified veterinary dentists. As veterinary technicians and veterinarians we need to be completely aware of what kinds of dental care and treatments are available, and when to offer a referral instead of opting for more basic dental care in hospital.

The primary concern that we often see in dogs and cats is periodontal disease; however if teeth can be salvaged instead of extracted through periodontal surgical techniques and home care, then through these treatments we could benefit the patient over the long term, to retain important teeth for their function.

Dental radiographs
Radiographs must be obtained to fully assess the extent of any suspected bone loss. Evaluation of a full set of intraoral dental radiographs will help determine the success of any proposed advanced dental procedure, as well as give the veterinarian a baseline to monitor the progress of treatment. If your veterinary practice does not have the ability to obtain those dental radiographs and the client is interested in advanced dental care and saving teeth rather than extraction, then considering referral from the onset may be in the best interest of the patient.

Advanced periodontal therapy
Larger and more important teeth can be difficult to extract even with significant periodontal disease, which can result in horizontal or vertical bone loss, furcation bone loss and tooth mobility due to loss of attachment. When we look at teeth through clinical observations and measurements as well as radiographically, we must assess the true extent of the pathology. A tooth can be evaluated on a root by root basis as well as an individual side of each tooth root. A tooth with significant bone loss (>50%) on a tooth root’s surface may have a very poor prognosis even with advanced periodontal surgery, especially if the bone loss is all the way around the root or what is called a four-walled defect.1, 3 The area in between a multi-rooted tooth’s roots is called a furcation and if the bone is lost from this area it reduces the success of an advanced procedure even further.1, 3

Total attachment loss
This is the sum of the measurement of any gingival recession on the root’s surface, as well as any pocket depth beyond that gingival recession. If gingival recession is not present then it is just the measurement of any periodontal pocket depth beyond what may be considered to be a normal sulcular depth for that specific tooth, in that specific pet’s mouth. This differs depending on the size of the animal, size of the tooth and length of the tooth root specifically.

In order to measure total attachment loss you must use a periodontal probe with clearly marked 1mm increments and measure from the marginal gingival edge to the bottom of the sulcus or periodontal pocket if there is attachment lost.1, 3 The bottom of the sulcus is normally attached to the tooth’s surface at or very near to the cementoenamel junction (CEJ). When attachment is lost at this point a periodontal pocket is created and a pathological process begins. The periodontal probe should be used with a gentle hand, in line with the vertical axis of the tooth and walked around the tooth’s structure recording measurements in at least four places around each tooth root. Whenever these measurements are greater than what would be considered a normal sulcular depth around that particular tooth, the measurement should be recorded on the patient’s dental chart.1

Conditions such as gingival enlargements further diagnosed by histopathology as gingival hyperplasia, can create a false pocket depth and not true attachment loss so careful measurement of the excess gingival tissue and noting if the bottom of the sulcus is at the CEJ is important to determining the extent of attachment on these teeth.1

If the bone loss or total attachment loss is <50% and there is not significant furcation involvement, or less than a four walled defect, it may be possible for advanced periodontal surgical techniques, frequent follow up care (possibly under anesthesia) and daily homecare which is a commitment that the client must make when attempting to “save” important or strategic teeth.

If a periodontal pocket depth exceeds 5mm, it is recommended that open root planing: RP/O (root planing-open) be performed with the use of flap surgery to facilitate the visualization of the bony defect and exposed root surface and allows the practitioner to treat the area to the best of their ability to get the best possible outcome from periodontal therapy.1

If the periodontal pocket depth is less than 5mm, root planing-closed can be performed (RP/C). This technique involves the use of a hand curette instrument below the gingival margin, adapted to the surface of the root that requires cleaning. Using the sharp blade of the curette, we want to carefully remove the bacterial laden debris from the cementum of the root surface. Thus improving the health of the local periodontal tissues and smoothing the rough root surfaces allowing the re-attachment of the periodontal ligament as possible.
The use of any curette involves four basic steps:

1. Holding the curette in a modified pen grasp, create a fulcrum by placing your ring finger near the tooth area to be instrumented but not in the “line of fire” to avoid the blade cutting your finger.
2. Insert the curette with the face of the blade in the “closed position” face towards the tooth root, this allows for adaption of the curette beyond the calculus below the gingival margin.
3. Rock blade handle so as to bring the terminal shank into a parallel position to the root, thus engaging the sharp edge of the blade into the root surface.
4. Working stroke: pull the instrument in either a vertical direction towards the crown tip, oblique direction across the crown or horizontal direction.
5. Readapt and repeat the motions in overlapping strokes to ensure the cementum of the root is free from bacterial laden debris and smooth to the touch of the instrument.

**Periodontal bactericidal ultrasonic debridement**

The final step in ultrasonic cleaning. A specially made periodontal tip insert is required for this procedure or some dental ultrasonic units are already equipped with a tip that can be safely inserted sub-gingivally. Please consult your ultrasonic equipment manual regarding which tips are safe to insert under the gum line into the sulcus, and at what setting the machine should be turned down to, reducing the frequency of vibrations to a safe level for this purpose.

Periodontal bactericidal ultrasonic debridement occurs due to the ultrasonic sound waves causing microscopic bubbles to form and then implode in the gingival sulcus, cavitation. These implosions can cause the bacterial cell walls to be disrupted and along with the water rinsing through the area at a certain pressure further reduces the concentration of bacteria within the space.

**Advanced periodontal flap surgeries**

Techniques to perform flap surgeries are fully described in several dental text books and can be learned by veterinarians at wet labs taught by veterinary dentists on the subject, however if surgical procedures are indicated that are beyond the practitioner’s skill level then referral may be the preferred option.

**Apically repositioned flap**

This technique can be used to help attached gingiva lay over any remaining alveolar bone, it requires that there is at least 2mm of gingiva to extend towards the crown. This surgery moves the gingiva down onto the root surface after the area is cleaned of unhealthy bone, granulation tissue and debris; and then the area is allowed to heal. This procedure can be performed on mandibular incisors to allow for a reduction in periodontal pocket depths, allow for daily cleaning by the client and to allow easier cleaning of areas of furcation exposure on multi-rooted teeth.

Contraindications for this procedure would be >50% bone loss especially on a four-walled defect, grade three (3) tooth mobility and the presence of less than 2mm of attached gingiva before surgery.

**Laterally positioned (pedicle) flap**

**Indications**

When the root surface of a single tooth is exposed significantly due to a cleft that extends to or near the mucogingival line.

**Contraindications**

Tooth mobility due to loss of bone on more than one wall of the alveolar socket, furcation bone loss or lack of commitment on the client’s part for daily homecare and more frequent follow up professional dental care.

Carefully created and planned vertical releasing incisions, and the creation of a donor flap which is moved laterally over the area and sutured, is required for this technique. The goal is to partially cover this exposed root surface and allow for at least 2mm of attached gingiva to help preserve the health of this particular tooth, the area of tissue that is exposed from the donor site will heal in by second intention.

**Free gingival graft**

Indicated in specific individual teeth with a cleft like defect that are free of endodontic disease and tooth mobility is not present.

Contraindicated if endodontic disease is the cause and endodontic disease is not treated first. Concurrent periodontal disease must be treated and controlled, if there is tooth mobility the success of this technique will be poor. Success will also depend on the client’s willingness to perform daily recommended homecare and follow up treatment with the veterinarian.

In this procedure a gingival graft is obtained from a donor site separate from the site to be treated and often on the buccal surface of attached gingiva over the maxillary canine, this site offers the largest expanse of tissue. The donor graft is carefully harvested using a template and careful technique is used to avoid damage to the periosteum under this split thickness of tissue. The donor tissue is then used to graft over the recipient site with careful surgical techniques that are fully described in dental surgical texts.

**Guided tissue regeneration**

The goal of this type of advanced periodontal therapy is to help facilitate the development of cementum on the root’s surfaces and the regeneration of healthy periodontal attachments. Barrier membranes that are either absorbable or non-absorbable are specifically
positioned to prevent granulation tissues from invading the area and to allow bone and periodontal ligament cells to develop in the area where they have been destroyed by periodontal disease.\textsuperscript{1}

The use of bone inductive materials can assist in such procedures where significant bone has been lost in two and three walled bony defects, and areas of class two (F2) furcation bone loss in multi-rooted teeth.

\textbf{In summary}

Basic uses of dental hand curettes, as well as knowledge of dental, periodontal anatomy and treatment techniques that will help regain attachments and healthy periodontium, are very important to the improvement of oral health in our companion animal patients. Further techniques for periodontal therapy using these hand instruments, should be pursued in a dental lab format as well as further reading on the subject.

\textbf{References}

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Dental Radiographs: Tips and Tricks
Benita Altier, LVT, VTS (Dentistry)
Pawsitive Dental Education
Prosser, WA

How to obtain veterinary dental radiographs
When you are first learning how to obtain a radiograph of diagnostic quality it is important to understand the basics of patient, film or digital sensor and primary x-ray beam positioning.

By creating a standard for patient position, sensor position and then the resultant x-ray beam position will become almost standard as well to minimize all of the variables that come into play when getting the angles correct. This creates a method for obtaining dental radiographs that is easy to repeat with each patient.

Remember this formula:

A+B+C=D

Animal position (A) + X-ray beam (B) + Sensor(C) = (D) Diagnostic image

It is also important to understand how the basic settings on your x-ray unit functions and how to manipulate these settings to obtain the best exposure for that particular patient and teeth to be radiographed.

Each x-ray unit may be a little different however, commonly used modern dental radiographic machines take a lot of the guess work or the necessity of developing a technique chart, out of the process by having a computer aided control panel that has easily set parameters based on the species and tooth to be exposed.

Digital sensors require much less radiation exposure than dental film packets do, so make sure if you are using a digital sensor that you set the exposure time at the appropriate place for a starting point. Slight changes in the exposure time will be made during the whole mouth series when we are x-raying areas with more or less bone and soft tissues since the machine is pre-set at a KVP and MA for dental uses already.

Note
Canine Patients at minimum will need a series of 10 to 23 exposures for a full mouth series, more if the patient is larger or you are using a size 2 digital sensor for large teeth.

Feline Patients at minimum will need a series of eight (8-10) exposures for a full mouth series.

Step 1: Patient positioning: (A)
Positioning of the patient is very important when you are first learning to radiograph oral structures. If you always position the patient the same way when you are obtaining maxillary teeth or conversely mandibular teeth, then the angles that you will use with the primary beam (PID) and the analog dental film, PSP or digital sensor in the mouth, will usually coincide with the patient position.

Placing the patient in ventral recumbency is the best position for all maxillary exposures in the canine and feline patient. Have the patient lie on its chest with the head resting about 3-6 inches above the table top either placed on a 3 x 5 plastic container filled with sand and sealed shut (I recommend a 500mL plastic irrigation saline bottle that has squared sides), this works very well to rest the chin or head of most patients on it to elevate the head up off of the table top surface. The goal here is to make sure that the hard palate is as parallel to the table top surface as possible. Make sure the head is resting as flat as possible on the “container”, the chin should neither be tipped up nor down.

Dorsal recumbency is the preferred position for all mandibular exposures. When you are ready to move the patient to this dorsal position, carefully turn the patient on its back ensuring that you do not twist the endotracheal tube. Try to make sure that the most ventral edges of the mandibles are as close to parallel to the table top surface as possible. This may require that you roll up a small towel and place it comfortably under the patient’s neck to make sure again, that the chin is neither tipped up towards the ceiling or down towards the table top.

Step two: Placement of the digital sensor in the patient’s mouth (C)
The placement of the digital sensor in the mouth is done in a specific way. The flat surface of the sensor is towards the primary beam. The sensor should be placed fully in the mouth with the edge of the sensor at the edge of the crowns in many cases; the cord from the sensor should always be directed toward the front of the mouth and should come out of the mouth towards the nose of the patient in between the mandibular and maxillary incisors.

Step three: X-ray beam angles (B)
When we are exposing the film, phosphor plate or digital sensor to the x-ray beam we want the resultant image to be a true representation of the root and crown structures size and dimensions. Incorrect angulations of the primary beam will distort the image.
much as our shadow is distorted on the ground when the sun “primary beam” is too high overhead or too low towards the horizon. When the primary beam is bisecting the vertical axis of the tooth root or as in the case of the sun beam and our upright body at just the right angle the resultant “shadow” that is cast on the ground (from our body) or on the film, PSP plate or sensor from the tooth structures is just the same height as the tooth (person’s body) in question.

Place the digital sensor in the patient’s mouth at the area to be radiographed with the edge of the sensor at the edge of the crown(s); most of the sensor will be inside the patient’s mouth. We are trying to project the roots onto the sensor so we need plenty of room in which to do that. The sensor will lay from palate to crown naturally, no need to make the sensor flat or parallel to the palate.

Obtaining dental radiographs in the most efficient and quickest way possible is both in the best interest of the patient and the dental provider. This author prefers to start with the maxillary incisors, move on to both maxillary canine views, and obtain all of the pre-molars and molars on one maxillary quadrant and then move on to the opposite maxillary quadrant. Then the patient is rotated to dorsal recumbency; the mandibular canines and incisors are obtained together if possible and then the side views of the mandibular canines and the first and second pre-molars on each side of the rostral mandible in the dog, then the remaining mandibular pre-molars and molars are obtained on each side respectively to finish the whole mouth series on the canine patient. This technique minimizes the changing of the vertical angle of the x-ray beam as much as possible as each exposure is obtained. The feline patient whole mouth series follows the same progression with fewer exposures due to the smaller mouth and fewer teeth to x-ray.

Vertical angle: The angle that can be dialed in on most machines, this controls the length of the tooth as it appears on the resulting digital image.

Horizontal Rotation: This is the movement of the x-ray tube head in a horizontal direction around the patients head. 0 degrees is pointing at the midline of the head from the nose; 90 degrees is pointing at the midline of the head exactly perpendicular to the midline of the head. All other angles are more or less than those two horizontal rotations. Example: 30 degrees, 70 degrees, 110 degrees horizontal rotation.

When exposing the maxillary incisors you will need to adjust the vertical beam to 70 degrees, the cone (PID) of the x-ray unit will fit down right over the patient’s nose in many cases for this exposure. Horizontally the beam will be rotated to point at the midline of the patient’s head at 0 degrees.

Always keep in mind that when you get to the maxillary canine tooth roots that they are at a more horizontal angle and very far back in the patient’s mouth compared to the maxillary incisors. You will need to change the angle of the vertical beam to avoid foreshortening of these roots to 60 degrees. You must take two separate exposures at a horizontal rotation to each side of the face at 70 degrees, this will result in an image of each maxillary canine tooth because you cannot obtain one view and see both root apices clearly due to the probable superimposition of the pre-molar teeth on the roots of the maxillary canine teeth.

All maxillary pre-molars and molars can be obtained with a vertical angle of 45 degrees and horizontal rotation of the beam from 90 degrees for the ‘05’06’07, to 110 degrees horizontal for the ‘08’09’10.

The mandibular canines and incisors can both be viewed in one exposure unless the crowns are desired and then two individual exposures may be required. A nearly parallel technique can be used with the primary beam oriented directly above the tooth roots and the sensor parallel to the roots and the ventral edges of the mandibles and the PID is at a vertical angle of 75-80 degrees and horizontal rotation of 0 degrees.

When exposing only the mandibular incisors, pull the sensor more rostral in the patients’ mouth with the edge of the sensor at the edge of the most coronal aspect of the crowns, again the primary beam will be at 70 degrees vertical and 0 degrees horizontal.

In the feline patient, the zygomatic arch of the maxilla can be superimposed over the maxillary pre-molars, by decreasing the vertical angle to 40 degrees and rotating the beam horizontally to about 80 degrees, just slightly less than the 90 degree mark you will find that the zygomatic arch appears to be more like a ghost over the pre-molar teeth and much easier to interpret.

Parallel technique

This is the simplest technique in veterinary dental radiology and is commonly used for the mandibular pre-molar and molarteeth307, 308,309,407,408,409 in the cat and the 407, 408,409,410,411,308,309,310,311 teeth in the dog. The digital sensor is placed in the oral cavity with the patient in dorsal recumbency. The sensor is as close to parallel to the tooth/teeth roots as possible. This allows us to focus the primary beam at a more perpendicular angle directed right through the bone/teeth at the sensor and get an image that closely represents the true size and dimensions of the structures without elongation or foreshortening.

By adjusting the angle of the primary beam slightly up (the patient is in dorsal recumbency) over the mandibular bones at 40 degrees and slightly caudally or distally in a modified oblique position you will have much success in obtaining all of the roots on your mandibular exposures in the feline patients. You should have teeth 307,308,309 in one exposure and teeth 407,408,409 in the other exposure for each mandibular quadrant.

Some more difficult exposures to obtain such as the 310,311 or 410,411 molars in dogs require a similar adjustment to the primary beam at 10 degrees with a distal tube shift to 100 degrees horizontal rotation, when you can only push the sensor so far back in the patients’ mouth due to limitations caused by bony structures or soft tissues. It is very important that the sensor follow the mandibular bones caudally so that the resulting image is strait and the last molar tooth is visible.
S.L.O.B. rule
Whenever we are obtaining exposures of teeth with multiple root apices we need to be able to differentiate one root from another root. Superimposition of one root on top of another root hinders our ability to make diagnostic decisions for that tooth.

There is a rule that helps us to obtain a radiograph of a tooth such as the maxillary fourth pre-molars #108 and 208 in the cat and dog and to shift the image such that the mesial-buccal root and the palatal root are no longer superimposed upon one another.

*Same Lingual Opposite Buccal* means that when we shift the primary beam from being at a direct angle focused on one tooth to an oblique position going through the tooth/roots to the sensor, the palatal tooth root will follow the shift of the primary beam. The palatal tooth root can be described as lingual since it is more toward the tongue, so that is why the word “lingual” is used in this rule.

The most common method is to take the primary beam and shift it to 110 degrees caudally or distally. The resultant image will show the distal root where it is in a caudal location, the palatal root will now be in the middle and the mesial/buccal root will be the most rostral on the sensor’s resulting image. Conversely if the beam is shifted horizontally to 70 degrees rostrally then the resultant image will show the palatal root in the most rostral position, the mesial/buccal root in the middle and the distal root will be superimposed over the first molar position.

Keeping the patient in a constant position while obtaining all of the maxillary views with a standard setting for the vertical x-ray beam and ensuring that the sensor is in the correct position in the patient's mouth to accept the image that we are projecting toward it is a very simple and repeatable concept. Check to make sure the patient is in the same position with every exposure, and then setting the patient into a standard position in dorsal recumbency for the mandibular views will greatly speed up the efficiency and accuracy of obtaining diagnostic dental radiographs.

**Diagnostic image (D)**
What is a diagnostic image?

There are some basic requirements for our images of dental structures to be diagnostic. For every image obtained ask yourself these questions.

1. Did I get the tooth or teeth desired on this image?
2. Did I get 100% of the root structures of these teeth on the image?
3. Did I get at least 3mm of bone visible around each apex of each root on the image?
4. Did I get at least 3mm of crown structures beyond the horizontal margin of alveolar bone?
5. Is the image the correct length? Did I elongate or foreshorten the tooth structures?
6. Is the exposure correct? Is the image too dark or too light?
Dental instruments range from power instrumentation such as that of the dental delivery unit which may house many different handpieces such as the high-speed, low-speed, air-water syringe, the ultrasonic scaler and maybe even suction. A stand alone motor pack can be used for low-speed work and you can also use a separate ultrasonic scaler unit instead. Fine tipped sharp hand instruments are also an important part of thorough and complete veterinary dentistry.

These items will all need care and maintenance to ensure their proper function, safe use and longevity. The veterinary dental technician should perform daily safety checks on the power equipment, provide the maintenance that is recommended by the manufacturer’s guidelines and clean the equipment in between patients to prevent cross-contamination and ensure infection control.

**Handpieces**

High and low-speed dental handpieces need care and maintenance. These are the hand held air or motor-driven pieces to which we attach the prophy angle, dental burs for cutting and drilling or contra-angles or reduction gear angles to do more advanced dental procedures. The use of an approved lubricant is recommended by most manufacturers; it may be in the form of a spray or liquid. This lubricant is placed in the smaller of the two holes in the bottom of the handpiece, and then the handpiece is reinserted and screwed on to the cord and then operated for 20-30 seconds to distribute the lubricant into the working parts in the hand piece.

This should be done as often as recommended by that particular handpiece’s manufacturer.

The dental delivery system may require that dilute bleach and water solution or a manufacturer approved solution be run through the water lines in the system without the handpieces attached to remove the bio-film or bacteria that builds up in the water containers and the water lines. Check with the manufacturer before you perform this kind of maintenance for the unit’s specific requirements.

Clean the outside of the hand pieces with 70% isopropyl alcohol to remove debris, then the hand pieces may be autoclaved if desired.

**Scaler tips**

The scaler tip should also be cleaned to remove debris and then can be autoclaved to ensure sterility in between patients. Each scaler tip comes with a guide that will help you determine when the tip needs to be replaced due to wear down. If a tip loses even 2-3 millimeters of length, it is much less effective than it should be. Piezoelectric type scaler tips are less expensive than the magnetostrictive stack type inserts, however due to the higher frequency that the piezoelectric tip operates at, wear down will occur and it will need to be replaced much more often.

Ferrite rod inserts are easily broken if accidentally dropped so the hospital should always have an extra replacement rod on hand if you are using this type of scaler.

The leaves of nickel alloy in the magnetostrictive type insert should be inspected daily for any fractures in the stack or separations at the base of the insert. If these are detected, the insert will need to be replaced. It is a good idea to have an extra insert on-hand to replace a broken or damaged insert without interrupting the quality of patient care during a procedure.

**Fine hand instruments**

Scalers and curettes require daily care and sharpening to maintain a useful instrument. The fine metal blade edges of these instruments should be kept sharp at the proper angulations and undamaged. Damage can occur due to dropping the instrument, improper use of the instrument or incorrect sharpening techniques.

It can be very helpful to have a new instrument kit handy for a quick comparison when you are discerning if an instrument is damaged, incorrectly shaped or angled at the working end. You can quickly replace an instrument that has been damaged or worn beyond repair with these extra instruments without having to wait for an ordered instrument to arrive.

**The parts of the scaler and the curette**

When holding an instrument to locate the parts of the instrument, first locate the terminal shank and orient it so that the terminal shank is perpendicular to the floor, the face of the instrument is up towards the ceiling and the toe is pointing towards your nose when you look at the instrument. When holding a curette this way, the handle will often be angled out to one side or the other when the terminal shank is perpendicular to the floor.

- **Handle**: This is the part of the instrument on which we place our thumb and fingers for the main grip to hold the instrument. Different sizes, weights and textures are available. Dental scalers and curettes are double ended so the handle is in the center of the instrument extending on each side to the instrument’s working ends.
- **Shank**: This is the next portion of the instrument on each end. It is made of metal and depending on the type and use of the instrument.
- **Terminal/Distal Shank**: Farther down toward the working end, the terminal shank is where the instrument attaches on each end of the double-ended instrument.
- **Blade**: The working end or tip of the instrument. It is a mirror image of the opposite end.
- **Face**: The top surface of the blade end of the instrument.
- **Back**: This surface is directly opposite of the face surface; it is rounded on a curette and pointed and triangular on a scaler.
- **Toe/Tip**: The final tip of the instrument on each end, rounded on a curette and very pointed and sharp on a scaler.
- **Heel**: The heel is the opposite end from the toe/tip of the blade.
- **Cutting Edge**: The edge where the face and the sides of the working end of the instrument meet forming a sharp edge that is used in removal of dental calculus.

On Universal type curettes and scalers the terminal shank attaches at a 90 degree angle to the blade or working end of the instrument. Area specific type curettes called Graceys have an offset attachment at 70 degrees and only have one cutting edge on the lower side.

It is important to understand where the cutting edge is on each instrument if you are planning to sharpen it!
Instrument sharpening: Goals

1. Keeping the instrument’s cutting edges sharp enough so that the operator can be effective with each working stroke at removal of calculus without a tremendous effort and to avoid burnishing the calculus on to the dental surfaces.
2. Maintaining the instruments integrity, original shape and function as much as possible.

Scalers that are to be used on the coronal surfaces above the gingival margin have two blade cutting edges, one on each side of the working end. The tip of the scaler is not blunted but kept at a sharp point; just the sides of the instrument’s working end are to be sharpened.

Curettes are to be sharpened in a similar manner, however care should be taken to make sure that each cutting surface is sharpened at the proper angle and that the tip or “toe” of the instrument is “blunted” or rounded off at each sharpening to prevent obtaining a sharpened tip that would not be appropriate to insert subgingivally because it would lacerate sulcular attachments.

There are two main methods used for sharpening instruments with a sharpening stone:

1. Moving stone- stationary instrument method
2. Stationary stone-moving instrument method

The choice of method depends on the operator and what they find easiest to use.

- Required items for instrument sharpening: Coarse and fine stones
- Arkansas stone (fine grit): This is a fine grit stone that is used for instrument maintenance and finishing or after re-contouring with a course grit stone if that is necessary. This stone does not remove as much metal when used so it is not appropriate for use when an instrument is very dull or needs to be re-contoured.
- India stone (medium grit): These stones are more coarse in grit and helpful when more metal removal is required to re-contour or sharpen an excessively dull instrument.
- Honing stone oil: Both types of stones require that special honing stone oil be placed on the face of the stone before sharpening and gently wiped into the crevices of the stone. Be careful not to remove all of the oil when spreading it across the stone with a finger or paper towel. When the oil is on the stone it protects the stone from the metal shards embedding in the stone and shortening the life of the stone, and the oil reduces friction.
- Ceramic stone: (Not required): Ceramic stones are not as commonly used in sharpening veterinary dental instruments, however if this stone is what you have available to use, it is a fine grit stone (not as useful for reworking or reshaping a dull instrument) and requires water as a lubricant not honing oil.
- Care and disinfection of the sharpening stones: Stones can be autoclaved if desired, however instrument sharpening should take place after the instrument has been cleaned with water and an approved cleaning solution, dried and autoclaved. The heat from the autoclave will dull metal instruments so sharpening after autoclaving is recommended. Autoclaved instruments used on the sharpening dental stones should not contaminate the dental stones which should eliminate the need for autoclaving the stones unless they are used to sharpen instruments during dental procedures.
- Stone shapes and sizes: The most common size for the flat Arkansas stone is one inch wide by four inches long. This is a good size for most people to hold in their hands when sharpening. The India stone should also be a flat type of stone, larger in size; approximately 1 ¾” X 4 ½” long with a rounded side and a contoured sloping edge on the other long side. Using a conically shaped Arkansas stone on the face of the instrument will be the last quick step in the sharpening procedures. All stones are easily broken if dropped so care should be taken to ensure a firm grip on the stone and the stones should be kept in a cushioned container when not in use to prevent damage.
- Acrylic test stick: This round short piece of plastic about the size of a straw is used to “test” the hand instrument’s cutting edges for sharpness both before and after the sharpening procedure. The cutting edge of the instrument should “bite” into the acrylic stick when engaged slightly. It should not bounce off the test stick.

Moving stone-stationary instrument method

1. Hold the instrument very steadily on the edge of the counter top with the terminal Shank perpendicular to the floor at 12 o’clock and the tip or toe pointing towards the operator.
2. Immobilize the instrument by bracing the instrument on the edge of the counter and resting your lower arm on the counter top.
3. Hold the oiled stone face towards the side of the working tip of the instrument at approximately 70 degrees or at 1 o’clock or 11 o’clock. The stone is then moved using an up and down motion, ending on a down stroke to sharpen the cutting edge of the instrument. Sharpening should be done by moving from the heel of the instrument at first and then more towards the tip or toe of the instrument last.
4. When sharpening a curette with a blunted toe the operator must take the stone and bring it forward in an up and down motion around the toe at a 70 degree angle to make sure it is blunted and not sharpened into a point. Always end on a down stroke.
Universal curettes have a cutting edge on both sides of the instrument so you can keep the instrument in the exact same position and just move the stone to the opposite edge and repeat the process on that cutting edge.

1. The conical stone is then oiled and rolled over the face of the instrument a couple of quick times to remove any metal filings off of the cutting edges or face of the instrument.
2. The instrument is then turned over, repositioned, stabilized and the stone is repositioned in the other hand so that the cutting surface(s) on the other end may be sharpened in a similar way.

If you do not have a guide to help you position the instrument, then the terminal shank should be as close to lined up with 12 o’clock (90 degrees) on an imaginary clock face as possible. The angle off of that for the stone should be at or near 70-80 degrees for universal curettes and scalers but not for Gracey curettes. Gracey curettes are off-set already at 70 degrees so you will need to line the stone up with the one cutting surface at or near 50-55 degrees and only sharpen the lower side not both sides.

A protractor or a paper guide can be tremendously helpful in visualizing the above angles.

Methods of sharpening dental elevators and luxators

Usually a stationary stone-moving instrument technique is employed to sharpen these tools.

It is very important for the instrument's working end to maintain its shape and integrity. Using a method that sharpens the back side of the edge of the instrument will avoid removal of the wings on a winged elevator and prevent thinning of the instruments cutting surface which could weaken the end of the instrument over time.

1. Place stone on table and hold stone with one hand to keep it stationary. Drop a couple of drops of sharpening oil on the stone and smooth this over the surface.
2. Place side of working end on stone, pointer finger on top. Handle at table top. Holding instrument firmly in hand.
3. Raise handle to 45 degrees off of the table.
4. While rotating the working end under in a fashion on the stone that draws a "smile" on the stone. Rotate palm up and sharpen all the way around the back side edge of the elevator or luxator, then go back over the "smile" to the beginning position.
5. Use care not to press down too hard when you start the movement, when you get to the palm up position with the pointer finger under the instrument you will automatically not be putting as much force on the stone with the instrument.
6. Maintain the 45 degree angle off of the stone's surface through-out the whole movement.
7. After several passes across the stone in the "smile" format make sure to take the conical stone and run it through the face or concave side of the working end a couple of times to remove the "wire-edge" that will accumulate on the instrument.
8. Use your magnification to visually inspect the convex surface to insure even sharpening.
9. Use the Arkansas stone for daily sharpening and the India Stone for more aggressive sharpening and fixing metal spicules that may be on the instruments edge from misuse.

Mechanical sharpening devices

There are a few very nice mechanical sharpening devices available. Though the mechanical sharpeners are more expensive initially, they have the advantage of taking the positioning guess work out of the technique to produce consistently sharp and correctly angled instruments.

- Rx Honing Machine® (This machine can even sharpen scissors!)
- http://www.rxhoning.com/sharpening-sets/
- Side-Kick® by Hu-Friedy®  www.hu-friedy.com

References


Oral anatomy and pathology

Before we can recognize what may be abnormal we need to have a full understanding of what is considered normal anatomy in the canine and feline patient’s mouth. Dental disease can affect the patient throughout the entire body due to bacterial shed from oral infection spreading through the bloodstream and affecting vital body systems and organs over the long term. A general physical exam and pre-anesthetic blood and urine testing and any other testing recommended by the veterinarian should ideally be performed prior to anesthesia to further assess the overall health and anesthetic risk for the veterinary dental patient.

Oral anatomy can be divided into soft tissues and bony or hard tissues. As we assess the veterinary patient we will assess both types of structures for any abnormalities. It is a normal tendency to focus on looking inside the patient’s mouth and focusing on the teeth when we are looking for oral disease; however we need to start by examining the patient’s head, skull and facial areas first and then moving on to the inner oral cavity.

Patient examination

On the conscious patient we want to begin by visually observing the head and face of the patient.

- Do we see any areas of swelling, inconsistencies or imbalances?
- We should notice the eyes of the patient, are they protruding out of the orbital sockets, and is there any ocular discharge, masses or drainages around the eye margins? Are the pupils dilated or constricted in a bi-lateral manner?
- Does the patient tilt the head to one side or the other?

Once a visual inspection of the head and neck has been performed then we can move on to palpate the structures of the skull and face.

- Palpate the bones of the skull, above and below the eye areas, over the cheeks and zygomatic arches.
- Palpate the mandibular bones from the mandibular symphysis to the caudal edge of the mandible and continuing on back to the temporamandibular joint on each side.
- Palpate the lips on all sides assessing for any swellings or signs of pain or discomfort.
- Palpate the mandibular lymph nodes and any other regional lymph nodes in the area.
- A visual inspection of the ear canals with an otoscope is an important part of the overall skull area exam.
- Does the patient respond appropriately to simple neurological tests done on the face and head?
- Assess the patient’s occlusion. This must be documented while the patient is either awake or just after induction of anesthesia prior to the placement of an endotracheal tube so that the mouth can be closed completely without any obstructions.

These same parameters should be re-examined once the patient is properly anesthetized, intubated and at a safe plane of anesthesia for examination. A much more thorough oral examination will take place at that time.

Inside the patient’s mouth we can further divide this area into two regions; the first region encompasses all of the soft tissues of the lips, which inside the mouth are covered by oral mucosa, called the buccal mucosa, which consists of stratified squamous epithelium. This area, called the vestibule, continues until it reaches the area demarcating the beginning of attached gingiva known as the mucogingival margin. The second region begins at the attached gingiva and extends medially towards the hard palate on the maxilla and from the mucogingival margin on the mandibles medial towards the tongue, this is called the oral cavity proper.

Anatomy of the teeth and surrounding structures

- **Alveolar Bone:** This is not the name of a particular bone but more of a descriptor of the bone that surrounds and supports the tooth structures in the mouth.
- **Alveolar Jugum:** This is the palpable alveolar bone that overlays a large tooth root such as the maxillary canine tooth.
- **Alveolar Margin:** This is the most coronal edge of the alveolar bone that surrounds the teeth; it consists of very dense cortical bone.
- **Attached Gingiva:** Covering the alveolar process this attached gingiva which is highly keratinized can withstand the forces of mastication.
- **Cementum:** Serving as a protective covering for the tooth root and a surface for the periodontal ligament fibers to attach, this calcified mesenchymal tissue is avascular in nature.
- **Cementoenamel Junction (CEJ):** This is the junction where the enamel from the crown surface of the tooth and the cementum that covers the root surface of the tooth meets.
- **Crown:** This is the portion of the tooth structure that is supragingival or above the gingival margin when erupted. It is covered with a very hard substance called enamel.
• **Dentin:** This substance consists of hard calcified tissue containing tubules and makes up the greater volume of the inside of the tooth. Overtime the dentin becomes thicker as the patient ages. Dentin surrounds the pulp chamber and root canal’s blood and nerve supply and fuses with the cementum on the inside of the tooth root and the enamel on the inside of the tooth crown.

• **Enamel:** This is the smooth and shiny surface that covers the coronal aspect of the tooth and serves to protect the dentin from the environment of the oral cavity. It consists of hydroxyapatite crystalline compounds and is the hardest substance in the body. Once the enamel is destroyed or lost it cannot be regenerated.

• **Free Gingival Margin:** The most coronal edge of gingival tissue and circumnavigates the tooth crown and forms the gingival sulcus. It is not attached to the tooth’s surface.

• **Gingival Sulcus:** This is the area that lies between the marginal gingiva that is resting against the crown of the tooth but is not attached and the tooth crown itself. We use our periodontal probe to explore the gingival sulcus for loss of attachment at the bottom of this sulcus where the normal attachment should be.

• **Junctional Epithelium:** At the base of the gingival sulcus this tissue is the beginning of the attachment of the attached gingiva to the alveolar bone. This should be located at or near the cementoenamel junction. Care should be taken not to destroy this attachment when cleaning the patient’s sulcus.

• **Mucogingival Junction (MGJ):** The line that demarcates the transition from the attached gingiva to the alveolar mucosa.

• **Odontoblasts:** These cells line the pulp cavity and produce dentin throughout the tooth’s life which causes the dentinal walls to thicken as the tooth ages. This decreases the size of the pulp canal over time.

• **Occlusion:** The positional relationship between the maxillary teeth and the mandibular teeth when the mouth is in a fully closed position.

• **Periodontal Ligament (PDL):** These ligaments attach the tooth via the cementum on the outside of the tooth root in many directions to the bone that lines the tooth’s socket. Consisting of cells, collagen fibers and nearly 70 percent water these ligament fibers play a significant role in the tooth’s capability to withstand the daily forces of chewing.

• **Periodontium:** The periodontium are the structures that support and surround the teeth themselves. It consists of the alveolar bone, attached gingiva to the mucogingival junction, the periodontal ligament fibers which attach the tooth root to the tooth socket and also the cementum which is the outside covering of the tooth root.

• **Pulp Cavity:** Containing the highly vascular and nerve tissues; this cavity can be further divided into the root canal in the root section of the tooth and the pulp chamber in the crown section of the tooth.

• **Root:** This is the portion of the tooth structure that is below the gum line or subgingival, the root is covered with a substance called cementum and should be firmly attached to the alveolar socket by periodontal fibers. These periodontal fibers run from the alveolar bone to the cementum on the root surface acting like shock absorbers when the pet masticates and the teeth need to move in the socket slightly as this process of chewing occurs.

• **Dental Directional terms:**

  - **Mesial:** This refers to the tooth surface that is directed toward that of the first incisor in the quadrant.
  - **Distal:** This surface is the surface that is opposite to the mesial surface.
  - **Lingual:** This is the tooth surface that is closest to the tongue.
  - **Palatal:** This is the surface that is closest to the palate. Usually used with maxillary teeth only.
  - **Caudal:** Refers to structures or moving in the direction towards the back of the mouth.
  - **Rostral:** Refers to structures or moving in the direction towards the front of the mouth.
  - **Apical:** In the direction of the apex of the tooth root.
  - **Coronal:** In the direction of the tooth crown.
  - **Labial:** Surface towards the lips of the patient.
Charting the patient’s oral structures
Now that we have a better grasp on how to properly do an orofacial exam on the conscious and also anesthetized patient we need to understand the techniques involved and methods of proper documentation of the findings on a dental chart using the American Veterinary Dental College’s (AVDC) website www.avdc.org, method of abbreviations and notations.3

It is important to have and use a complete dental chart that allows us to document findings in a three dimensional way to create an overall picture of all sides of the tooth and root structures below and above the gum line. Having a pre and post treatment image of the mouth structures is also an important step to help follow treatment over time and to ease the documentation and readability of the chart.

The chart should also have a place to document the patient’s signalment, hospital and practitioner information, date of charting and treatment, skull type, occlusion, periodontal disease, plaque, calculus, gingivitis and notations regarding regional anesthesia.4

Instrument required for charting
Periodontal probe and explorer
This instrument on one end is used for measuring periodontal pocket depths, loss of gingival attachments, extent of gingival hyperplasia and furcation bone loss. A shepherd hook explorer is used as a tactile instrument to further assess for any defects in the enamel or exposed dentin surfaces, the cementoenamel junction and/or exposed root surfaces if any. A probe and shepherd hook explorer is often a double ended instrument.

Charting should be performed in a systematic and consistent fashion each time. The practitioner should start at the midline and working in quadrants document all findings as thoroughly as possible, noting all abnormal findings on the chart at their location using the buccal, coronal or palatal/lingual view to illustrate. Using the AVDC abbreviations as necessary to document certain conditions and findings, further defines our charting.

Once the dental chart has been completed for the pre-treatment pathology then a plan can be made for further diagnostics and treatment of the patient’s oral cavity. Further diagnostics such as radiographs, will assist in the proper documentation of structures that we cannot visualize below the gingival margin.

If a tooth appears to be missing because the crown is not present in the mouth, a radiograph should be obtained and if the root structure is missing then the whole tooth can be circled as missing on the chart. If there is root structure still present then only the crown of the tooth should be circled on the chart. If a tooth is unerupted then it should be documented on the chart within the bone in which it resides.

The patient’s dental chart is a part of its permanent medical record and should be further documented with a written account of all pathology, diagnosis, radiographic interpretation, treatment or procedures performed, prognosis, client discussions, homecare recommendations, follow up care recommended and a long term plan for management and prevention of oral disease for that particular patient.

During the procedure a proper anesthesia record should be maintained including all drugs, doses and methods used for the general anesthesia, analgesia and any other drug therapy. A record of all anesthesia monitoring as it is documented should be kept during the procedure as well.

AVDC abbreviations
These abbreviations help us to document specific findings easily and allows us to communicate within the veterinary profession about these findings through a defined understanding of what each abbreviation means.

It is important to have an understanding of the differences in using the words: stage, index and grade. Each of these has a different meaning when we are discussing disease.

- Stage: This is used when we are discussing the extent of pathological lesions in a course of a disease that is likely to progress.3
- Grade: The quantitative assessment of the degree of severity of a disease or abnormal condition at the time of diagnosis, irrespective of whether or not the disease is progressive.3
- Index: The quantitative expression of predefined diagnostic criteria whereby the presence and/or severity of pathological conditions are recorded by assessing a numerical value.3

Below is a list of the most commonly used abbreviations in the general practice of veterinary dentistry.

Triadan numbering system
100=maxillary right 200=maxillary left 300=mandibular left
400=mandibular right
*Deciduous teeth are noted 500-800 starting at the animal’s upper right quadrant and moving clockwise.

Dogs have 28 deciduous teeth and 42 adult teeth
Cats have 26 deciduous teeth and 30 adult teeth
Remember the rule of 4’s and 9’s. 4’s=canines and 9’s =first molars
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Diagnostic</th>
<th>Treatment</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>Abrasion</td>
<td></td>
<td>Object caused tooth wear</td>
</tr>
<tr>
<td>ALV</td>
<td></td>
<td>Alveoectomy/Alveoloplasty</td>
<td>Bone removal or contouring alveolus</td>
</tr>
<tr>
<td>AT</td>
<td>Attrition</td>
<td></td>
<td>Tooth on tooth wear</td>
</tr>
<tr>
<td>ATE</td>
<td>Extrusion</td>
<td></td>
<td>Abnormal tooth extrusion</td>
</tr>
<tr>
<td>B</td>
<td>Biopsy( see specific types)</td>
<td></td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
</tr>
<tr>
<td>CA</td>
<td>Caries</td>
<td></td>
<td>Carious lesions</td>
</tr>
<tr>
<td>CB/C</td>
<td>Crossbite caudal</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>CB/R</td>
<td>Crossbite rostral</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>CEJ</td>
<td></td>
<td></td>
<td>Cementoenamel junction</td>
</tr>
<tr>
<td>CL/B/L/T/P</td>
<td>Chewing lesion</td>
<td></td>
<td>Buccal/labial/sublingual-tongue/palatal</td>
</tr>
<tr>
<td>CR/A</td>
<td>Crown Amputation</td>
<td></td>
<td>crown amputation/intentional root retention</td>
</tr>
<tr>
<td>CU</td>
<td>Contact Mucositis</td>
<td></td>
<td>contact mucosal ulceration</td>
</tr>
<tr>
<td>D</td>
<td>Diastema</td>
<td></td>
<td>open space between teeth</td>
</tr>
<tr>
<td>DT/P</td>
<td>Deciduous Tooth</td>
<td></td>
<td>Deciduous tooth/persistent</td>
</tr>
<tr>
<td>DTC/R</td>
<td>Dentigerous cyst R=removal of cyst</td>
<td></td>
<td>cyst defect around unerupted tooth</td>
</tr>
<tr>
<td>E/D</td>
<td>Enamel Defect</td>
<td></td>
<td>involves only the enamel</td>
</tr>
<tr>
<td>E/H</td>
<td>Enamel Hypoplasia</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>E/HM</td>
<td>Enamel Hypomineralization</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>GC</td>
<td>Gingival Curettage</td>
<td></td>
<td>Curettage of gingival lining only</td>
</tr>
<tr>
<td>GE</td>
<td>Gingival Enlargement</td>
<td>in the absence of a histopathology dx</td>
<td></td>
</tr>
<tr>
<td>GR</td>
<td>Gingival Recession</td>
<td>measured in millimeters</td>
<td></td>
</tr>
<tr>
<td>GV</td>
<td>Gingivectomy/Gingivoplasty</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>IO IO/R</td>
<td>Intraoral fistula O/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>LAC/R</td>
<td>Laceration LAC/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>MAL/1/2/3/4</td>
<td>Classifications of Malocclusions</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>OAF</td>
<td>Oroantral fistula OAF/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>OM</td>
<td>Oral Mass</td>
<td>Oral or maxillofacial mass: see <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>ONF</td>
<td>Oronasal fistula ONF/R-repair</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>PD 1/2/3/4</td>
<td>Periodontal disease</td>
<td>Stages of Periodontal disease</td>
<td></td>
</tr>
<tr>
<td>PRO</td>
<td>Professional dental cleaning</td>
<td>Scaling/polishing/irrigation</td>
<td></td>
</tr>
<tr>
<td>RCT</td>
<td>Root canal therapy-standard</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>RP/C, RP/O</td>
<td>Root planing Closed/Open</td>
<td>Root planing without or with visualization</td>
<td></td>
</tr>
<tr>
<td>RTR</td>
<td>Retained tooth root</td>
<td>tooth root remains</td>
<td></td>
</tr>
<tr>
<td>ST</td>
<td>Stomatitis ST/CS: Caudal stomatitis</td>
<td>See <a href="http://www.avdc.org">www.avdc.org</a></td>
<td></td>
</tr>
<tr>
<td>T/A, T/LUX</td>
<td></td>
<td>Avulsed or Luxated tooth</td>
<td></td>
</tr>
<tr>
<td>T/FX</td>
<td>Fractured tooth</td>
<td>See additional handout</td>
<td></td>
</tr>
<tr>
<td>T/NE</td>
<td>Near pulp exposure</td>
<td>See tooth fracture classifications</td>
<td></td>
</tr>
<tr>
<td>T/NV</td>
<td>Non-vital tooth</td>
<td>Tooth ceased to mature-dead tooth</td>
<td></td>
</tr>
<tr>
<td>T/SN</td>
<td>Supernumerary tooth</td>
<td>Extra tooth in the quadrant</td>
<td></td>
</tr>
<tr>
<td>T/SR</td>
<td>Supernumerary root</td>
<td>Tooth has atypical extra root</td>
<td></td>
</tr>
<tr>
<td>T/U</td>
<td>unerupted tooth</td>
<td>Tooth did not erupt-remains in bone</td>
<td></td>
</tr>
</tbody>
</table>
Classifications of tooth fractures

www.avdc.org

EI: Enamel Infraction (Craze lines)
EF: Enamel Fracture (enamel only)
UCF: Uncomplicated Crown Fracture (Does not involve the pulp/crown only)
UCRF: Uncomplicated Crown/Root Fracture (Does not involve pulp)
CCF: Complicated Crown Fracture (Pulp is open)
CCRF: Complicated Crown and Root Fracture (Open pulp both root and crown)
RF: Root Fracture

Tooth resorption

Type 1: Traceable periodontal ligament space, roots not resorbing
Type 2: Periodontal ligament space mostly absent, roots are resorbing (root by root basis)
Type 3: Combination of type 2 and type 1 in same tooth.
TR1: Mild loss of hard tissue * Cementum or cementum and enamel only.
TR2: Moderate loss of hard tissue that does NOT extend into the pulp.
TR3: Deep dental hard tissue loss that does extend into the pulp; most of the tooth remains intact and retains its integrity.
TR4: Deep hard tissue loss extending into the pulp: Most of the tooth has lost its integrity.
   TR4a: Both crown and root(s) are equally involved
   TR4b: Crown is more severely affected than the root(s)
   TR4c: Root(s) are more severely affected than the crown
TR5: Remnants of dental hard tissues are only visible as irregular radiopacities and the gingival covering is complete. (End stage tooth resorption).

References

www.AVDC.org/nomenclature
When we think of the words “a dental” which we have commonly come to know as really any dental care that is done under general anesthesia for our veterinary patients, we are really over simplifying what is, or should be, occurring when we undertake professional dentistry for animals.

Dentistry is a large discipline that requires its own specific set of skills, knowledge, correct instrumentation and equipment to accomplish prophylactic and therapeutic treatment. Extensive training and practice by the practitioner are required to ensure the correct methods are used to reduce or eliminate infection and pain in our patients’ mouths.

A thorough knowledge of anatomy and pathology as previously discussed is a starting point for the professional dental treatment of veterinary patients. Only after diagnostic methods have been employed by an oral exam, complete charting of the oral cavity and obtaining dental radiographs, can we determine the extent of the disease and create a treatment plan for the patient. When the diagnostics have been completed then the actual treatment can begin.

If there are no indications of periodontal disease, fractured teeth, tooth resorption, missing or unerupted teeth, supernumerary, crowding, mobile teeth or other situations that will need more advanced treatment, the dental prophylaxis can begin. Prophylaxis, which means the prevention of disease, really can only apply to healthy mouths that need to be thoroughly cleaned of any plaque and tartar to help prevent pathology that may develop if the plaque and bacteria that it contains is allowed to stay in contact with the oral soft and hard tissue structures.1

If the patient’s mouth is currently in a state of active disease such as that of periodontitis, where there is destruction of the periodontal ligament and alveolar bone occurring, this requires more extensive treatment which should correctly be called “Periodontal Therapy.”1

Periodontal therapy requires more involved and invasive treatment of pathology to bring their mouth back to a healthy state. This should be discussed with the client to help inform and increase understanding of why disease has already occurred and why treatment of this disease will require longer anesthetic procedures, possible tooth extractions and dedication to homecare procedures if the client desires to try and save teeth instead of having teeth extracted. Sometimes the periodontium has undergone such destruction that saving teeth even through more advanced methods is simply not a feasible option due to a poor prognosis for the tooth, lack of commitment to homecare or future anesthetic visits, to allow follow-up therapy to be performed.

General anesthesia is required for all veterinary dental patients and should be undertaken with all of the same precautions that would be allowed for any surgical candidate. Pre-operative blood/urine or other diagnostic testing should be performed and interpreted. An estimate for treatment should be presented to the client with a contingency plan for further authorization once the patient is fully evaluated under anesthesia and radiographs have been obtained. Prevention of hypothermia, hypotension or other anesthetic complications should be carefully assessed and steps should be in place to manage the patient as closely as possible to prevent any situations that could be avoided.

A multimodal pain management protocol should be taken into consideration as well, especially if periodontal surgery or extractions are part of the dental treatment plan. The use of regional dental anesthetic blocks is fast becoming a standard of care in oral and dental pain management when painful procedures are to be performed.

Use of a cuffed endotracheal tube is a must to prevent accidental aspiration of fluids or debris from the oral cavity into the airways. This tube should be monitored closely for any obstructions and the cuff should be checked again several minutes into the procedures to ensure a secure seal without causing any trauma to the trachea by over-inflation.

There are several steps involved in the Complete Professional Dental Prophylaxis, these are outlined below and will be discussed in further detail. If the patient is not in the prophylactic category then periodontal therapy and possible exodontics or extraction of diseased teeth will take place. We will discuss the dental prophylax first.

15 step oral evaluation and treatment

1. Oral exam on “conscious” patient: Evaluate occlusion as well as all soft and hard oral and facial tissues as much as possible.
2. Take “before” treatment photographs at this time.
3. Oral exam on anesthetized patient: rinse mouth with a 0.12% chlorhexidine oral rinse prior to this evaluation. Gross Calculus may need to be removed to allow for access to soft tissues.
4. Thorough charting and documentation of all oral structures. Attempt to locate any areas of concern or pathology: missing teeth, fractured teeth, periodontal pockets, mobile teeth, extra teeth etc.
7. Perform regional anesthetic blocks at this time if necessary.
8. +/- Periodontal Therapy and Exodontics.
9. Obtain post-extraction or treatment radiographs as indicated prior to suturing extraction sites.
10. Re-evaluate occlusion as necessary after extractions. Extubate and then re-intubate.
11. Clean all dental surfaces both supragingival and subgingival by instrumentation to ensure coronal and root surfaces are completely clean.
12. Polish all crown surfaces with fine grit prophy paste.
13. Irrigate all tissues and the periodontal sulcus with water and gently dry tooth surfaces with air to further evaluate that all areas are clean and free of debris, calculus and polish.
14. Take “after” treatment photographs
15. Optional treatments: Apply sealants such as Oravet™ or Sanos® to dry clean crown surfaces.

### Basic dental instrumentation

<table>
<thead>
<tr>
<th>Item</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explorer/probe:</td>
<td>Probe/explorer combination (UNC15/23) General use</td>
</tr>
<tr>
<td>Scalers-dog:</td>
<td>Towner/Jacquette Sickle Scaler</td>
</tr>
<tr>
<td>Scalers-cat:</td>
<td>Morse 0-00</td>
</tr>
<tr>
<td>Curettes-dog:</td>
<td>Gracey 1/2</td>
</tr>
<tr>
<td></td>
<td>Barnhart 1/2 Universal curette</td>
</tr>
<tr>
<td></td>
<td>Columbia 13/14 Universal curette</td>
</tr>
<tr>
<td></td>
<td>Columbia 4R/4L Universal curette</td>
</tr>
<tr>
<td>Curettes-cat:</td>
<td>Double ended NV series feline curette (Shorter working end is ideal for cats)</td>
</tr>
<tr>
<td>Sharpening kit:</td>
<td>India slip stone (for reworking instruments), Arkansas stone kit (daily sharpening), stone oil and plastic test sticks.</td>
</tr>
<tr>
<td>Power Instruments:</td>
<td>Ultrasonic scaler of either a piezoelectric, magnetostrictive stack insert or a magnetostrictive type with a ferrite rod insert. This scaler must have a water source to cool and irrigate the working end while in operation. It can be a stand-alone unit that is attached to a pressurized water bottle or integrated into a dental delivery unit that houses a compressor, which uses compressed air to drive the slow-speed handpiece, ultrasonic scaler, high-speed handpiece and air/water syringe.</td>
</tr>
<tr>
<td></td>
<td>Low-speed handpiece: The handpiece is either driven by an electric motor pack or integrated into an air driven dental delivery unit.</td>
</tr>
<tr>
<td>Prophy Angle:</td>
<td>This attaches to the low-speed handpiece and allows a prophy cup to be placed on the working end. This is used to polish the teeth after the cleaning. Disposable angles are important to prevent patient cross-contamination.</td>
</tr>
<tr>
<td>Prophy paste:</td>
<td>These should be single use individual cups of prophy paste, to prevent patient cross-contamination, which when used on the teeth following the ultrasonic and hand instrumentation of the tooth will reduce any microscopic grooves created in the enamel to eliminate a rough, plaque-retentive surface that can be created by scaling and curettage. These should be single use individual cups of prophy paste, to prevent patient cross-contamination, which when used on the teeth following the ultrasonic and hand instrumentation of the tooth will reduce any microscopic grooves created in the enamel to eliminate a rough, plaque-retentive surface that can be created by scaling and curettage.</td>
</tr>
<tr>
<td>Chlorhexidine Oral Solution: This 0.12% chlorhexidine solution is used to irrigate the oral structures to help reduce bacterial aerosolization exposure to the operator and bacteremia to the pet’s bloodstream.</td>
<td></td>
</tr>
</tbody>
</table>

### The fifteen step dental cleaning procedure with/without advanced care

**Step 1 : The basic oral/facial/skull examination**

This exam should occur in the awake patient. This helps us to create a treatment plan for the client prior to anesthesia. This is just the initial exam however. Please see the notes in the pathology and anatomy section.

**Step 2: Photographs**

With the use of a digital camera we can take before photos of the oral cavity and hard and soft tissues of interest so that we may offer the client a visual comparison.

**Step 3: Oral exam on the anesthetized patient**

This is a more thorough evaluation of the oral and facial structures including a complete occlusal evaluation. (Evaluate occlusion prior to the placement of the endotracheal tube on the sedated patient.)
Step 4: Charting:
Thorough documentation as previously discussed is a must in locating any areas of concern or pathology and working towards creating a plan for further diagnostics and treatment. The use of the instrument called the explorer/probe is necessary during this step. Also a dental mirror can further enhance our ability to visualize the areas of concern. Proper lighting and magnification will greatly increase our ease of recognition of oral structure abnormalities. A complete chart that allows full documentation of pre and post treatment with multi-directional views of each tooth will assist in complete and accurate documentation as well. Decontamination of the gross calculus may be necessary at this time to help facilitate correct charting.

Step 5: Radiology
As fully discussed in the radiology notes, this is an important step in further diagnostics and documentation of oral structures and should be obtained prior to commencing treatment. Some prophy pastes can be seen on radiographs so post-treatment radiographs should be obtained prior to the polishing step.

Step 6: Treatment plan
The creation of a treatment plan for each and every tooth. Paring the clinical findings from the oral examination, documented by charting and the radiographic findings to create this plan. If the plan is to truly perform only prophylactic procedures such as supra and subgingival cleaning and polishing then regional anesthesia and a more complicated treatment plan will not be necessary.

Step 7: Regional anesthetic blocks
These should be performed now and given a few minutes to take effect before more painful stimulus is caused by extractions or sub-gingival curettage.

Step 8: Advanced periodontal therapy, exodontics, endodontics or other procedures
Prioritize these procedures as directed by the veterinarian.

Step 9: Post extraction radiographs
As indicated by changes to tooth or bone structure these radiographs should be obtained prior to suturing the extraction sites to avoid the need to undo sutures to retrieve root or tooth structure that was inadvertently left behind during the extractions.

Step 10: Re-evaluate occlusion as necessary
This can be an important step if extractions of major teeth were performed to insure that there are no complications from the patients jaws closing more fully or if we are extracting teeth to alleviate any current malocclusion issues.

Step 11: Dental cleaning procedure
If the patient does not require any other procedures as outlined above then step 7 will be omitted. The dental prophylaxis consists of removal of gross calculus and then removal of all dental calculus from the crown surface or supragingival. The use of the ultrasonic scaler to do most of the major work and then the hand scalers to perfect the work are helpful for this.

The ultrasonic scaler, which operates at a vibration range of 18,000 to 45,000 cycles per second, is utilized to break up the calculus or tartar deposits on the coronal surface of the teeth. The instrument tip should be continuously in motion over the surface of the enamel in a cross-hatching pattern. Care should be taken to keep moving on to the next tooth and allowing each tooth to cool down in between sessions of cleaning. Ultrasonic vibrations can generate enough heat that if persistent can cause thermal damage and possible necrosis to a tooth’s vital inner blood and nerve supply. Water spray, in a fine mist, further reduces the heat that is created and should be sufficient and always in use. The water also helps rinse the debris off of the tooth as it is being scaled clean.

Subgingival calculus and plaque must be removed if there are periodontal pockets below the gingival margin. This is a very important step if truly effective dental cleaning is desired. If there is any debris left below the gum line in the gingival sulcus or in a periodontal pocket then the prevention of oral infection and disease will not be accomplished.

The use of curettes which can safely be inserted under the gingival tissues and into periodontal pockets is recommended. Due to the rounded back and toe of the curette, this instrument, which will reduce the likelihood of damage to the attachments at the bottom of the sulcus if used properly, should be used instead of a sharper pointed scaler.

Curettes must be held in a modified pen grasp, a fulcrum should be established, the instrument should be adapted to the surface to be cleaned, the blade of the instrument should be engaged and then the down or cleaning stroke performed. Overlapping strokes in different planes will ensure that the surface that needs to be cleaned will be completely cleaned.

Different variations of dental curettes are available and help with instrument adaption whether working in the most rostral portion of the mouth on incisors or adapting the instrument to caudal pre-molars and molars. Choosing the correct instrument for the area to be curetted is important to successful adaption, effective plaque and tartar removal and prevention of operator injury due to inappropriate handling of the instruments at awkward angles.

Periodontal bactericidal ultrasonic debridement is the final step in ultrasonic cleaning. A specially made periodontal tip insert is required for this procedure or some dental ultrasonic units are already equipped with a tip that can be safely inserted sub-gingivally.
Please consult your ultrasonic equipment manual regarding which tips are safe to insert under the gum line into the sulcus, and at what setting the machine should be turned down to, reducing the frequency of vibrations to a safe level for this purpose.

Periodontal bactericidal ultrasonic debridement occurs due to the ultrasonic sound waves causing microscopic bubbles to form and then implode in the gingival sulcus, cavitation. These implosions can cause the bacterial cell walls to be disrupted and along with the water rinsing through the area at a certain pressure further reduces the concentration of bacteria within the space.¹

**Step 12: Polish tooth crowns**

This important step helps to create a smooth, non-plaque retentive surface so that the teeth will remain free of plaque.³ Polishing can remove any plaque that was missed during the scaling and curettage phase of cleaning and helps to remove stains from the enamel.¹ This requires that a prophy cup, usually a fairly soft cup, be attached to the working end of a disposable oscillating prophy angle. This is attached to the slow-speed handpiece either on the motor pack dental unit or the air-driven dental delivery unit which rotates at between 1,000 to 3,000 rpm.³ The oscillating disposable prophy angle reduces excessive heat from being generated by rotational forces on the tooth surface and also prevents the patient’s hair from winding around the angle when in use near the patient’s hair on the lip or cheek areas.¹ Disposable, one-use prophy paste cups further prevent patient cross-contamination from the alternative of a multi-use large container of paste.¹ Metal non-disposable prophy angles can be used but generally are not oscillating and require cleaning and maintenance to keep them functioning correctly.

Ample prophy paste should be applied or rubbed onto the tooth surface via the non-spinning prophy cup prior to commencing polishing. It is the prophy paste and not the cup that does the actual smoothing of any enamel defects so this is an important step. By smoothing the paste on the teeth in quadrants prior to polishing you avoid spraying as much prophy paste around the mouth and onto the operator. The use of prophy paste helps to reduce the friction on the surface and minimizes the heat that is generated as well. The choice of prophy paste will depend upon whether fluoride is desired and the grit of the paste required.¹, ², ³ Standard paste is either fine or medium grit and usually contains fluoride.³ Course prophy paste can be used to remove stains from the enamel, however it will remove more enamel and also should be followed up by a fine paste as the ending step to polishing.¹, ²

All coronal surfaces, buccal, palatal or lingual, mesial and distal should be polished in a systematic fashion by starting at the most caudal teeth and working towards the midline or central incisor in each quadrant. The prophy cup should be applied to each surface with only enough pressure to slightly flare the cup out onto the surface and into the gingival sulcus area.¹ Thermal damage to the tooth pulp can occur if the oscillating prophy cup is kept on the tooth for more than a few seconds.

**Step 13: Irrigation of sulcus and teeth**

The gingival sulcus is a prime place for left over debris to accumulate after a thorough dental prophylaxis or periodontal therapy has been performed. If this debris is allowed to stay in the sulcus it will act as an irritant and source of further inflammation or possibly even a periodontal abscess in the future.¹, ³

Potential debris is dental calculus, cellular debris, prophy paste and plaque containing harmful bacteria. We must gently lavage this debris out of the sulcus either by using the three-way syringe on our dental machines to use air and water together to rinse all of the prophy paste and debris from the crowns and sulcus. In addition to this, we may choose to utilize a 6-12 cc syringe filled with a 0.12% chlorhexidine gluconate oral solution and rinse the sulcus around each tooth completely with a 22-28g blunt tip needle or cannula.¹, ²

**Step 14: Post treatment/cleaning photographs**

These digital images along with images of the dental radiographs if applicable can be shared with the client along with the pre-treatment photos to further illustrate the remarkable difference that dental prophylaxis, periodontal therapy or more advanced dental treatment can make for their pet. These can be printed out in color for the client to take home, shared with the client via e-mail or sent to a specialist for their evaluation if necessary to help facilitate future treatment and care. Photos and radiographs also help us to follow visual changes in the patient’s dental health over time. These serial photographs can really show a client the progression of disease if we neglect homecare or professional cleanings.

**Step 15: Application of dental sealant products or fluoride if indicated: Fluoride foam**

Application of fluoride foam is controversial but may have some benefits to patients, such as decreased tooth sensitivity especially if dentin is exposed on the coronal or root surfaces because it acts to seal exposed dentinal tubules, an anti-plaque and antibacterial effect because it inhibits bacterial metabolism; and it can help the enamel resist decay.¹ Cavities in dogs are rare and extremely rare in cats so this may not be a viable reason to apply fluoride in our veterinary patients.¹ The down sides to using fluoride are possible toxicity if chronically used in higher than recommended doses and the interference of fluoride with certain restorative, bonding or sealing agents.¹, ³

If fluoride is applied it should be applied to cleaned, polished, lavaged and dried tooth surfaces. The fluoride foam should be allowed to remain in contact with the enamel or dentin for 3-5 minutes, after that it should be carefully wiped off with dry gauze, do not rinse fluoride foam off with water because it will inactive the fluoride.³
Oravet™ Sealant
Merial Oravet™ is a non-toxic waxy polymer that is applied to the clean and dry tooth surfaces of both cats and dogs. The professional application is of higher viscosity than the thinner homecare kit. It is the base application for the prevention of dental plaque adherence to the enamel surfaces of the tooth crowns. It should be applied up under the gingival margin on the surfaces of the crown and in the sulcus to prevent plaque from accumulating under the gum line. The manufacturer recommends that the client begin the homecare kit applications two weeks after the initial professional application to keep the thickness of sealant in place on the enamel surfaces.

Sanos®: AllAccem, Inc
Sanos® is a product that was developed to help improve gingival health and prevent periodontal disease by providing a liquid bandage like barrier that when applied to the gingival sulcus stays in place for up to 6 months. It has a V.O.H.C. (Veterinary Oral Healthy Council) label for prevention of plaque and tartar accumulation and it prevents gingival inflammation that may be caused by the plaque bacteria invading under the gingival margin. It is easily applied to clean and dry teeth and gingival sulcular surfaces with the brushes in the kit. It dries quickly and is clear to slightly opaque in color. It is non-toxic and approved for use in both cats and dogs.

Note: If the practitioner plans to use Sanos® on the teeth and gingiva then a fluoride application is not recommended.

References
4. www.vohc.org
5. www.fda.gov/ForConsumers/ConsumerUpdates
It is important to understand that ear disease is only a symptom (no more specific than “pruritus”). As Dr Flemming Kristensen stated “A patient showing ear problems is a dermatology case until proven otherwise”. As Dr James Noxon brilliantly observed- the challenge is not only to find the “WHAT” is causing the otitis but the “WHY” do they have otitis. The technician can help in many ways determine both the WHAT but also the WHY, beginning with a detailed history. an

Specific questions that should be asked include:

1. When did the symptoms first occur? This is an important question, because many owners will only tell you when this current episode of symptoms occurred, not the very first time it occurred;
2. Other than the problem the owner presents the patient for, you must ask all owners if the dog has EVER had problems with excessive licking, scratching, chewing, biting or rubbing. Has the dog ever had ear problems before this episode? If so, when, with what medication and what was the response to treatment;
3. Where does the dog live- indoor, outdoors, both? Describe the environment, especially the outdoor environment;
4. Is the dog on heartworm and flea preventative? If so, what product, how often is it administered and is it year round or seasonal?
5. Are there any other pets in the household? If so, what kind and are they symptomatic. If they are cats, do they go outside?
6. Are any of the humans in the household showing “new” skin problems? If so, what kind;
7. Do they board the dog, take him to obedience school, training or to the groomers? If so, when was the last time?
8. Do they know if the parents of the dog or any siblings have ear or pruritic skin problems? If so, what was done and what was the response?
9. What does the dog eat?
10. How do the ears seem today- is today’s presentation the best, worse or average since the problem began?
11. Do you notice if the symptoms were better, worse or no different or not sure between the different seasons.

In addition to obtaining the history, the technician should be sure that other information is readily available to the veterinarian. This would include having the age, breed and sex information in the record and if the dog has had previous ear or skin problems- GET A COPY of medical records from the previous veterinarian. Many times treatment can be expedited by reviewing what previous treatments and tests were prescribed and the response.

The veterinarian will then do complete physical examination since some times there are systemic signs associated with otitis externa (fever associated with pemphigus, lethargy associated with vasculitis, etc) This is followed by a complete dermatologic examination. Because ears are really just skin attached to the skull many diseases that affect the ears frequently will affect the rest of the skin and vice versa. Therefore even when a dog is presented only for otic disease the veterinarian will still need to examine the rest of the body. And the opposite also holds true, when a dog is presented for skin disease the veterinarian will also do an otic examination.

Now diagnostics and treatment needs to be pursued. As mentioned previously when dealing with a cause of otitis we want to know WHAT is causing the otitis and WHY did it occur. To understand the differences it is helpful to divide factors that are involved in otitis into predisposing, primary and secondary factors.

Primary (underlying) cause(s) of the ear disease (the WHY) . These would include:

- Parasitic (including Demodex, Otodectes, Sarcoptes);
- Foreign bodies;
- Hypersensitivities- 80% or more of the dogs with atopic dermatitis (food or environmentally triggered) have otitis externa (NOTE OE may be the ONLY symptom in 3-5% of the environmentally triggered atopic dermatitis cases and

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it may be UNILATERAL!!; it may be seen in cutaneous adverse food reactions where it too may be the ONLY symptom in up to 20% of the cases and also may be unilateral or flea allergy dermatitis. In cases of FAD there should be involvement of the posterior 1/3 of the body in addition to the OE;

- Allergic or irritant contact dermatitis;
- Endocrinopathies, keratinization or sebaceous gland disorders leading to an altered lipid layer in the epidermis, alteration in normal keratinization or glandular function; idiopathic seborrhea (is there such a disease?) - Hypothyroidism is commonly cited as a cause of otitis externa. It has been stated that "Recurrent bacterial and yeast infections of the skin and ears often occur secondary to hypothyroidism and may be the only presenting signs,"6 The author refers the reader to a textbook that makes this statement.6 If you look at that reference you see that this is the 6th edition of a dermatology textbook and in that textbook the reference is the 5th edition of the same textbook. The 5th edition references the 4th and the 4th edition references the 3rd edition10,11,12 When you further investigate the reference you find that the original reference is NOT about hypothyroidism but about hyperthyroidism in mice and the effect of administering sheep RBC to mice. So the bottom line is there NO EVIDENCE that otitis externa will be the only clinical sign associated with hypothyroidism.;
- Autoimmune or immune mediated diseases (eg pemphigus complex, vasculitis- note these diseases involve the pinna canals);
- Zinc responsive dermatosis (will involve more than the pinna);
- Juvenile cellulitis;
- Immunosuppressive diseases (distemper, FeLV, FIV, parvo virus);
- Neoplasia (adenoma, adenocarcinoma) ;
- Dermatophytosis (affects the pinna rather than the ear canal).

In addition to identifying the primary cause, secondary factors must be addressed if possible. Secondary factors don’t cause ear disease but increases the risk of developing ear disease and may make successful treatment more difficult. Secondary factors are: anatomical factors (eg- long pendulous ears in the Basset Hound or stenotic ear canals in Shar Peis); excessive moisture in ears (swimming); and iatrogenic trauma (plucking hairs from the ear canals, cleaning ear canals with cotton tip applicators).

Lastly perpetuating factors must be identified and treated (the WHAT). These factors don’t initiate the problem, but will cause the disease to continue, even with the elimination of the primary factor, once it has been established until these factors have also been addressed. Perpetuating factors include:

- Bacteria (coci most commonly Staphylococcus intermedius (acute infections), beta hemolytic streptococci and rods most commonly E. coli, Pseudomonas spp (chronic infections); Proteus spp, Klebsiella spp and Corynebacterium spp);
- Fungi (Malassezia pachydermatis (which may cause a hypersensitivity reaction so that small numbers may be significant) );
- Progressive pathological changes;
- Otitis media;
- Contact hypersensitivity/irritant;
- Treatment errors (most commonly due to under treating the infection).

Laboratory tests are a necessary component to the proper workup of a case of canine ear disease and once again the technician is invaluable in performing these tests. CBC, serum chemistry profile, urinalysis, skin scrapings, fungal culture, endocrine testing and skin biopsies may be necessary depending on what the differential diagnoses are for that patient. Cytologic examination of a roll swab sample should be performed on any discharge. The numbers & type of bacteria, yeast and inflammatory cells should be quantitated. In cases of OE the question of what is an abnormal number of organisms, per oil field, has not been settled. Depending on the study, cutoff numbers, per oil immersion field, that differentiates between normal and abnormal ears ranges from >1 Malassezia to >4


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Malassezia and from >1 bacteria to >10 bacteria.13,14 It is the author’s opinion that the number of organisms present to be considered significant is not just a “number”. The author doesn’t perform cytology on normal ears – it is only done if the ears that are inflamed or have exudate. Therefore ANY organism seen will be considered significant and will be treated as part of the therapy regardless of the number present. Since many times we will select our favorite otic product for the initial treatment of otitis externa, the question may be raised, why do the cytology if you are going to use your first line product in most cases anyways?. The key reason is if there are WBC or rods on the initial cytology I will ALWAYS do a follow up cytology regardless of the appearance of the ear canal since these never should be present in a normal ear. Otherwise the only time cytology is performed during therapy is when the ear is not clinically normal. If there is a single population or a mixed population of organisms (cocci, Malassezia) present at the initial examination without rods or WBC’s and the ear is clinically normal at the recheck examination, follow-up cytology is not performed. In a report evaluating otitis clinical score, it was concluded that cytology was unable to differentiate between normal and affected ears and also that cytology failed to identify clinical success in otitis treatment.15

With the information gathered above, the treatment is directed toward the primary cause(s) (eg parasiticidal treatment, food trial, intradermal testing and allergen specific immunotherapy, etc) and perpetuating factors. Ear cleaning is performed in the clinic with a bulb syringe or by retrograde tube flushing with a red rubber tube (under anesthesia). If on the initial examination the ear canals are swollen and painful, ear cleaning may not be performed on the first visit, preferring to use topical glucocorticoids (GC) and systemic GC for 10-14 days to decrease the swelling. Once the swelling has decreased it will be much easier to examine the ear canals and visualize the TM.

Cleaning agents contain substances that soften and emulsify wax and lipids. This initial cleaning is necessary in order to remove debris that may interfere with the effectiveness of topical agents and to reduce inflammatory debris (bacterial toxins). The author doesn’t usually have the owner do cleaning after the initial exam since it seems that many owners have trouble with just medicating the ear, let alone cleaning too. Many of the cleaners have a low pH leading to discomfort if used in an inflamed ear. A study comparing 2 ear cleaners (original formulation and then a new formulation) noted that in 38% of the cases with the old formulation the ear, let alone cleaning too. Many of the cleaners have a low pH leading to discomfort if used in an inflamed ear. A study comparing 2 ear cleaners (original formulation and then a new formulation) noted that in 38% of the cases with the old formulation and 37.5% of the cases with the new formulation dogs had a moderate to marked avoidance to having the cleaner instilled.16 This behavior was believed to be due to either a reaction to the ear cleaner or just overall animal irritability. Also the base in the otic ointments/suspensions (mineral oil, liquid paraffin) acts as a ceruminolytic agent. In addition, a recent study calls into question whether any of the ear cleaners have any ceruminolytic activity.17 In this study the ceruminolytic activity of 13 ear cleansers was evaluated using a standardized synthetic cerumen (SSC) that mimics the composition and texture of canine cerumen. Of the tested products only Cerumene®, Epiotic® and Vet Solutions Ear Cleaner® are available in the US. The test products were incubated with mild agitation for 20 min with 500 mg of SSC previously compacted at the bottom of a test tube. Ceruminolytic activity was then assessed by quantifying the SSC removed by decantation. Overall, Otoclean® (OT) was most efficacious, reaching an activity of 86–90% followed by Netural® (NET) with a 39%, Specicare® (SP) with a 23% and Cerumene® (CE) with an 8% ceruminolytic activity. None of the other products displayed any ceruminolytic activity. It was concluded that, in the experimental conditions used in this study, only 1/13 products had significant ceruminolytic activity. Please note that the company that manufactures OT funded this study. A follow up study by Robson, et al using Australian and US products revealed that 15/24 cleaners had <5% efficacy while only 6/24 ear cleaners had >80% efficacy-none of which are available in the US.18 Lastly a study was performed to test the efficacy of the 4 ear cleanser products compared to distilled water. Only the product manufactured by the study’s sponsor performed better than distilled water.20

15 Nuttall, T. and Bensignor, E. (2014), A pilot study to develop an objective clinical score for canine otitis externa. Veterinary Dermatology, 25: 530–e92
19 Robson D, Morton D, Burton G In vitro ceruminolytic activity of 23 ear cleaners against standardised synthetic canine cerumen: preliminary results Australian College of Veterinary Scientists Dermatology Chapter Science Week Proceedings 2008: Neoplasia, Oncology and Otitis
To the author’s knowledge there are no studies showing that ear cleaning has any impact on the treatment or prevention of otitis externa. However, there is a study that evaluated the efficacy of a dermocorticoid administered twice weekly in the ear canal as a long term maintenance measure to prevent recurrence of OE in dogs with atopic dermatitis. Twenty atopic dogs with relapsing (>3 episodes/year) bilateral OE were included in the study. After successful treatment of otitis externa with a topical antibiotic-antifungal-corticoid combination, dogs’ left and right ears were each randomly allocated to either an ear cleansing maintenance regimen once weekly or the same regimen followed by application of three drops of 0.0584% hydrocortisone aceponate in the ear canal two consecutive days per week. The dogs were examined on day 30 the q 60 days. At the end of the 6 month study it was determined that the probability of remaining free of relapse was 95% in group B (cleaner plus 2 consecutive days/week of a dermocorticoid) compared to 50% in group A (median time to relapse: 90 days) (P < 0.01) after 6 month. The authors concluded that twice weekly hydrocortisone aceponate application in the ear canal provides an effective maintenance regimen to control canine allergic otitis. My comment is that cleaning was not effective when compared to cleaning PLUS the steroid. I suspect if they only did the steroid the outcome who have been the same but this was not evaluated in this study.

There is frequently a discussion of the ototoxicity of agents put into ears. Remember that it is inner ear damage, specifically vestibular and/or cochlear damage that occurs with ototoxic agents, not middle ear damage. In order to differentiate the inner ear from the middle ear, it is important to distinguish between the inner ear and the middle ear. The inner ear is the innermost part of the ear, and it contains the vestibular (oval) or cochlear (round) window(s).

In humans because ofloxacin otic solution (Floxin Otic®) is the only topical agent to be labeled by the U.S. Food and Drug Administration (FDA) for use when the tympanic membrane is perforated, oral antibiotics have traditionally been used in this situation. However, according to otolaryngologists because the risk of cochlear damage with the use of other topical medications seems quite small, perforation alone is not an indication for oral antibiotics.

The opinion of this author is that the concern for ototoxicity due to topical medications is overstated. This position is supported by a consensus panel on reviewing the use of ototopical antibiotics. In their report they stated “There have been very few irrefutable cases of ototoxicity reported (after proper use of a topical otic preparation). Under many circumstances, it is difficult to separate the underlying disease process, which is also known to cause ototoxicity, from ototopical drug use.” They go on to state “For more than 40 years, the most common treatment has been aminoglycoside combination drops. A longstanding debate over the safety of these drops centers on ototoxicity. Even though the theoretical risk exists, there have been few reported cases in the literature, considering the millions of doses given”.

The author has only seen one ototoxic reaction that was suspected to be due to a topical agent and in that case the TM was intact! Therefore, agents are chosen more for their effectiveness than the concern about ototoxicity, especially since there are very few agents that have been proven to be safe in cases of a ruptured TM. It is more important to get rid of the infection than to avoid (effective) drugs because of ototoxicity concerns. Also, just because the TM is intact doesn’t mean that the barrier function is complete, therefore, even in the presence of an intact TM it is possible to get drugs into the middle/inner ear.

In the author’s practice, technicians clean the ears and then will examine the ear to note if the ear canal is adequately cleaned – if so then the technician would have the veterinarian finish their otoscopic examination. In order to know if the ear canal is adequately cleaned the technician needs to know how to perform an otoscopic examination.

When performing an otoscopic exam, the first thing is to remember that the ear canal is “L” shaped. Due to this curve in the external ear canal, the ear canal must be straightened in order to see the horizontal canal and the tympanic membrane. This is accomplished by placing the tip of the cone of the otoscope in the opening of the external ear canal. As you advance the cone is proximally you need to pull the pinna laterally (outward). By “stretching” the pinna laterally into a straight line horizontally the ear canal becomes straight and allows examination of the horizontal canal and the tympanic membrane.

After the technician has verified the ear is as clean as he/she can get it, the veterinarian needs to evaluate the appearance of the “cleaned” ear canal to note changes as mentioned earlier in the lecture. It is also important to note if the tympanic membrane is visual and intact. If it is not visible, why is it not visible- is the ear canal too swollen? Is there a mass or a ceruminolith obstructing the ear canal? Is the dog too painful to allow thorough evaluation?

After ear cleaning topical agents are dispensed. The author prefers ointments over drops because of the impression that ointments get the drugs to the region of the tympanic membrane better than drops do (this may be a volume issue more than the formulation- it has been reported that it takes 1.0 cc of medication to get down to the TM in a medium sized (40 pound) sized dog - personal communication). The other advantage of ointments is that the base vehicle in the otic ointments (mineral oil/liquid paraffin) acts as a ceruminolytic agent.

Most topical products contain a combination of glucocorticoids, antibacterial and antifungal agents.

Before discussing a couple specific scenarios I want to address an under treated aspect of otitis- that is PAIN. If you have or someone you know has had an ear infection, you know how PAINFUL it is. We should not be examining or cleaning ears on dogs if there ears are painful without adequate sedation/analgesia!! The author has seen many dogs that were initially unmanageable when dealing with their ears that subsequently allowed otic examinations and treatments once the PAIN was gone.

Specific scenarios- note for any of the treatments the key to success is filling the ear canal with whichever product you choose to use. The recommended low volume (5-8 drops) of the otic product is a frequent cause for failure to respond to treatment.

Acute otitis (and/or infrequent) externa treatment overview. It is important to differentiate whether this is a first time occurrence, a recurrence or an unresolved infection. The only way to know this is to do follow-up examinations on ALL cases of OE. Remember that the absence of symptoms is not synonymous with resolution of the disease. This means that owners are unable to determine whether the infection is resolved and the dog must be rechecked. THIS IS WHERE THE TECHNICIAN CAN HELP RE-ENFORCE THE IMPORTANCE OF RECHECK EXAMINATIONS In cases of chronic (recurrent and/or Recurrent/unresolved/chronic otitis externa. These are impossible to differentiate without follow up examinations and will dictate the long term management of the disease. If it is unresolved is it because of owner compliance? If it is poor compliance then this problem must be resolved! If it is recurrent (or unresolved with good owner compliance) in addition to the above, a very aggressive search is performed to identify and treat the primary, perpetuating and secondary factors. Treatment should be for a minimum of 30 days.

As you can see the technician is an important team member in the management of otitis externa.
Marijuana is formed from the dried leaves and tops of the hemp plant (Cannabis sativa) (Svienska 2008). Marijuana has been a part of recreational, religious and medical activities of a variety of cultures for over 5000 years (Krietzer 2009; Burns 2006). Indeed, it was among the most commonly prescribed medications in the United States Pharmacopeia until declared illegal in the 1930s. It subsequently has been declared a controlled substance, Class I. No currently accepted medical use and a high potential for abuse. However, particularly with the legalization of medical marijuana in several states, this classification clearly no longer applies and Schedule II status is being promoted by advocates (High potential for abuse, but less than Schedule 1, with sever psychological or physical dependence; considered dangerous, but significant clinical indication). The potential efficacy of marijuana for control of pain has led to a passage of laws allowing medical use in several states. This, in turn, has stimulated a flurry of scientific activity in an attempt to provide evidence for medical use of marijuana. Not surprisingly, pet owners have also been engaged in the conversation, with a potentially legitimate reason for administering marijuana. Not surprisingly, most of the scientific information generated as evidence is intended to support human, rather than veterinary use. To understand the allure of marijuana, and specifically whether or not it is cultivated in or outdoors, when it is harvested and the conditions at harvest, and how it is dried and stored.

Marijuana ingredients

Marijuana is a pharmacologically (and toxicologically) diverse herb. Cannabis contains at least 480 unique compounds, with their presence varying with the plant product. Plant products include, in addition to marijuana, hashish and hashish oil, formed from the resin secreted by the plant. It is important to note that the amount of any one compound in the hemp plant can vary markedly, depending on the plant part.

The most well known of the compounds in the hemp plant are the cannabinoids, a term used to refer to a terpenephenoic compounds. The discovery of cannabinoids led to the recognition of the endocannabinoid system with endogenous cannabinoids. Since their discovery, both by pharmaceutical companies and substance abusers have synthesized synthetic compounds. “Phytocannabinoids” is thus used to refer to those occurring in the plant whereas “endocannabinoids” refers to endogenous and synthetic chemicals. Endocannabinoids also appear to be important as neuroprotectants (e.g., antioxidants, inhibition of calcium influx and excessive glutamate production), for example, that associated with CNS ischemia or hypoxia, or the presence of neurotoxicants. These effects appear to be mediated predominantly by CB1 (located particularly in the dorsal horn of the spinal cord) although CB2 also plays a role, depending on the tissue (Svizenska 2008). Cannabinoids also inhibit neuroinflammation (see therapeutic indications).

Close to 70 phytocannabinoids, divided into 10 classes, have been identified in the hemp plant, and particularly marijuana. Table 1 lists those associated with presumed therapeutic use (Brenneisen Ch. 2). Among the cannabinoiids compounds found in marijuana, THC is the most pharmacologically and toxicologically relevant, and the most understood. It is THC that is responsible for most of the natural effects of the Cannabis plant. It acts by binding to the CB-1 receptor. CBD is the next “best” phytocannabinoid. In addition to its anxiolytic effects, it also reduces unpleasant side effects, primary due to potent inhibition of cytochrome P450 3A11 which otherwise would metabolic THC to much more potent psychoactive compounds.

In addition to the cannabinoids, marijuana contains approximately 140 different terpenoids which are responsible for its scent. The terpenoids yield from a marijuana plant depend on the type of Cannabis (based on drug or fiber content), the part of the plant, its sex and age, whether or not it is cultivated in or outdoors, when it is harvested and the conditions at harvest, and how it is dried and stored. The serotonergic effects of marijuana (5-HT1A and 2A) may reflect the impact of these essential oils, contributing to analgesia and mood modification. Other components in the plant include nitrogen containing compounds (n = 70: alkaloids, amines); carbohydrates, including common monosacharides (n=13: fructose, glucose, mannose), selected disaccharides (sucrose, maltose), and several polysaccharides (eg, cellulose, pectin) as well as several sugar alcohols (n = 12: mannitol, sorbitol, glycerol). A number of flavonoids also are present (n=23); among them, apigenin has a wide variety of effects, including interaction with benzodiazepine receptors, resulting in an anxiolytic effect. Other ingredients include fatty acids (n=33) and others.

The target: Cannabinoid receptors

The endocannabinoid system is comprised of eicosanoid cannabinoid [CB; protein g coupled, negative to adenylyl cyclase] receptors [CBr], their endogenous ligands and the enzymes responsible for their synthesis and degradation. This system as a known contributor to physiology has been recognized for only about 25 years old. In general, the system contributes to homeostasis (Relax, Eat, Sleep, Forget and Protect); McParland 2014. At least two CBr have been identified in many species, including the dog. CB1r occurs in the brain but also occurs in some peripheral tissues (cardiovascular, reproductive, gastrointestinal). They are responsible, in part, for central and peripheral regulation of food intake, fat accumulation and lipid and glucose metabolism. The dopaminergic reward pathway is stimulated by CB1 receptors, motivating eating, smoking and substance abuse. CB2r are located principally on immune
cells, but this includes microglia. CB2 also is located on neurons where it may be associated with cell differentiation (Svizenska 2008). In the CNS, CB receptors are suggested to influence neurotransmitter release. At least 5 endogenous cannabinoids have been described, with anandamide (CB1 and 2 agonist, but higher affinity for CB1) being the most thoroughly studied. It is synthesized by post-synaptic neurons, acting as a retrograde messenger to influence neurotransmitter, and particularly GABA release. It is extremely unstable, being rapidly hydrolyzed to ethanolamine (an antimistamine) and arachidonic acid. Cannabinoids are able to disrupt short-term memory, impair cognition and time perception, alter mood while enhancing body awareness, discoordination, sleepiness, and reduce attention focus and the ability to “filter” irrelevant information.

As with many CNS active drugs, marijuana is associated with both tolerance (higher concentration needed to impart a similar pharmacologic effect) and withdrawal (a clinical syndrome of nervousness, tension, restlessness, sleep disturbance and anxiety). However, the long elimination half-life of the most active ingredient, THC (and others) appears to preclude a clear cut abstinence syndrome (Svizenska 2008). As with other addictive agents, laboratory rodents have been demonstrated to self medicate, suggesting an addictive component. It is important to note that although interaction with cannabinoid receptors is unique among plants to hemp, other receptors are also targeted (as noted above: benzodiazepines, serotonin, others). Cannabinoid deficiency has been linked as an etiology of a variety of illnesses: ("eCB deficiency syndrome") as an etiology in migraine, fibromyalgia, irritable bowel syndrome, psychological disorders, and others (McParland 2014).

Cannabinoid receptors have been studied in a limited fashion in dogs. Initial studies focused on relevance to humans and provide evidence that dogs may react with unique behaviors.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Proposed Therapeutic Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBGA (cannabigerolic acid)</td>
<td>Antibiotic</td>
</tr>
<tr>
<td>CBG (cannabigerol)</td>
<td>Antibiotic, antifungal, Antinflammatory, Analgesic</td>
</tr>
<tr>
<td>CBC (cannabichromene)</td>
<td>Antibiotic, antifungal, Antinflammatory, Analgesic</td>
</tr>
<tr>
<td>CBDA (Cannabidiolic acid)</td>
<td>Antibiotic</td>
</tr>
<tr>
<td>CBD (Cannabidiol)</td>
<td>Anxiolytic, antipsychotic, analgesic, anti-inflammatory, antioxicant, antispasmodic</td>
</tr>
<tr>
<td>CBN (Cannabinol)</td>
<td>Sedative, antibiotic, anticonvulsant, anti-inflammatory</td>
</tr>
<tr>
<td>THC (delta-9-tetrahydrocannabinol; delta-8 to a lesser degree)</td>
<td>Euphoriant, Analgesic, Anti-inflammatory, Antioxidant, Antiemetic</td>
</tr>
<tr>
<td>THCV</td>
<td>Analgesic, euphoriant</td>
</tr>
</tbody>
</table>

**Medicinal marijuana (?)**

The proposed indications for medical marijuana have included, but are not limited to behavioral, sleep and gastrointestinal disorders, neuroprotection, antispasmodic but prokinetic, anorexia, nausea, glaucoma, diabetes, immunosuppression, malaria, anti-inflammatory and, of course, pain (Table 1, Izzo 2009). However, other potential indications have included a proposed advantage of medical marijuana compared to a single drug (e.g., dronabinol, a synthetic THC (Marinol®)) is the multiple compounds contained in the plant. Two advantages are offered: 1. The compounds might act synergistically (a “synergistic” shotgun) to provide an enhanced desired pharmacologic effect while 2. at the same time, mitigating (one compound acting on another) undesirable effects. However, evidence for a synergistic benefit is lacking based on the lack of differences when THC is consumed as marijuana, versus Marinol® (humans). (Brenneisen 200X). Presumably, because marijuana contains so much THC, it may not be the most effective portion of the plant and it may contribute to more side effects (hence the question mark for this section; see also Marijuana and pets). Note that some plants may be designed to contain more or less of a specific target compound.

**Pain and inflammation/Immunomodulation**

The capacity for cannabinoids to control pain is among the most studied responses. They are effective in both acute (phasic) and chronic (tonic) pain. They peripherally and centrally modulate processing of nociceptive signals. They act as antihyperalgesics. CBD has demonstrated efficacy in experimental models; the effects also appear to involve transient receptor potentials (Izzo 2009). CBD also influences T-cells, causing a generalized immunosuppressive effect. A number of mechanisms of immunomodulation have been proposed, including altered interleukin or tumor necrosis factor production or release, neutrophil migration, production of specific antibodies, etc. Arthritis and psoriasis are among the chronic inflammatory diseases in humans for which CBD has demonstrated or is suggested to have some potential efficacy.
**Epilepsy**

Experimentally, CBD attenuates experimentally-induced seizures in animals; this may reflect reduced calcium fluxes (Izzo 2009). THCV also has been associated with some anticonvulsant effects by virtue of its inhibitory effects on CB1.

**Anxiolytic**

These effects have been demonstrated in healthy human volunteers (Izzo 2009). CBD exerts benzodiazepine independent effects, possibly by activating postsynaptic 5-HT1A receptors.

**Neuroprotection**

CBD is an antioxidant and as such has been proposed for treatment of Alzheimer’s disease, Parkinson’s disease and Huntington’s disease. Restoration of calcium homeostasis may prevent apoptosis (Izzo 2009). In rodents, CBD reverses brain damage associated with ischemia.

**Anti-Emesis/appetite suppression**

Again, CBD has been demonstrated in animal models to be effective for the control of vomiting otherwise not responsive to 5-HT3 antagonists. THCV and synthetic CB1 antagonists decrease food intake.

**Diabetes mellitus**

CBD inhibits development of diabetes in non-obese diabetic mice, including ameliorating clinical signs of disease. This appears to reflect, in part, control of pancreatic inflammation, but also reduction of oxidative stress in target tissues (e.g., retina).

**Bone formation**

A number of cannabinoids (essentially all in Table 1) stimulate mesenchymal stem cells responsible for bone formation and fracture healing. CBD also controls bone resorption, reducing bone loss (Izzo, 2009).

**Cancer**

A number of the cannabinoids (all in Table 1) have antiproliferative-anti apoptotic effects in a number of tumor cell lines. The National Cancer Institute has a link describing ongoing studies. [http://www.cancer.gov/about-cancer/treatment/cam/patient/cannabis-pdq](http://www.cancer.gov/about-cancer/treatment/cam/patient/cannabis-pdq)

**Antimicrobial**: CBC and CBG have demonstrated potent antibacterial effects towards selected microbes, including methicillin resistance staphylococci (MIC of 0.5 to 2 mcg/ml).

Finding evidence to support either the negative or positive effects of cannabis can be difficult because such information is often tainted with emotionally-mediated opinion. [PRO-CON](http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881) is a useful site that provides links to evidence using a categorical approach, as well as information on approval status among the states.

**Designer cannabinoids**

Several approaches are currently underway to bring cannabinoids to the medical arena. Hybrids typically of *C. indica* or *C. sativa* are developed with the intent of generating specific combination of properties designed for a specific purpose. [http://www.leafly.com/hybrida](http://www.leafly.com/hybrida) is a website that delineates over 550 different strains, each with a differing combination of attributes.

**Approved products**: Several products are undergoing regulatory approval either in the United States or other countries. In general, these products are either concentrated forms of a single cannabinoid, or a synthetic variation of one with THC and CBD the primary compounds. In the US, Dronabinol (THC) is undergoing approval as an appetite stimulant for AIDS or cancer patients and Nabilone (THC-like) for control of vomiting in patients, reducing bone loss (Izzo, 2009). Nabiximol is a combination of THC and CBP (1:1) undergoing approval for treatment of spasticity associated with multiple sclerosis and epidixol is a synthetic CBD analogue undergoing phase 1 clinical trials for treatment of pediatric epilepsy.

Synthetic Cannabinoids. An increasing problematic issue is the synthesis of cannabinoids. Modification of an R group on the cannabinoids that does not alter the psychotropic effects results in a compound that is not in the list of illegal drugs. Such products are sold in a variety of stores as “non-illegal substances” under names such as “spice” and other names. The DEA has passed emergency laws that are intended to make illegal the sale of any compound that is based on modification of cannabinoids. However, testing of such products is difficult because of the ease with which chemical modifications are made.

**Regulatory considerations**

In 1937, as the prohibition on alcohol ended, rather than focus on the potential benefits of the cannabis plants, the US government chose to prohibit it. In 1996, California ended this prohibition with the Compassionate Use Act which provided for the use of medical marijuana. Many states have followed suit, with two states legalizing marijuana for recreational use. [http://www.governing.com/gov-data/state-marijuana-laws-map-medical-recreational.html](http://www.governing.com/gov-data/state-marijuana-laws-map-medical-recreational.html) Currently, at least 24 (PRO-CON). States have approved marijuana in some form. According to NORML [http://norml.org/states](http://norml.org/states), a site dedicated to law reformation, 34 states have some type of conditional use, 15 states of decriminalized use, 14 states of medical marijuana laws. However, throughout the US cannabis is a controlled 1 substance meaning it has a high risk of abuse potential and no recognized medical benefit. Cannabidiol, the major cannabinoid other than THC often cited for medical use also falls under the same category; potentially, sale of products containing less than 0.3% CBD is allowed, although this was not confirmed by the DEA. 10 different pharmaceutical cannabis products (including synthetic) are undergoing some level of approval [http://medicalmarijuana.procon.org/view.resource.php?resourceID=000883](http://medicalmarijuana.procon.org/view.resource.php?resourceID=000883) which begs the question regarding medical benefit.
Marijuana and pets

Regulatory issues regarding the use of medical marijuana in pets are unclear and likely to remain as such for some time. Legalization in states has yet to include veterinary medicine. As such, most of the information surrounding marijuana and pets is from a toxicologic standpoint. THC is among the compounds cited as a toxicologic hazard in detection (police) dogs (Llera 2008). It is the most common drug to which detection dogs are exposed. Both dogs and cats may become intoxicated with smoke inhalation as well as ingestion of food containing marijuana (or hashish). It is absorbed rapidly following either oral or inhalant administration with clinical signs evident within 30 to 60 minutes of ingestion, although one reference (Osweiler 2008) indicates onset as long as 12 hours after exposure. Cannabinoids of medical significance appear to undergo first pass metabolism and as such, the risk of toxicity with inhalant products is much greater. The implication for medical use is that oral administration may not be cost effective. The drug is eliminated by hepatic metabolism and biliary excretion with elimination being complete in 5 days in dogs; duration of toxicity ranges from 30 minutes to 3 days, but 18-24 is the average. Enterohepatic circulation contributes to the prolonged half-life. The most common signs of toxicity following ingestion in dogs include tachycardia, hypotension, depression, ataxia, vomiting (inducing emesis is not recommended in clinically depressed dogs because of the risk of aspiration), altered behavior, bradycardia, hypersalivation, weakness, hypothermia and seizures. Legalization of medical or recreation marijuana among the states is likely to be associated with an increased incidence of toxicity, with a 4 fold increase cited in one study (Meola 2012). Treatment is largely supportive, with sedation with benzodiazepines or phenothiazines as needed. Antiemetic therapy may be indicated.

Among the approaches that veterinarians can take regarding the use of medical marijuana in animals is the use of “legal” (“non-illegal”) hemp-based products. For example, commercially available dietary supplement purportedly consisting primarily of hemp stem are being marketed for dogs. Because the stem contains very little THC but a high proportion of CBD and other non-psycotropic cannabinoids, as well as flavonoids, terpenoids and other potentially beneficial compounds, product claims include effective analgesia without psychotropic effects. While such a product is more appealing than marijuana as an analgesic, neither data supporting efficacy nor safety nor quality assurance data is thus far available. No data exists regarding the efficacy of any portion of the hemp plant as an analgesic, or for other therapeutic indications in companion animals.

References

What is “See something, do something. Why wait? Aspirate. Dr. Sue Cancer Vet?”

“See Something, Do Something” (SSDS) is a lumps and bumps cancer awareness program that provides guidelines for evaluating superficial masses in dogs and cats. We hope these guidelines to increase client awareness will promote early cancer detection and diagnosis, as well as early surgical intervention. In veterinary medicine, most skin and subcutaneous tumors can be cured with surgery alone if diagnosed early when tumors are small.

• See Something: If a skin mass is the size of a pea (1 cm) and has been there 1 month,
• Do Something: Aspirate or biopsy, and treat appropriately!

Why do we need SSDS?

It is well documented that cytologic and histologic evaluations are important diagnostic tools in veterinary oncology and that obtaining a preliminary diagnosis optimizes treatment planning. It is also recommended to evaluate masses that are growing, changing in appearance, or irritating to the patient. At this time, no specific guidelines exist for determining when to aspirate or biopsy or when to monitor canine and feline skin and subcutaneous masses.

Without standard of care guidelines, superficial masses may be monitored for too long. This can negatively impact our patient’s prognosis as well as limit their treatment options. Larger tumors that are diagnosed later may require more advanced treatments. Surgical excision of larger masses may result in less than adequate surgical margins (narrow or incomplete), leading to recurrence and additional costly therapy (second more aggressive local surgery, radiation therapy and/or chemotherapy).

With significant time delays and prolonged monitoring, there may be no reasonable surgical treatment options to remove large advanced tumors. These are often the most frustrating and heartbreaking cases.

Why diagnose early?

Obtaining a definitive diagnosis with cytology or biopsy early and before excision will lead to improved patient outcomes for superficial masses. When smaller, superficial tumors are detected early, surgery is likely curative - especially benign lesions and tumors that are only locally invasive with a low probability of metastasis. If tumors are removed with complete surgical margins, the prognosis is often good with no additional treatments needed.

• Visual monitoring is not enough.
• Pet owners need to be aware of the “pea” size requirement to have masses evaluated
• Veterinarians must measure and document the size of the mass in order to compare growth.
• If > 1 cm (or size of large pea) and present for a month, the mass should be aspirated or biopsied.
• Knowing the tumor type prior to the FIRST surgery will increase success of a curative-intent surgery.

What are the most common tumors?

Primary skin and subcutaneous tumors are common in dogs and cats. While the overall incidence in dogs and cats is difficult to determine, approximately 25 to 43% of biopsies submitted in dogs and cats are of the skin. Of submitted samples, 20 to 40% are reported to be malignant.

The most common malignant skin tumors in dogs are mast cell tumors (MCT) (10-17%), soft tissue sarcomas (including fibrosarcomas [2-6%], malignant nerve sheath tumors [4-7%]), and squamous cell carcinomas (2-6%). The most common benign canine skin and subcutaneous benign tumors include lipomas (8%), histiocytomas (8-12%), perianal gland adenomas (8-12%), sebaceous gland adenomas/hyperplasia (4-6%), trichoepitheliomas (4%), papillomas (3%), and basal cell tumors (4-5%).

In cats, the most common superficial tumors include basal cell tumors (BCT) (15-26%), mast cell tumors (13-21%), squamous cell carcinomas (10-15%), fibrosarcomas (15-17%). These four tumor types make up about 70% of all skin tumors in cats. Sebaceous gland adenomas are much less common (2-4%). If BCT are excluded, the percentage of malignant skin tumors in cats is higher than dogs, with studies reporting 70 to 80%.

Is visual monitoring acceptable?

Even the most experienced veterinarian or oncologist cannot look at or palpate a mass and know whether it is malignant or not. Cancer is a cellular diagnosis! It is always recommended to evaluate masses that are growing, changing in appearance, or irritating to the patient. But these guidelines are not enough. All skin and SQ masses that are >1 cm and have been present for 1 month should be aspirated for cytologic evaluation. Biopsy is indicated if cytology does not provide a diagnosis.
Methods of diagnosis

Aspirate and cytology

Fine needle aspiration (FNA) and cytology provide a diagnosis for many skin and SQ masses, especially those that exfoliate well. FNA is useful to distinguish neoplasia from inflammation. Cellular morphology may also allow for determination of benign or malignant phenotype. FNA is useful for identifying benign masses including lipomas and sebaceous adenomas. For malignant tumors, cytology provides information that assists in formulating diagnostic and treatment plans.

The advantages of cytology include: minimally invasive approach, low risk, low cost procedure, and results are available more quickly than biopsy results. The disadvantages of cytology are that it may be non-diagnostic or equivocal. This may be due to a small number of cells in the sample, poor exfoliation of the cells, or poor sample quality. If the sample is non-diagnostic or equivocal, histopathological confirmation may be required for definitive diagnosis.

Unless the sample is comprised exclusively of only fat, clear cystic fluid, or acellular debris, the sample should be submitted to a trained cytopathologist. WHEN IN DOUBT, SEND IT OUT. Including an adequate history helps the pathologist in diagnostic accuracy.

Biopsy

If cytology is non-diagnostic, a pre-treatment biopsy is recommended PRIOR to complete tumor removal. The pre-treatment biopsy will determine the optimal treatment plan.

The role of excisional biopsy is controversial, even among oncologic surgeons. A practical recommendation for non-diagnostic cytology and the lesion fits in an 8 mm punch biopsy, then PUNCH IT OUT. If the mass is larger than an 8 mm punch biopsy, an incisional biopsy (wedge, tru-cut, punch) is required for diagnostic confirmation.

It is tempting to remove the mass right away. An excisional biopsy establishes a diagnosis and removes the tumor at the same time. However it is not recommended for undiagnosed skin and superficial masses. Malignant tumors often require 2 to 3 cm margins. When an excisional biopsy (or debulking surgery) leads to incomplete margins for malignant tumors, more treatment, more morbidity, and more expense ensue. Thus removing the mass entirely is not recommended without a cellular diagnosis prior to definitive excision. Surgical approaches vary with different tumor types. Research confirms that the first surgery is the best chance for a cure.

Staging diagnostics are often indicated prior to curative intent surgery. Consultation with a veterinary oncologist is recommended.

After the aspirate/biopsy

If the mass is benign

Benign tumors may not need to be removed. A variety of factors, including mass location should be considered. Surgery should be recommended when a benign tumor is causing pain, irritation, bleeding, or infection. Surgery should also be recommended if an increase in growth would prevent a surgery in the future.

Alternatively, if removing the tumor requires a complicated surgery (i.e. near a joint, on the distal limb with minimal surrounding tissue for reconstruction) or the pet has other pre-existing issues, you and the pet owner may make an educated decision as to whether proceeding to surgical removal is warranted. PETS WITH MASSES NOT REMOVED SHOULD BE MONITORED (via measurement) BY THE VETERINARIAN EVERY 3 TO 6 MONTHS.

If surgery is performed, most benign masses require smaller surgeries, as wide margins are typically not needed.

If the mass is malignant

If the aspirate/biopsy reveals malignancy, consult with veterinary oncologist for appropriate staging recommendations. For malignant tumors, the first surgery should be a wide excisional surgery.

If wide excisional surgery is not possible due to the size or anatomic location of the mass, consultation with a veterinary oncologist or board-certified surgeon is indicated. Surgeons may be able to perform specialized surgeries such as axial pattern flaps to remove the tumor completely.

Debulking (cytoreductive) surgery may not be recommended, as this will not obtain margins, and additional post-operative treatments such as radiation will be required to prevent recurrence. In some cases, cytoreductive surgery may be performed for palliation, or with an understanding that adjunctive therapy such as radiation therapy will follow the procedure.

After surgery

- Review the histopathology report – tumor type, grade, vascular and lymphatic invasion.
- Consult with a veterinary oncologist for additional therapeutic considerations for malignant tumors.
- Assess the QUANTITY of surgical margins in consideration of tumor type and biologic behavior. (One mm margins for a malignant tumor may be called “clean” on a biopsy report, but size of margins must be considered in light of tumor histology.)
- If margins are inadequate, recommend adjunctive treatment before tumor recurrence for optimum patient outcome. Post-operative options include scar revision (second surgery), radiation to prevent regrowth, or chemotherapy which may slow recurrence in some cases.
• It is important to consult a board certified surgeon before attempting scar revision.
• Monitor for local tumor recurrence and metastasis as indicated by the histologic diagnosis and margin assessment.

Recurrence and monitoring
Patients with reported complete surgical margins can potentially suffer tumor recurrence due to microscopic cancer extension that is not seen in the evaluated sections. Therefore, it is essential to monitor for local regrowth, and to recruit the pet owner to monitor the surgical scar as well, to identify early relapse.

For malignant tumors with wide, clean margins and low metastatic potential, follow-up rechecks are recommended every two to three months after the surgery for as much as one year of follow up. Early detection is key to addressing recurrence and metastasis to ensure the highest possible chance of success.

Owners are encouraged to check their pets regularly at home for new masses
• Owners should check their pet monthly for superficial masses by noting their location and size.
• Create a “body map” with size and location of superficial masses recorded, along with fine needle aspiration cytology results. This body map can serve as an objective medical record document and owner guide to follow masses longitudinally, and to allow for identification of new masses over time.
• All masses should be aspirated and submitted for cytology. Masses that do not need cytologic assessment include lipomas, cysts, and those containing acellular debris.
• If cytology is non-diagnostic, discuss repeating the aspirate, or proceeding to biopsy.

Know the tumor type prior to surgery. The first surgery is your patient’s best chance for cure.

Surgery may be all that is needed
We all must be proactive to advocate for early cancer detection. Visual monitoring of superficial masses is not enough. Obtaining a definitive diagnosis via either cytology or biopsy early and before excision will lead to improved patient outcomes for superficial masses. Surgery is likely curative for the majority of these cases, especially for benign masses and those locally invasive malignancies that are non-metastatic. If tumors are detected and removed earlier – when they are small and with clean margins, the prognosis is often good and the patient may not require additional therapy.

• See Something: When a skin mass is the size of a pea (1 cm) and has been present for 1 month,
• Do Something: Aspirate or biopsy, and treat appropriately!


References/suggested reading
Although fecal float via centrifuge is an excellent test to identify fecal shedding of parasitic eggs, oocysts, and larvae, there are multiple other tests to use in parasitology testing in domestic or wild animals. These tests are discussed below.

**Fecal egg count**
Used to enumerate certain parasites in livestock or poultry to determine 1) pasture/pen contamination, 2) antiparasicide efficacy, 3) determining which animals in herd have natural immunity to parasites and thus should be selectively bred and, 4) which animals have poor immunity and should be culled or separated from rest of herd. This is very useful test to minimize chance of selecting for resistant parasites in a herd and reduces the amount of money the producer spends.

**FAMACHA Test**
Used to score the conjunctival color of goats, sheep and other small ruminants to determine the relative severity due to *Haemonchus* parasites. Those with moderate to severe infection that is reflected in pale color of conjunctiva should be de-wormed only.

**Baermann exam**
Used to identify larvae of lungworms. Use a funnel or so device that allows gravity to bring live larvae to a dependent area to be used to put on a slide and examined. Should be used in combination with fecal float to diagnosis parasites causing lung problems.

**Scotch tape test**
Used for diagnosing pinworms in horses since eggs are laid around perineum. Place scotch tape on slide and then examine under microscope

**Knott’s test**
Used to concentrate microfilariae of filarid worms. Should be used in conjunction with antigen test for routine heartworm testing.

**Blood smear**
Used to look for various blood parasites including Babesia, *Cytauxzoon*, malaria, *Trypanosoma cruzi*, Leishmania, *Hepatozoon*

**Serology testing**
Used for a number of parasitic diseases. More tests are being developed every year. Serology needs to be interpreted along with clinical signs, lesions, and case history to understand importance. Also serological tests are subject to positive and negative predictive values which are influenced by the pathogen’s prevalence in a focal area. Tests can have false negatives and false positives so need to be interpreted with caution.

**PCR testing**
Used to identify the DNA of parasites. Positive PCR products should be sequenced. PCR negative does not necessarily mean that the animal was not infected with particular parasite, it just means the DNA was not amplified. Should be interpreted with caution.

**Radiographs and other imaging**
May show evidence to suggest various diseases including heartworm disease, *Spirocerca* infection, Giant kidney worm, etc.

**Urine sedimentation**
Can used to identify various parasites including bladder worm and kidney worm or cats and dogs.

**Skin scrapping**
Used to identify various arthropods that can cause alopecia.

**Oral, nasal, ear exam**
Used to identify arthropods or other parasites.

**External exam**
Used to examine arthropods
A cat is not a dog. Developing a program for a cat that needs physical rehabilitation is sometimes challenging, but can absolutely be performed. The misconception exists that cats will not cooperate when asked to perform therapeutic exercises. If you ask them nicely, they will gladly be receptive. (You should be smiling after this statement). The success of physical rehabilitation with cats demands a good understanding of feline behavior, including excellent handling skills. This lecture will hopefully give some insights into dealing with cats in a potentially stressful situation.

Physical Rehabilitation or Physiotherapy is concerned with physical function, and considers the value of movement and the optimization of physical potential as being core to the health and wellbeing of individuals.1 Manual therapy (e.g. Massage, Passive Range of Motion, Stretching), Thermotherapy (e.g. Hot and cold), Electrotherapy (e.g. Laser therapy, Ultrasound therapy, Neuromuscular electrical nerve stimulation (NMES), Exercise Therapy (e.g. Basic exercises for the postoperative orthopedic and neurological patient, Hydrotherapy, Strengthening exercises, Flexibility exercises, Endurance exercises, Balance and proprioception exercises, Gait reeducation, Postural management for neurological patients, Positioning and chest care for intensive care patients and Maintenance exercises for recumbent patients) can all be utilized in feline patients.

The most common reasons to perform physiotherapy in cats are generally related to injuries sustained as a result of trauma or joint conditions.2 Cats often make willing patients but sessions should be kept short and interesting, and should be undertaken in a quiet, relaxed environment.3 Cats are most often referred for rehabilitation for osteoarthritis,4 fractures, neurological conditions, femoral head and neck excision (FHNE) and weight reduction. Cats appear to have fewer developmental orthopedic diseases and orthopedic injuries as a whole.5

Helpful hints for handling stress, anxiety and pain

If cats are faced with something stressful, their most common method of alleviating the stress they feel is to create distance between themselves and the stressor, i.e. they use flight.6 If they can’t run, they may attempt to groom or “waste time” hoping the stress goes away. As a last resort, they use aggression.

When the cat arrives at the rehabilitation facility or even if the rehabilitation is held in the patient’s home, the kitty may already be stressed or painful from whatever condition has prompted the need for therapy. Transportation to the vets can be stressful causing them to toilet or even vomit, something that may be particularly unpleasant for these obsessively clean animals.7 Waiting rooms can be extremely stressful for cats. Use pheromone diffusers like Feliway® or Comfort Zone® in the hospital/rehabilitation facility and exam rooms. Feliway® is clinically proven to help reduce stress related to traveling and visiting the veterinarian.8,9 Keeping waiting times to a minimum, having separate areas for dogs and cats, or providing benches, so that the cat carrier can be placed off the ground, thus helping the cat feel less exposed. Examination areas should be quiet and secure, with little or no traffic to cause disruption. Gather any equipment required for the visit prior to getting the cat out of the carrier. Take time to allow the cat to become familiar with the surroundings. Allow it to explore the area and feel more comfortable. Remember “less is more” in terms of restraint for cats. Avoid sudden or rapid movements, as these can be threatening. Encouraging the owner to bring the cat’s own bedding and toys not only makes the owner feel useful, but can also help the patient feel more settled through the retention of the more familiar scent. This time spent with the patient helps to develop a rapport between cat and nurse. Cats can mask signs of pain. The rehabilitation nurse must be skilled at recognizing pain in feline patients. The therapy will have little to no benefit if the patient is painful. Immediately alert the rehabilitation veterinarian if you suspect pain in your patient. Do not proceed with any stressful therapy until the cat is no longer suffering from pain. The owner should be asked prior to the first visit what “treats” their cat enjoys. Having a variety of low-calorie, palatable treats on hand is helpful in bonding with the kitty and goes a long way to establishing trust for future rewards after therapeutic exercises.

Manual Therapy

The therapies that veterinary technicians/nurses can perform include Massage, Range of Motion Exercises, Stretching.

Massage

Massage is defined as the therapeutic manipulation of the soft tissues of the body1,10 and has mechanical, physiological, and psychological effects.11 When massaged, muscle is mechanically stretched, reducing its tone and increasing its pliability. Over time, this can lead to a reduction in muscle soreness and an increase in connective tissue strength.12 Scar tissue is also mobilized and softened, helping to maintain movement between tissues and restore function after injury or surgery.12 Physiologically, massage increases interstitial pressure, which in turn increases venous and lymphatic flow. Massaging in a distal to proximal direction is recommended to move fluid from the extremities back to the central circulatory system.13 As the hands move, squeeze, and stretch the tissues, pressure differences are created between one tissue and another. High pressure pushes old fluid and irritating metabolites into
the vasculature and areas of low pressure draw in new fluid. This flushing effect may be responsible for decreasing inflammation, pain, and muscle fatique.\textsuperscript{12} The body and mind are both linked to the skin via the nervous system. Different types of touch will elicit different types of mental responses. Psychologically, massage decreases stress and anxiety, produces relaxation, and improves emotional wellbeing.\textsuperscript{1,10,11,12} The types of techniques used are Stroking, Effleurage, Compression (kneading, wringing), Friction, Percussion.

Range of motion exercises
Passive ROM exercises manually exercise joints through their natural pain-free range without voluntary muscle contraction. They are typically performed in patients with stiffness secondary to surgery or in weak patients unable to walk on their own.\textsuperscript{13} Active ROM exercises put joints through active muscle contraction. Activities include using cavaletti rails (i.e., a system of rails placed at adjustable heights and widths); climbing stairs; swimming; and walking in water, sand, or tall grass.\textsuperscript{13}

Stretching
Stretches are also passive movements that help to improve or restore full range to a joint or full length to a muscle. Stretches create plastic (permanent) deformation and an increased length/age.\textsuperscript{1} Long-term effects of stretching include adding sarcomeres to muscle mass.\textsuperscript{1} Stretching is generally more effective if preceded by light exercise, massage, heat or therapeutic ultrasound, all of which increase the extensibility of collagen.

Electrotherapy
Many electrotherapy modalities can be used on feline patients. All possess inherent dangers and should only be used by operators who have received specialist training.

Laser\textsuperscript{14}
The mechanisms by which low-level laser therapy (LLLT) decreases pain includes release of endogenous opioids, changes in conduction latencies of nerves, increase of cellular metabolism, increase in circulation, promotion of neovascularization, decrease in fibrosis formation and reduction of inflammation. Feline conditions that respond well to LLLT include osteoarthritis, degenerative lumbosacral stenosis, fractures, chronic wounds and stomatitis. Most cats tolerate the treatment well as it is not in itself painful and requires a relatively short time to deliver the treatment.

Ultrasound\textsuperscript{5}
For deep tissue heating in veterinary physical therapy, therapeutic ultrasound (ThUS) is the commonly used modality to improve the extensibility of connective tissues, to decrease pain and muscle spasms, and to promote tissue healing and improve the quality of scar tissue. The biological effects of ultrasound differ depending on the used mode: using a continuous mode, the thermal effects are maximized and it is therefore primarily used for tissue heating before stretching. If pulsed ThUS mode is used, the thermal effects are decreased but other effects occur based on the phase of tissue repair, including the acceleration of the inflammatory process, increased fibroblast proliferation, and increasing tensile strength of healing tissues.

Neuromuscular electrical nerve stimulation (NMES)\textsuperscript{5}
Electrical Stimulation (ES) is a useful therapeutic modality and is often possible in cats. In fact, many cats enjoy this modality. Nevertheless, cats must be introduced carefully to ES in order for them to become familiar with ES. Principally, ES can be used for muscle strengthening and pain control. Neuromuscular electrical stimulation is a form of ES whereby current is used to stimulate a motor nerve and cause the contraction of a muscle or muscle group. To stimulate a denervated muscle (e.g., in patients with spinal cord injuries), the muscle fibers must be excited directly and the ES is then called electrical muscle stimulation. For pain control, analgesia occurs because of several mechanisms such as the gate control theory and the release of endogenous endorphins. The most commonly used type of ES for pain control is transcutaneous electrical nerve stimulation.

Therapeutic exercises
Therapeutic exercises are one of the most important parts of the rehabilitation process. The design of the therapy program depends strongly on the needs of the individual patient and should ensure that the exercises can be performed safely without the risk to worsen the symptoms. The exercises should be selected based on the stage of tissue repair, and therefore, the rehabilitation veterinarian should understand the underlying pathology, the expected recovery progress, and biomechanical considerations.\textsuperscript{15} Exercise represents the final element in the process of helping a cat achieve optimum function following injury, surgery or disease. If assistance is required for the animal to perform an exercise, this can be provided manually or with the aid of ‘physio-rolls’, slings, harnesses or carts.

Therapeutic exercise may be used to improve\textsuperscript{1}
- Aerobic capacity and endurance
- Agility, coordination and balance (static and dynamic)
• Gait and locomotion
• Neuromuscular capability and movement patterning
• Postural stabilization
• Range of motion
• Strength and power
• Pain

Types of exercise

- **Strengthening** - the quality or state of being strong; bodily or muscular power; vigor. Strengthening exercises include such activities as running, slope work (uphill and downhill), use of leg or body weights, dancing, wheelbarrowing and swimming.

- **Flexibility (suppleness)** - the quality of bending easily without breaking. Flexibility is important for cats as it also helps to protect against injury. Flexibility exercises include activities that make the cat reach or stretch for something, or encourage crawling under, through or over obstacles.

- **Balance and proprioception** – Balance is an even distribution of weight enabling someone or something to remain upright and steady. Proprioception is the ability to sense stimuli arising within the body regarding position, motion, and equilibrium. Proprioception diminishes with age, and is also affected by injury or surgery, especially following neurological damage. All cats need good balance and proprioception to function normally. Balance exercises include activities requiring rapid responses to changes in supporting surface (e.g., wobble cushion, balance pad, trampoline) and changes of direction when moving, as well as playing with toys, dancing and standing on a gym ball. Proprioception exercises include weight shifting, walking in circles or weaving, walking over obstacles of various shapes, height and spacing, and walking over different terrains.

- **Endurance (stamina)** - is the ability of an organism to exert itself and remain active for a long period of time. Endurance exercises are less relevant to cats, which rely more on stealth and rapid movements to catch prey.

**Land-based exercises**

Land based exercises should form the major component of exercise programs designed for cats because, being land animals, they must obviously be able to cope with life on land. Examples of land-based exercises are Bicycling, Assisted Standing, Weight Shifting, playing with Laser Lights, Toys, and Treats, Crawling Under Cavaletti Poles, and Wheelbarrowing and Dancing.

**Water-based exercise**

Hydrotherapy is one of the most useful forms of rehabilitation therapy, and has become a very popular modality for dogs to help in the recovery of musculoskeletal and neurological conditions. Water provides an ideal environment for performing non-concussive active exercise, and through its natural properties (buoyancy and resistance) can help improve limb mobility, strength and joint ROM. There are several forms of hydrotherapy, including pools and water treadmills. The rehabilitation technician/nurse should accompany the cat into the water to provide assistance and reassurance until it is accustomed to the activity. Some cats may be more accepting of water if it is initially introduced to it in the home environment (bath or sink), as a gradual progression from being bathed to being rehabilitated is often more acceptable. The presence of the owner can often provide confidence and reassurance to nervous cats. At no time should any animal be left unattended during a hydrotherapy session, because water aspiration and drowning are real risks. Therefore, a lifesaving vest in a small size for cats should be utilized. Postoperatively, hydrotherapy may be employed as soon as the surgical incision has established a fibrin seal (generally 48–72 h post-surgery), although in practice most hydrotherapy with dogs is started 2–3 weeks following surgery.

**Conclusion**

Physical rehabilitation for cats is different than that for dogs. The plan must be creative, fun, easy to follow and basically have short intervals for cats. The attention span for cats is much less than that of dogs. Prior to beginning any rehabilitation, the cat must be examined by the rehabilitation veterinarian, checked to make sure pain is not an issue, observed to ensure that stress is not a huge factor for the patient and have the rehabilitation veterinarian draw up the therapeutic plan. The rehabilitation veterinary technician or nurse will most likely be interacting a great deal with the owner, carrying out parts of the therapeutic plan and monitoring comfort for the cat. Feline patients will benefit from a rehabilitation program just like any patient. It’s all a matter of learning to speak “cat”.

**References**

How Can I Be a Patient Advocate in Pain Management for Exotics and Zoo Animals?
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We will first look at how veterinary nurses became advocates for their patients. Naturally we turn to the published literature where human nursing has the most evidence.

Nursing leaders since the time of Florence Nightingale have envisioned advocacy for both patients and caregivers as an integral part of nursing’s mission. While advocacy on behalf of patients and caregivers has remained a central concern—the American Nurses Association (ANA) publication *Nursing: Scope and Standards of Practice* identifies advocacy for safe, effective practice environments as a responsibility of the professional nurse. Nurses can fulfill the role of patient advocate by determining the best interests of their patients and using their own voices to promote those interests.

The use of behavioral and physiologic indicators is recommended for pain assessment in nonverbal patients. In humans, this group includes pediatric patients, traumatic brain injury patients, mental disabilities patients, geriatric patients and Alzheimer’s patients.

**Veterinary technicians and nurses as advocates**

The quality of pain management in practices seems to be directly related to veterinary technicians and nurses. The role of advocate for a nonverbal patient can be daunting. Veterinary technicians and nurses are in the unique position of being responsible for most of and the quality of patient care without the freedom to prescribe or initiate therapy. Knowledge of the physiology of pain and pharmacology of analgesics is essential for good communication between veterinarians and veterinary technicians and nurses. The skilled technician is a source of vital information required to choose and administer appropriate analgesics.

**Communication**

Technicians use critical thinking, observation, and interpretation skills to make important pain management recommendations. Discussion about each case directly with the clinician might include the technician's concerns about a patient or a general approach to managing different types of pain. Based on his or her interaction with patients, the technician may offer suggestions for adjustments in analgesic regimens, changes or additions to drug protocols, or the possible addition of sedatives, if needed. Technicians and nurses must learn to include important criteria when reporting to the veterinarian. The skills of pain assessment and current physiologic state of the patient must be accurately presented. They need to indicate that they can accurately tell how painful the patient is while explaining why or why not additional analgesics could be beneficial. Veterinary technicians and nurses have the responsibility of continually monitoring their patients and often develop a sense of which analgesics seem to work best under various circumstances. Technicians should provide as much feedback as possible for which analgesic protocols are working well, and which need to be improved to increase patient comfort. Pain management issues, such as the appearance and behavior of the patient that prompted the administration of analgesics; the type, dose, and timing of previous analgesic administration; and the response and any adverse reactions after administration, should be described.

**Allowing the technician or nurse additional freedoms**

Giving technicians greater choice and control over pain management involves trusting their judgment and experience. After standing orders are established, the success of pain management relies on giving skilled technicians the freedom to give analgesics as needed, to adjust dosages when required, to administer adjunctive medications, and to potentially reverse drugs when severe adverse reactions occur. If trust has been established, then the responsibility and freedom to administer agreed-on analgesics is rewarding for all concerned. Giving technicians a voice in the pain management process creates a truly positive team environment in which their thoughts and skills are valued. Patients ultimately receive better care, and technicians are satisfied knowing that they are doing everything they can to ensure the well-being of patients in their charge.

**How stress and pain intersect**

Pain and distress can be thought of in terms of a continuum of emotional and experiential states that may occur in an animal. Comfort represents a state of well-being, where the animal is contented and comfortable. Stressors acting upon the animal in increasing severity cause the animal to progressively become uncomfortable (Discomfort), then stressed (Stress), and finally distressed (Distress). Distress represents the extreme point in this continuum, on the far right. Stressors acting upon the animal may move the animal’s experience along this continuum between the extremes of well-being and distress. Depending on the nature and severity of a stressor and on the animal’s current state of being, the animal may adapt successfully to a stress (Adaptive Behaviors) or it may become distressed in a way that threatens its well-being or health (Maladaptive Behaviors). Maladaptive behaviors include abnormal feeding, absence or decreased grooming, and changes in social interaction (aggression, withdrawal). A departure from an animal’s normal behavior is an important indicator that it is undergoing pain and distress.
Signs of pain and distress

There are numerous stereotypical responses to stress or pain stimuli in animals, particularly in mammals. Nevertheless, species differences do exist. Recognition of changes in behavior and physical appearance in the species under study will allow early identification of an animal experiencing pain or distress. As caregivers, humans may know that an event or situation is no threat, but the animal usually does not function with the same information base as humans.

Non-human primates (NHP)

Monkeys often show remarkably little reaction to surgical procedures or to traumatic injury. Obvious signs of pain are not readily seen. Loud and persistent vocalization, for example, commonly signifies only alarm or anger. The animal in pain may be huddled in a crouching posture with a "sad" facial expression and glassy eyes, or it may sit hunched with its head forward and its arms across its body. It may avoid its companions and may stop grooming itself. A monkey in pain may also attract increased attention from its cage mates, which can vary from social grooming to attack. Acute abdominal pain may be shown by facial contortions, clenching of the teeth, restlessness, and shaking accompanied by grunts and moans. Food and water intake is usually diminished or absent.

Key Signs: hunched position, failure to groom, refusal of food or water, dejected appearance.

Mice

After procedures, which cause pain, mice may increase their sleeping times. Reduced food and water intake, with resultant weight loss, dehydration and wasting of the muscles on the back may be observed. Piloerection (erection of hair) and a hunched appearance indicate pain or distress. The animal fails to groom, but scratches more frequently. Sick mice are often isolated from the remainder of the group. Aggressive vocalization is observed in the early stages, decreasing where pain or stress reduces the ability to move and respond. The eyes appear sunken, and ocular and nasal discharge may be noted as the animal's condition worsens. The respiration rate increases and breathing may be forced or labored. As its condition worsens, the animal becomes quiet and unresponsive, separates from the group and eventually becomes unaware of its surroundings. Hypothermia is observed with increasing deterioration in condition; the animal feels 'cold' to the touch.

Key Signs: withdrawal, biting response, piloerection, hunched back, sunken eyes and abdomen, dehydration, weight loss.

Rats

Rats are generally docile and less aggressive than mice towards members of their own species and humans. Acute pain or distress is usually accompanied by constant vocalization and struggling. Rats will often lick or guard a painful area. Increased scratching can indicate chronic pain. A rat in pain will often sit crouched with its head turned into its abdomen. Sleeping periods will be disturbed and increase if pain or distress is present. An elevated respiratory rate associated with sneezing occurs where the respiratory system is affected. Increasing piloerection (staring coat) is noted, along with an increasingly untidy appearance as the animal fails to groom itself. The eyes may appear sunken, and ocular and nasal discharge is common, often progressing to red-colored hematoporphyrin exudate which may encircle the eye. Nasal discharge, if present, may be red-colored as well.

Initially, the rat exhibits increased angry or aggressive vocalization, especially on handling. There is a gradual reduction in vocal response as the pain or stress continues, and movement ceases unless a sudden painful stimulus is experienced. Hypothermia indicates significant deterioration in the animal's condition. A pale appearance indicates anemia or blood loss.

Key Signs: vocalization, struggling, licking/guarding, weight loss, piloerection, hunched position, hypothermia.

Guinea pigs

Guinea pigs are alert, but timid and apprehensive animals which will try to avoid capture and restraint. Rarely is there any aggression towards humans. Any sign of acceptance indicates the animal is unwell. Loud vocalization will accompany even minor and transient pain. Guinea pigs often appear sleepy when in pain. The eyes may be sunken and dull. There may be pain associated with locomotion, lameness, and careful gait due to sore feet in older animals.

Key Signs: withdrawal, vocalization, failure to resist restraint, staring coat, unresponsive.

Mongolian gerbils

Gerbils are highly active, nervous animals and usually attempt to avoid restraint. Signs of pain and distress are difficult to assess, as gerbils apparently, object to any interference. There is an increased level of response under painful or stressful stimuli. Ocular discharge is common. Under stressful conditions, the eyelids may be half closed, with dry matting of the eyelids. Dehydration is rarely seen, since the gerbil's normal metabolism enables full utilization of the water content of the diet. Only small quantities of urine are voided under normal conditions. Feces are normally firm, dry pellets. A hunching up and arching of the back may be observed, especially with abdominal involvement. Abnormal gait is associated with locomotion or abdominal involvement.

Key Signs: hunched appearance, weight loss, shock syndrome.
Syrian (golden) hamsters
Under normal conditions, hamsters will sleep for long periods during the day, and little activity will be seen. They often appear aggressive towards their cage mates and emit loud screeching noises, disproportionate to the degree of interference, when handled. This response increases under painful or stressful stimuli. Ocular discharge is commonly associated with stress. Daytime sleep periods may be extended and increasing lassitude may be seen except when the animal is being handled. Exploratory behavior is reduced. A hunched appearance is noted, as is an unwillingness to move, especially where abdominal organs are involved. Lateral recumbency can indicate that the animal is moribund. Normal gait is affected when pain is associated with locomotion. Stilted movements are sometimes associated with abdominal involvement, e.g., ascites following cirrhosis of the liver.

Key Signs: weight loss, hunched appearance, increased aggression or depression, extended sleep periods.

Rabbits
The rabbit presents significant difficulties in recognition of pain and distress, as it often quietly accepts apparently painful or distressing procedures; this may relate to its feral behavior where concealment is important to survival. Even healthy rabbits may not move frequently or indulge in exploratory behavior. Pain is usually characterized by a reduction in food and water intake (and thus weight loss and dehydration) and limited movement. Ocular discharge is a common response to stress in the rabbit, with protrusion of the nictitating membrane.

Under continued pain or stress, rabbits assume a 'sleepy' appearance. The animal exhibits increased depression, progressive unawareness and lack of response. The animal will often face the back of cage, away from light. Where foot soreness is involved, weight may be thrown forward or backward to reduce discomfort. Body stretching and lying flat are common indications of abdominal discomfort. Pain may be associated with locomotion, especially with sore feet.

Key Signs: reduced eating and drinking, faces towards back of cage, limited movement, and apparent photosensitivity.

Ferrets
Pain tolerance likely varies greatly between individual ferrets just like in other species. There is a proof that solitary-living animals and prey animals are masters of disguising pain. Ferrets in pain may stay curled in a tight ball or have a hunched back. They may have an altered gait. They may have decreased or increased food and water intake. They may exhibit bruxism. They may hide in the back of a cage, vocalize, be aggressive, not groom and look unkempt. The most likely causes of pain in ferrets are arthritis, cancer, or dental problems.7

Key Signs: Stiff posture, demented behavior, lack of grooming, hunched head and neck, and inappetence.

Birds
Many clinical signs may be associated with pain in birds including change in temperament to either aggressive or passive, restlessness, reluctance to stand, perch or even move, anorexia, lethargy, a hunched appearance, tachypnea, and lameness. Birds may avoid a painful area and reduce grooming, or they may over-groom, feather pick, or chew at the area. Behaviors such as vocalizing and writhing may only manifest during acute or severe pain or may not manifest at all in birds.

Few consistent physiologic indicators of pain have been identified in birds. In feather-plucked chickens, heart rate and respiratory rate varied between animals but hypertension was a reliable indicator.8 Fecal corticosterone concentrations have shown potential as a non-invasive method of determining stress and pain.9

Key Signs: Escape reactions, atonic immobility, inappetence, and avoidance of use of pain site.

Reptiles
Acute pain in reptiles may be characterized by flinching and muscle contractions. There may be aversive movements away from the unpleasant stimulus, and attempts to bite. More chronic and persistent pain may be associated with anorexia, lethargy and weight loss, although it is difficult to associate any of these signs of lack of well-being specifically with pain.

Key Signs: flinching and muscle contractions, weight loss, anorexia.

Fishes and amphibians
It is difficult to determine the nature of the response to pain in fish and amphibians. Although they exhibit a pronounced response to injuries or to contact with irritants, their response to chronic stimuli may be small or absent. Fish and amphibians with severe wounds which would cause immobility in a mammal, will often appear to behave completely normal, even resuming feeding. Fish and amphibians will react to noxious stimuli, such as that administered by a hypodermic needle, by strong muscular movements. Fish when exposed to a noxious environment, such as a strong acid, they show abnormal swimming behavior with attempts to jump from the water, their coloring becomes darker and their opercular movements become more rapid. Such effects are indicative of some degree of distress; however, it is not possible to describe these unequivocally as signs of pain. However, we must assume that which causes pain in mammals, birds and reptiles will also cause pain in fish and amphibians.
Key Signs: Amphibians: Muscular movements, closed eyes, color changes, rapid respirations, immobility, and anorexia.

Fish: Abnormal swimming behavior, attempting to jump out of water, rapid opercular movements, clamped fins, pale or darkened color, and hiding. Anorexia is the first sign.

**Invertebrates**

Nociceptive cells have been found in invertebrates and opioid systems are functional in Invertebrate nociception. Opioids and local anesthetics provide good analgesia.

Key Signs: Invertebrates: Rapid withdrawal.

**Zoo animals**

Wild animals look different, have different social systems, and react to pain and pain medications differently than their domestic species counterparts. Prey and predator species mask their pain in front of conspecifics (belonging to the same species) and caretakers. Patients with a Traumatic Brain Injury: An Integrative Review. *Pain Management Nursing*, 15(2), (June), 2014: pp 506-518

Some animals that are sick or injured will allow a threat, that is, veterinary staff, to get closer than if they were healthy. An observer could then use changes in flight distance as an indicator of the severity of the injury or illness. While veterinary technicians or nurses do not prescribe medications, they typically dispense and administer them. Currently used treatments and doses have been extrapolated from similar species, which works in some cases, but not in the others. Forums and networking between institutions and zoo or wildlife professionals are valuable tools when trying to determine what analgesic protocol to use. Veterinary technicians/nurses have a discussion forum at the Association of Zoo Veterinary Technicians (AZVT) website [http://www.azvt.org/](http://www.azvt.org/).

Key Signs: Behavioral changes, appetite changes, animal isolation from their group or pack, aggression, lameness, unkempt appearance, or lowered head.

**References**

As stated by Kara M. Burns, MS, MEd, LVT, President, Academy of Veterinary Nutrition Technicians, “Pet obesity has reached epidemic proportions in the US and other industrialized countries, which parallels the epidemic in the human population. It is estimated that 35%-40% are overweight or obese”\(^1,2,3,4,5\). Additionally she states: “Obesity can be defined as an increase in fat tissue mass sufficient to contribute to disease. Dogs and cats weighing 10-19% more than optimal weight for their breed are considered overweight; those weighing 20% or more above the optimum weight are considered obese\(^6,7\).”

Obese dogs die sooner and have a higher incidence of orthopedic, cardiac, respiratory, urinary, reproductive and dermatological disorders, some cancers and anesthetic complications\(^8\). Obesity related hyperlipidemia is common and has been linked to the increased incidence of pancreatitis. In cats, the health risks of obesity are also well established; diabetes, hepatic lipidosis, urinary tract disease, lameness and dermatopathies are all more common in obese cats\(^8\). Obesity represents a significant health and welfare problem for pet dogs and cats. Following recent studies showing that approximately 40 per cent of pets are overweight, obesity is now the most common medical disorder of companion animals and a major welfare concern\(^9\).

**Why is being obese bad?**

The mechanical effects of fat accumulation certainly account for some obesity-related morbidity: increased wear and tear on joints cause or worsen osteoarthritis; fat deposits around the respiratory tract mechanically impede ventilation; increased pressure due to visceral fat worsens incontinence; and the presence of skin folds predisposes to dermatitis\(^10\). The primary reason for development of obesity in any animal is that they are consuming more energy than they are expending. This can occur when a dog or cat has excessive dietary intake of calories (food and treats) or when there is a reduction in energy expenditure (reduced activity, illness or injury resulting in less exercise, etc.)\(^11\). Obesity predisposes animals to osteoarthritis and diabetes\(^12\) but weight loss can help improve these conditions\(^13,14\).

**What to do?**

It all begins with a patient assessment. A complete physical exam relevant laboratory and imaging studies, and assessment for comorbidities that may impact either caloric needs or require additional management. Evaluate the pet’s current body weight (BW), Body Condition Scores (BCS), and muscle condition score (MCS) as part of the health assessment and for determining healthy weight\(^15\). Estimating the pet’s ideal weight helps determine the pet’s caloric requirements and establishes a motivating goal\(^15\). Assess the client and current diet plus whether the client is willing to participate in what is needed to have the program be effective. After the initial assessment is complete, formulate an individualized weight loss plan. The plan should include the determination of the following\(^15\):

- Ideal BW
- Caloric restriction
- Food selection and treat allowance(s)
- Feeding management and activity plans
- Scheduled follow-up

**Obesity prevention**

For dogs and cats, it’s just like in humans, the easiest way to prevent obesity is to watch the number of calories eaten and increase energy expenditure. In a recent canine study, each 1000 steps of walking increased energy expenditure by 1 kcal per kg 0.75 of body weight.\(^35\) Physical activities can improve and maintain cardiovascular and musculoskeletal fitness, and improve the owner–pet bond. Regular daily sessions are recommended for both species. For dogs, at least 1 daily walk of 30 minutes is recommended.\(^36\) When play sessions are used in cats, short periods are sufficient activity, typically 1 to 2 minutes at a time 2 or more times per day.\(^36\)

**Methods of promoting physical activity in dogs and cats\(^36\)**

<table>
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<tr>
<th>Dogs</th>
<th>Cats</th>
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<tr>
<td>Walking (on or off leash)</td>
<td>Play activity using fish rod toys</td>
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<td>Play activity using balls, Frisbees, etc</td>
<td>Motorized toys</td>
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<tr>
<td>Hydrotherapy</td>
<td>Puzzle feeders</td>
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<td>Puzzle Feeders</td>
<td>Climbing frames and activity centers</td>
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<tr>
<td>Free exercise outdoors (in yard or garden)</td>
<td>Allow outdoor access (eg, cat flap)</td>
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How does physical rehabilitation fit in?
Most likely, the primary care veterinarian has referred the obese patient to the Certified Physical Rehabilitation Veterinarian and their Veterinary Technician Certified in Physical Rehabilitation. Research in humans has shown that combining caloric reduction with exercise offers the best chance of successful and sustainable weight loss16,17. Physical activity provides several potential benefits including preservation of lean muscle mass, increased caloric expenditure, and promotion of behaviors that aid in sustainable weight loss18. The pet will be brought to the rehabilitation practice and undergo a formalized physical exercise program. A complete understanding that the pet will initially not be able to tolerate strenuous activity is understood. Tolerance is increased as the patient progresses. Always make sure that the patient is not experiencing any pain. The rehabilitation therapy will not proceed very far if pain is an issue. A pain-free patient is much more cooperative and willing to work.

Dogs
There are several rules that help achieve success with canine therapeutic exercise programs19:

1. Always start within the animal’s comfort zone, gradually increasing the intensity until goals are met. If the goal is to complete 10 repetitions (reps) of an activity in good form, the therapist or assistant starts with three to four reps. As the patient approaches the ability to complete 10 good reps, the exercise is changed or progressed. This may involve changing to a more challenging movement or to doing the same movement in a more challenging environment.
2. Strength work is generally done three to five times per week with days off alternating with training days. The dog’s motivation to carry out the exercises must be maintained, and overtraining can quickly lead to a loss of motivation.
3. Some owner/handlers will insist on working their dogs every day despite clear instructions. For this group, exercises focusing upon the forelimb can be performed one day, the trunk the next day, and the pelvic limb the next day. This “split training” helps to avoid overtraining and gives the muscles time to recover.
4. Daily stretching routines are advised

Specific exercises for dogs19
- Walking
- Proprioception Training
- Flexibility
- Balance and Weight Shifting
- Speed Work
- Endurance Work
- Land Treadmill
- Aquatic Therapy

Cats
With cats, you must be more creative!
The success of physical rehabilitation with cats demands a good understanding of feline behavior, coupled with excellent handling skills20.

Activity through play is most effective with these cats as, in addition to burning calories, it increases muscle mass and resting metabolic rate, improves mobility and mental stimulation, and often improves the cat–owner bond21. All rehabilitation sessions should be kept short to maintain interest and prevent boredom.

Using play to provide exercise and mimic predatory behavior22,23:
- Move a rod or wand with a fur or feather toy on the end in a way that mimics flying prey (swooping through the air) or ground prey (moving in straight lines swiftly away from the cat).
- Let the cat catch the toy on the end of the rod or wand to simulate a capture.
- Reward the cat with a treat following play or interaction with the owner.
- Use toys that cats can manipulate with their paws or mouth and those that can contain food.
- Use feather and fur toys that can be pounced on and tossed into the air to mimic flying or ground prey.
- Use large, soft toys that can be raked and bitten.
- Hide toys in puzzle boxes or other locations that require searching, locating and capturing.
- Use the cat’s toys on a rotating basis to prevent habituation and boredom24.
- Avoid using hands and feet in any type of play to prevent injury to the cat or handler.
- Climbing a cat tree
- Scratching on a cat post or pads
- Playing with other cats

Specific exercises25
- Walking
Horses

It seems that in the UK, the fat horse or pony is now so commonplace that it has come to represent “the norm” in the eyes of many owners. OBESITY predisposes to important conditions in horses, such as laminitis and equine metabolic syndrome. The American College of Veterinary Internal Medicine consensus statement on Equine Metabolic Syndrome (EMS) published in 2010 lists three major components: increased adiposity in specific locations (regional adiposity) or generally (obesity), insulin resistance (IR) with hyperinsulinemia, and a predisposition to development of laminitis. Equine metabolic syndrome can affect all domesticated equids. Pony, Morgan Horses, Paso Finos, and Norwegian Fjord breeds are overrepresented, but the syndrome is recognized in many other breeds of horse, including Arabians, Quarter Horses, Saddlebreds, Tennessee Walking Horses, and warmbloods. Most horses and ponies with EMS are obese, and owners often describe them as “easy keepers.” Environmental issues such as overfeeding and lack of exercise contribute to obesity, and these problems are increasing with modern management practices. Obesity has a greater impact on insulin sensitivity in certain animals, which corresponds with clinical observations that some obese horses are insulin resistant whereas others have normal insulin sensitivity. EMS is a disorder that should be managed with diet, housing, and exercise interventions.

So, here we are again, developing physical rehabilitation exercises for our fat horses to help them manage their weight problems. For those insulin resistant animals, diet alone will not be effective. The treatment plan must be individualized for each horse. Equine Physical Rehabilitation includes manual therapies, electrotherapy, functional retraining, and therapeutic exercise-based treatments, along with education and ongoing owner-managed procedures.

For the horse, manual therapy will include massage and stretching. Exercise Therapy for neuromotor control and hydrotherapy. The physical rehabilitation will include muscle re-education, reflex actions, and passive movements. Rehabilitation aids include the hot walker, equine treadmill, and hydrotherapy. The swimming pool, hydro spa, water treadmill, and more recently, a water walker, all make use of water either as a training adjunct or an aid to recovery. Sensory Integration can include body wraps. Long reining with to reins driving the horse from the ground is appropriate. The use of a single rein or lunge does not allow the handler sufficient control of the hind legs of the animal. Each exercise is loading/building muscle power/strength in the muscle groups doing the most work during the activity. The art of rehabilitation from the ground, in long reins, is to ‘read’ the horse’s muscles, then to choose suitable ‘exercises’ to influence the groups to be targeted. Pasture or fields are invaluable not only to alleviate boredom, but slopes can be incorporated, worked across, up or down, and also a horse can be made to back up, going up, down or across a slope for two or three strides. Each movement recruits different muscle interaction, as does being forced to balance on uneven ground.

Specific exercises

- Walking – Long Reins (can encourage flexibility)
- Proprioception – Cavaletti Rails (on the ground and slightly raised)
- Balance and Weight Shifting
- Endurance
- Land Treadmill
- Water Treadmill and water work

Final step – Ridden work

Go slowly!

When starting ridden work:

- check bridle fit – is the brow band/headpiece too tight?
- check position of the bit, its size and type. Is it too narrow/wide, severe/high?
- check the saddle fit. Is there even distribution of weight?
- check the girth for comfort and safety;
- slowly increase the time the horse must carry weight, thus allowing muscles to accommodate;
- hack out for two to three weeks before starting work in the school;
- be certain the horse is capable of, understands, and is confident in the simple movements before you ask for the more difficult ones;
- if possible, loose school over fences before riding at fences.
- do not demand concentration for long periods.

While this mainly speaks to English Ridden Horses; it can easily be adapted to Western Ridden Horses.
Summary
Successful weight management begins by recognizing that overweight and obesity is a disease as well as the importance of weight control in our pets. It is essential that the rehabilitation healthcare team, specifically the rehabilitation veterinary technician, communicate the serious effects that even a few excess pounds can have on the health and longevity of their pet’s lives. Weight management should be a cornerstone wellness program in every clinic and the rehabilitation veterinary technician the champion of the program and advocate for the patient.

References
What are the best antibiotics for urinary tract infections?
Most urinary tract infections are caused by ascending bacteria such as E. coli, Staph and Strep organisms. Short courses (7 – 10 days) of amoxicillin or trimethoprim-sulfa are probably the best and safest drugs to use. Using amoxicillin first, and for most simple UTIs, will help prevent antimicrobial resistance.

What are the exceptions to using these common antimicrobials?
Recurrent infections and infections that extend to the kidneys, prostate or blood stream require longer term and more specific treatments. Treatment for 3 – 6 weeks is required for these complicated infections. Fluoroquinolones are the best choices for penetrating the kidneys and the prostate gland in male dogs.

Asymptomatic UTIs do not necessarily need to be treated. Subclinical infections are common in dogs with other diseases or with abnormalities of the urinary tract. Most clinicians now recommend waiting for symptoms to initiate treatment, unless there is a high risk of the infection ascending to the kidneys or into the bloodstream. Determining this degree of risk can be tricky though.

Are there any treatments that help with sterile cystitis?
In cats, a sterile, inflammatory cystitis is common and is considered idiopathic (Feline Idiopathic Cystitis or Feline Interstitial Cystitis). FIC is characterized by occasional episodes of hematuria, pollakiuria, and inappropriate urination that are not associated with bacterial infection and are self-limiting in nature. However, a subset of affected cats have more refractory disease, with signs that recur multiple times during a given year or, less commonly, persist for longer than 7 days.

**Short-term symptomatic relief** can be used for 2 to 5 days during acute flare-ups to minimize discomfort and shorten the hematuric phase. Signs will resolve spontaneously in approximately 85% of affected cats within a few days.

- **Analgesics.** For acute flare-ups of lower urinary tract signs, short-term analgesic treatments may be useful to reduce the discomfort. Opioids also have some anti-inflammatory effects that may be beneficial in this setting.
- **Alpha adrenergic antagonism?** (Phenoxybenzamine or prazosin) Agents that may relax urethral musculature also have been recommended to facilitate urination in dysuric cats and to alleviate functional urethral obstruction in postobstructed cats.
- **Non-steroidal anti-inflammatory agents?** Nonsteroidal anti-inflammatory agents have also been recommended for analgesic and anti-inflammatory effects.

**Long term strategies**
Although not exactly medications, dietary and environmental strategies (including Feli-way) are usually recommended to increase water intake and reduce stress. Pharmacologic agents may be added only if the cat still experiences frequent recurrences. The effects of these mediations may take weeks to months to be fully realized; treatment is indefinite to lifelong.

- **Anti-anxiety medication.** Amitriptyline is an antianxiety drug that also has effects on the bladder muscle, inflammation and bladder pain. It has been studied for both acute non-obstructive episodes and for longer term usage in cats. Other tricyclic antidepressants or SSRIs (like Prozac) may be useful in cats as well; in the author’s experience, clomipramine is better tolerated by cats than amitriptyline. The drug should be given daily for several months to assess effectiveness. For cats in which amitriptyline is indicated, a starting dosage of 5 mg/cat every 24 hours is empirically recommended; the dose is adjusted to effect a mild calming behavior in the cat, which is usually achieved with dosages of 2.5 to 12.5 mg/cat per day. The dose of clomipramine is approximately 0.5 mg/kg/day. Others prefer fluoxetine (0.5-1.0 mg/kg PO q24h). If ineffective, these medications should be slowly tapered instead of withdrawn abruptly.

- **Glycosaminoglycans.** Pentosan polysulfate (PPS, Elmiron) is a synthetic polysaccharide that augments the glycosaminoglycan (GAG) layer of the urinary bladder. This protein layer attracts water molecules and creates a protective barrier on the inside bladder wall. Orally administered PPS has resulted in good long-term responses (>6 to 12 months) in some women with IC and may be effective in reducing clinical episodes in cats with recurrent or chronic idiopathic disease. GAG have not proven more effective than placebo in two trials in cats, however. The currently recommended oral dosage for cats is 8 mg/kg (usually 50 mg/cat) PO q 12 hours. An injectable protocol includes PPS (3 mg/kg) administered subcutaneously on days 1, 2, 5 and 10.
- **Glucosamine and chondroitin sulfate** are the building blocks for formation of glycosaminoglycans. Anecdotally these nutritional supplements have been helpful in some cats with chronic disease but have not led to dramatic results in clinical trials.
What are the advantages and disadvantages of medications for incontinence in dogs?
Most incontinent dogs are spayed females who have weak structure and function of the urethra, allowing urine leakage between urinations. Treatments are directed at the smooth muscle in the urethra, the alpha receptors that favor muscle contraction, and the surrounding collagen and other supporting structures.

Reproductive hormones

**Estrogen** administration enhances urethral closure function primarily by increasing the number and responsiveness of alpha receptors in urethral smooth muscle. Estrogen also has effects on urethral mucosa, submucosal blood flow and density of peri-urethral collagen. All of these effects help the urethral surface stay moist and healthy and create a sealed outflow tract.

- **Diethylstilbesterol** (0.1-1.0 mg/dog q 24 h for 5-7 days followed by once or twice weekly administration) has been utilized for some time with reasonable safety and efficacy. The drug is usually obtained from compounding pharmacies.
- **Estriol** has become a favored estrogen product in Europe and is available in the US (Incurin, Merck). Improved to excellent responses were obtained in about 80% of treated dogs in a large group studied in western Europe. Product information for Incurin report improvement or continence in 99% of treated dogs by six weeks of treatment. The starting dose is 2 mg/dog estriol per day for a week, then the dose was reduced at weekly intervals to the minimal effective dose (typically 0.5 - 2.0 mg/dog given daily or every other day). Adverse effects were rare, but included signs of estrus at the initial estriol dose, which resolved in all but one dog after dose reduction.
- **Premarin**, a conjugated estrogen extracted from pregnant mare urine, is sometimes prescribed because it is readily available for women. Maintenance dosages range from 0.625 mg to 1.25 mg per dog, administered PO every 12 – 72 hrs. In some dogs, administration every 4 to 7 days is effective.
- **Adverse effects** are rare at maintenance doses but can include signs of estrus, behavioral changes and hair loss. Bone marrow suppression is very unlikely with usual doses of these types of estrogens.

**Sympathomimetic (Alpha) agonists**

- Available sympathomimetic agents have an indirect and nonselective stimulatory effect on the urethral alpha receptors. Sympathomimetic agents can be used in male or female dogs and in dogs for whom reproductive hormones are not advised or not tolerated. Typically, alpha agonist agents are so reliable that they can be used for short trial periods to confirm your diagnosis.
- **Excellent responses** have been observed in most dogs treated with **phenylpropanolamine (PPA, 1.5 mg/kg PO q 12 – 24 h)**, with 90% or greater responding in small studies.
- **Frequency of PPA administration** required for continence varies from one to three times daily. Some dogs may have acceptable continence with once daily (or less frequent) administration. Although we have previously recommended starting with a high frequency, then tapering down to the minimally effective dose and frequency, an opposite approach may be reasonable in dogs with mild incontinence.
- **Ephedrine and pseudoephedrine** are alternative alpha agonists with similar effects on urethral function. Their clinical use increases during periods when PPA is difficult to obtain. Dogs are a bit more likely to have adverse effects with pseudoephedrine treatment as opposed to PPA, including changes in appetite and behavior.
- **Adverse effects** are fairly rare in treated patients. Most commonly, dogs exhibit other sympathomimetic responses (agitation, panting, tachycardia) although central effects are possible (anorexia, unusual behavior, aggression). Typically, these effects resolve with reduced dosage or frequency although occasional dogs will not tolerate the drug. Systemic hypertension is theoretically possible, so blood pressure should be monitored. Sympathomimetic agents should be avoided or used with careful monitoring in patients with cardiac disease, renal disease or other uncontrolled hypertensive disease.
Table 1. Comparison of alpha agonists and reproductive hormones for management of urinary incontinence in dogs

<table>
<thead>
<tr>
<th></th>
<th>Alpha Agonists</th>
<th>Estrogens</th>
</tr>
</thead>
</table>
| **Effectiveness**    | 75 - 90% excellent results | 40 - 65% excellent results (DES)  
                          | 80-90% improved (estriol) |
| **Indications**      | Males or females, dogs or cats  
                          Poor response to estrogen | Female dogs  
                          Combination with alpha agonists  
                          Recurrent UTI or vaginitis? |
| **Administration frequency** | q 12 - 24 hrs; note tolerance may develop with higher frequency | q 1 - 14 days, depending on preparation |
| **Residual effects** | Short         | Possibly prolonged   |
| **Adverse effects**  | Hyperactivity  
                          Hypertension  
                          Anorexia, weight loss  
                          Hypertension? | Behavioral change  
                          Estrus/swollen vulva  
                          Exacerbation of immune-mediated disease?  
                          Bone marrow toxicity? (very rare) |

What if we actually need to relax the urethra instead of making it tighter?

Sometimes we see male cats or male dogs with a functional obstruction of the urethra. It’s easiest to think of this as a type of urethrosperm, although the urethra may simply not open when it’s supposed to. Urethrosperm is a challenging complication of feline obstruction. During recovery, blocked cats maybe doing well but still not be able to urinate. Short term administration of smooth muscle relaxants (prazosin, usually 0.25 mg once or twice daily), striated muscle relaxants (diazepam) and/or analgesics (NSAIDs, Opioids) can be somewhat helpful. Diazepam may transiently aid bladder expression in some cats. Some evidence exists that amitryptiline will relax the feline urethra too. All of these drugs have potential adverse effects.

On the other hand, weak bladder contractions (bladder or detrusor atony) are also possible following urinary obstruction and bladder overdistension. Recovery of normal detrusor function will be enhanced by preventing excessive detrusor stretch or strain in the days following relief of the obstruction. Atony can be managed with manual bladder expression if urethral resistance is low and expression is not difficult or painful. Manual expression of urine, especially in the face of any increased outlet resistance, can create further bladder wall trauma and may delay return to normal function. A cat whose bladder remains larger than a golf ball following a voiding attempt may require placement of an indwelling catheter for a variable period of time (usually 1-3 days) to maintain a small bladder size. Cholinergic drugs like betanechol can also be useful in the recovery of acute detrusor atony; however urethral outlet resistance must be lowered (typically with prazosin and/or diazepam) before introducing betanechol.

“Tincture of time” is the most reliable treatment for urethrosperm or bladder atony; however the urinary bladder must be kept small with urinary catheterization or gentle manual expression in the meantime.

Can we do anything to help bladder and prostate tumors besides aggressive surgeries or chemotherapy?

The most common tumors of the bladder or prostate are carcinomas, either a transitional cell carcinoma or adenocarcinoma. Although multimodal treatments for bladder and prostate carcinomas extend survival in some patients, many clients are unwilling or unable to try aggressive treatments. The response to aggressive treatments is not really dramatic either. Fortunately, simple medical treatment can buy good quality time for many dogs and cats.

In most cases, chemotherapy with piroxicam is used to reduce clinical signs and modestly prolong survival. **Piroxicam (0.3 mg/kg/day PO)** is a NSAID with additional antineoplastic activity. The anti-tumor effect may be due to immunomodulation (blocked COX 2 expression) or direct activity on tumor receptors. It is most effective against urinary bladder transitional cell carcinomas. Concurrent antacids (H2 blockers or omeprazole) or misoprostol (prostaglandin) are administered to protect the gastrointestinal tract. Complete or partial remission is seen in some dogs (about 30%), with survival times of approximately 6 months. Many treated dogs do well for a year or more. Similar results have been observed with Deracoxib (Deramaxx 3 mg/kgPO q 24 hrs).
Finicky Felines and Picky Pooches: Strategies for Patient Inappetence
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Tufts Cummings School of Veterinary Medicine
North Grafton, MA

Nutritional assessment and strategies for feeding hospitalized pets and those with chronic inappetence will be discussed by a board-certified veterinary nutritionist. Strategies for ensuring adequate calorie intake will be discussed. Strategies to increase owner adherence to prescribed nutritional plans will also be discussed. Case examples will be included to illustrate tips and strategies.

Terms useful for nutritional assessment of pets
- Anorexia: Complete loss of appetite, where a pet is not eating or ingesting any calories.
- Hyporexia: Decreased appetite where a pet is eating, but not enough to meet their daily calorie requirements (at least resting energy requirements, RER).
- Dysrexia: Change in food preferences, where a pet is eating, but not appropriate food (e.g., an unbalanced diet or foods not appropriate for a specific medical condition).
- Body condition score: Assessment of a pet’s fat stores only. Ideal body condition is described as ribs that are palpable without excess fat covering (tip: ribs should be no more padded than the back of your hand).
- Muscle condition score: Assessment of a pet’s muscle by palpation of spine, skull, scapulae, and ileal wings.

*Note: Non-branded charts of condition scoring can be found in the nutrition toolkit developed by the World Small Animal Veterinary Association (WSAVA), available at: http://www.wsava.org/nutrition-toolkit.

Chart of resting energy requirements for cats and dogs

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>RER (kcal/day)</th>
<th>Weight (kg)</th>
<th>RER (kcal/day)</th>
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<tr>
<td>1.0</td>
<td>70</td>
<td>15.0</td>
<td>534</td>
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<tr>
<td>1.5</td>
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<td>139</td>
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<tr>
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<tr>
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<tr>
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<td>953</td>
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<tr>
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Assessing risk of malnutrition

Assessing risk of malnutrition can alert the healthcare team when to intervene for a pet and consider additional nutritional support. During normal weight loss, the body of a healthy pet will adapt to calorie restriction and break down fat. However, when a pet has a medical illness, if calorie, and especially protein, needs are not met, the body will not adapt. Instead, pets will break down their own muscles to meet their nutrient needs and cause muscle wasting. Body condition scoring, muscle condition scoring, and assessing the risk for malnutrition is critical in pets not meeting their calorie or nutrient needs.

- **Low risk:** Previously healthy pets with no conditions that would increase protein loss (e.g., protein-losing enteropathy), who have been hyporexic or anorexic for 3 days or less. Examples would be elective surgery or a trauma.
- **Moderate risk:** Non-debilitated pets with conditions that increase protein loss, who have been hyporexic or anorexic for 3-4 days. Examples would be septic patients or a foreign body removal that required intestinal resection.
- **High risk:** Debilitated pets with chronic conditions that have experienced muscle loss, weight loss, have higher than normal nutrient needs (e.g., puppies or kittens), or have been hyporexic or anorexic for 4 or more days.

Note: For pets that are hospitalized, always assess the duration of hyporexia or anorexia including time at home before hospitalization!

**Nutritional intervention**

Strategies and the level of invasiveness for nutritional intervention differs depending on the risk of malnutrition for each pet.

**Medical strategies**

Assess current medications: Many medications may cause nausea or inappetence, including pain medications (e.g., opioids) and antibiotics. If temporary use in a low risk pet, this may not be a concern. However, pets that require nausea-inducing medications long term or who are already at high risk of malnutrition may need to be switched to alternate dosing or alternate medications. If palatability is a factor, some medications can be compounded with tasty flavors at compounding pharmacies, or topical/injectable options may be available, for example, injectable antibiotics such as cefovecin sodium.

Anti-nausea medications: For pets without alternatives for nausea-inducing medications, or for pets with chronic disease conditions that contribute to nausea, supportive medications can be used to counteract these effects, for example, maropitant citrate.

Appetite stimulants: Appetite stimulants are best used in low risk patients who have ‘forgotten’ their appetite and need a jump start. The effects of many of these medications are short term. Be cautious of pets who eat voraciously for one meal after receiving an appetite stimulant, but then return to hyporexia or anorexia within 12-24 hours. Examples of medications include: diazepam, cyproheptadine, and mirtazapine. One new medication on the market, capromorelin, has potential long term applications, though further clinical studies are warranted.

**Feeding strategies**

Coax feeding: Coax feeding should only be attempted in pets that are at low risk of malnutrition and the goal should be to minimize stress and make feeding an enjoyable experience. If pets are hospitalized, providing the owners a private and quiet room to feed their pet, especially cats, can minimize stress and encourage eating.

Consider diet history: A full dietary history is crucial to knowing food preferences for each pet (e.g., dry, wet, flavor, texture, etc.) and offering them foods that are familiar to them. There are many foods available now in stew forms, pate, loaf, shredded, chunks, with dried chicken bits, and in various shapes like doughnuts, stars, pyramids, etc. Ask owners to keep a diary of their pet’s preferences, which can be useful to guide diet selection if needed.

Food aversion: Altering food temperature can also be helpful – for those with nausea, placing food in a refrigerator may reduce smells that induce nausea and make food more palatable. For pets with food aversions, using new dishes each time or disposable dishes can reduce the chance of them smelling traces of an old food that they are averse to.

Disguise pet food: Likewise, some pets get excited about eating ‘human’ meals, and selecting one ‘human plate’ that is put on the table and then given to the dog or cat with their meal on it can make pets think they are getting a special treat. Similarly, putting regular kibble into an empty treat pouch or bag can also make pets think they are getting a special treat as it has the same smells and sounds of treats they like.

Rotating foods: Many chronic conditions can cause a cyclical appetite, meaning that food preferences and appetite can change over time, but may only be temporary. Keeping a journal of pet preferences can be especially helpful in these situations. Just because a pet refused a food once does not mean they may not like that food again later. We often will give pet owners a list of appropriate foods that they can rotate between if their pet has a change in appetite, or encourage palatability enhancers to disguise foods and flavors (see below).

Home-cooked diet options: If there are no commercial diets appropriate for a pet’s medical condition that they will eat, home-cooking can be an alternative option. This is also common in pets who have been fed table scraps long term and find it hard to then...
switch back to a commercial diet. Pets should ONLY be fed home-cooked diet recipes that have been formulated by a board-certified veterinary nutritionist (see www.acvn.org). Many studies have shown recipes online or in books are not complete and balanced and may cause nutrient deficiencies.

**Palatability enhancers**

Palatability enhancers can be used with caution in pets, keeping in mind altered nutrient needs of pets with medical conditions and calories content to not unbalance the diet. Reserving 10% of the pet’s total calorie intake for treats or palatability enhancers lowers risk of unbalancing the diet. Some popular palatability enhancers include shredded chicken breast (200 kcal/cup) for pets without protein restrictions, homemade chicken broth (store-bought is usually high in sodium and frequently contains onion or garlic), low fat and no salt added cottage cheese (200 kcal/cup), and honey or maple syrup (60 kcal/tablespoon), which is especially helpful for dogs with kidney disease or liver disease. Note: cats do not have taste receptors for ‘sweet’ foods and sugary items are not as effective as a palatability enhancer.

**Medication administration strategies**

Avoid putting medications, especially those with bitter taste, directly into pet foods as it may unintentionally cause a food aversion or affect appetite. An alternate low fat, low protein, low sodium option is to use banana (1/4 inch slice = 15 kcal), or melons (1 melon ball = 10 kcal) to give medications. Always ask owners what they are using for medication administration as it is not commonly included in diet histories (owners don’t think of this as ‘food’).

**Behavioral strategies**

In some situations, particularly pets with chronic diseases, owners can become very invested in their pet’s eating habits and become anxious over how much their pets are eating. This anxiety can spill over to their pet, who may not understand why his owner gets very upset at mealtimes. Pets then sometimes associate eating or mealtimes with something wrong or upsetting. This can be seen where pets eat normally when pet sitters are involved or a family member leaves the household temporarily. Have owners explain mealtime in detail and ask about all family members and other pets, who sometimes may also contribute to stressful mealtimes if there is fighting over food bowls. Anxious owners can leave food in timed automatic feeders, or place the food and their pet in a quiet, separate room in their house where the pet is left alone to eat. Alternatively, for social pets, talking to them in a soft soothing voice and petting them while they eat may encourage appetite and make mealtime more enjoyable.

**Assisted feeding**

Once a pet has become moderate or high risk (hyporexic or anorexic for 3 or more days) and previous strategies have been unsuccessful, a nutritional intervention plan should be developed to provide adequate nutrition long term. Assisted feeding can include a variety of short term or long term enteral or parenteral options. Enteral options (feeding tubes) are always preferred if tolerated as intestinal cells can atrophy without direct nutrition through ingested food. The WSAVA Nutrition Toolkit not only has easy-to-use calorie charts, but also provides example feeding orders, monitoring templates, and a helpful flow chart for how to intervene nutritionally for each pet.

Long term feeding tubes can be overwhelming to some owners, especially in pets who are dysrexic, and eating to meet their calorie needs, but not willing to eat foods that are appropriate for their medical condition (e.g., a dog with protein-losing nephropathy that will only eat beef or chicken). The Tufts Clinical Nutrition Service has a website with frequently asked questions for pet owners who are considering a feeding tube or have had a feeding tube recommended to them (http://vetnutrition.tufts.edu/about-feeding-tubes/). The most popular questions are included here:

**Why should a feeding tube be placed in my pet?**

Feeding tubes allow us to provide pets with nutritional support when they either cannot or will not eat enough to support their nutritional requirements. Feeding tubes also permit us to feed pets the optimal diet for their disease(s) if they will not eat it voluntarily. For many diseases, such as kidney disease, an optimal diet can greatly increase survival time as well as quality of life. Additionally, feeding tubes offer a great route for administering some medications and additional water supplementation when necessary.

**Can't we just wait to see if my pet will eat soon?**

A feeding tube has been recommended because your pet has already had a decreased appetite for at least a few days and is anticipated that he or she will continue to have insufficient food intake. Inadequate nutrition (starvation) can have detrimental effects on many organ systems and increases complications and mortality. Feeding tubes can be a great safety net to have in place if needed.
How are feeding tubes placed?
The two most commonly used tubes for at-home care include esophagostomy tubes (E-tubes) and gastrostomy tubes (G-tubes or PEG-tubes). Both types of tubes are placed under general anesthesia. The E-tube is placed directed into the esophagus while the G-tube is placed directly into the stomach (either surgically or with endoscopic guidance). Both tubes are usually extremely well-tolerated by pets.

What kind of maintenance does a feeding tube require?
Pets are usually fed three to four times daily with a feeding tube. Usually the diet will consist of a slurry made up of a specific canned food that has been blended with a specific amount of water. The tube site (where the tube exits the skin) will need to be checked twice daily and some simple bandage care is required.

Can my pet still eat and drink with a feeding tube?
Yes! Your pet will still be able to eat and drink with a feeding tube in place. This means that as he/she begins to eat on his/her own, the amount of food being given via the feeding tube may be decreased accordingly. Once your pet is eating enough to maintain his/her body weight, the feeding tube may be removed (under veterinary supervision).

How long will the tube stay in place?
Tubes are typically left in place until your pet has been eating well for at least one week. If necessary, E-tubes and G-tubes can be maintained for weeks to months with appropriate care.

Summary
Assessing each pet for their risk of malnutrition will help guide the type and level of nutritional intervention needed to meet nutrient and calorie goals.

General pet nutrition resources
- American College of Veterinary Nutrition (ACVN) Website: www.acvn.org
- Resources for pet owners, veterinarians, and a listing of all board-certified veterinary nutritionists.
- World Small Animal Veterinary Association Nutrition Toolkit: www.wsava.org/nutrition-toolkit
  - Note that this site has resources for pet owners and for veterinarians on pet nutrition topics.
- Tufts Clinical Nutrition Service Petfoodology Website: www.petfoodology.org
- University website created by board-certified veterinary nutritionists with frequently updated blogs on pet nutrition.
Prevention of problem behaviors is easier than treatment. Problem behaviors in cats are often associated with the stress of other cats in the house or outside the home. In order to decrease social tension in multi cat households, provide core areas for each cat, increase vertical living space, and prevent exposure to outside cats. When introducing a new cat to a resident cat, it should be a gradual process.

There are pros and cons to confining the cat indoors versus allowing access to outside. The indoor environment is not as enriching or stimulating. However, the indoor environment is safer. Through management and environmental enrichment, indoor cats can be given alternative activities to allow for mental and physical stimulation.

**Environmental enrichment**

Implementing routine play sessions with the owner in the morning and evening provides for routine interactions. Cats enjoy playing with toys that encourage pouncing and stalking (predatory sequence). Feather toys on the end of a pole, small stuffed toys and balls encourage exercise and positive interactions with the owners. Any type of direct play with human hands should be avoided as it can promote inappropriate play and result in potential injury to humans through accidental scratches and bites.

Cats are natural grazers and they are designed to eat small amounts of food at frequent intervals. Food puzzle toys can help to prevent obesity in cats as there is more activity involved in the feeding process and they provide great mental stimulation. Food puzzle toys also allow for exploration and discovery.

Hiding food and treats around the house in small dishes or cups promotes exploratory behavior and appeases the cat’s natural desire to search for food. Although not a toy, some cats enjoy the option of having indoor grass available. Most are easily grown indoors and are made up of either wheat or oat grasses. Offering fresh grass can prevent cats from eating house plants while providing roughage to their diet.

Providing exploratory outlets through a variety of interactive toys will help to appease the cat’s curiosity. Interactive homemade toys can provide cats with hours of entertainment. A cardboard box with holes for the cat’s paws and toys dangling from sisal rope is an easy to make homemade toy that most cats will appreciate. Sisal rope is a durable rope made from plant fiber. It is often used for scratching posts for cats. These toys can be inexpensively made to entertain boarding felines and sent home with the owners at pick up.

Vertical space is important not only for management but also environmental enrichment. Vertical space creates areas for exploration and additional hiding places. Cat trees, perches, shelves and elevated hiding places are great options for creating vertical space for cats. Tunnels, boxes and paper bags can be used at lower levels. In the veterinary setting, a cardboard box or paper bag placed in a cage with a feline patient can allow the cat a safe place to hide in the novel environment.

Secure outdoor enclosures and fences are available to allow cats to have exposure to the outdoor environment within a confined area. Most are designed to not only keep the pet cat in the yard but also prevent other feline intruders from entering the yard. For safety supervision by the owner is recommended during controlled outdoor exposure. Acclimatizing a kitten to wearing a cat harness can also allow the owner to manage the cat outside; thus allowing for more exploration. Adult cats that have not had previous exposure to outside, may never be comfortable or enjoy being outside regardless of the owners’ best effort. Instead the owner can focus on making indoors as enriching as possible.

**The first veterinary visit**

One of the first items that should be addressed during the first veterinary visit is teaching the kitten to become comfortable with the type of handling needed to keep it healthy and well-groomed throughout its life. This will also make procedures run smoothly and save staff time by creating a relaxed and cooperative patient in the clinic. The first kitten appointment is the ideal time to prepare kittens for physical exams, venipuncture, teeth cleaning, ear cleaning and pedicures. Not only in kitten hood but even in adult cats, it is imperative that technicians avoid mishandling patients regardless of their behavior. The goal always should be to create a positive association with the examination process that can follow the pet through the rest of his life. Rough or forceful handling methods teach fear and mistrust and often result in a difficult to handle cat. It also sets a poor example for owners to follow and could be considered malpractice.

By taking a few extra minutes during the first appointments, the kitten will be able to acclimate to the environment. Utilizing treats or canned kitten food during the examination and vaccination process, the kitten will likely be so distracted she does not even notice. This is also creating a positive memory for the kitten.
Prevention topics

Play biting and scratching
The motivation of this behavior is play and attention. It is a normal behavior of cats. They interact and explore their world with their feet and mouth. The consequence of the behavior is attention from the human. To prevent and manage this behavior, it is necessary to avoid playing with the cat with your hands, to provide appropriate toys, and schedule play time. Proactively provide the kitten with appropriate outlets for this behavior. If proactive measures are unsuccessful and the cat begins to mouth or scratch the owner, the owner should be advised to immediately stand up and look away briefly, and then ask the cat to sit and redirect the cat to an appropriate toy. Alternately, send the cat to a desired perch or resting place and reward. Avoid punishment (squirt bottles, verbal reprimands) because it creates fear and distrust and does not appease the cat’s motivation to play.

Destructive scratching
The motivation for this behavior is it is a normal marking behavior. It is self-reinforcing and consequently, it cannot be ignored. Prevent the behavior by providing an appropriate outlet. Keep the cat’s nails trimmed. If the cat is scratching an inappropriate object, interrupt the behavior, call the cat away, reward, and redirect to an appropriate area. It may also be necessary to prevent access to the object or make the object aversive to the cat.

Handling
Prevention is so important. Teaching the cat to tolerate restraint and handling at an early age is much easier than treating a cat that is aggressive with handling. With time cats quickly figure out that being held still or manipulated usually means something unpleasant is going to happen. The cat is restrained to have its nails trimmed, to be given a vaccine, and to blood drawn. The cat needs to have a learning history of being restrained and have only pleasant things happen. Use tasty treats or a feather on a string as a reward to desensitize and counter condition the cat to handling. If the cat becomes frightened and aggressive, avoid punishment. Verbally reprimanding the cat may inhibit its behavior, but it does not make the situation any more pleasant for the cat, or client.

Crate training
Most cats know that the cat carrier means, “We are going to the Vet!” To prevent this negative association, use the crate at all times. Make it a comfortable resting spot for the cat. Hide treats in the kennel and feed special meals in the kennel.

Obedience training
Cats can learn just as many tricks as dogs. Finding the right motivator can sometimes be a challenge. Small treats, a lick of tuna juice, or a feather on a string are potential rewards. Teaching the cat to come when called and to sit on cue can easily be facilitated with minimal effort. Positive reinforcement training provides mental stimulation for the cat and is a way for us to redirect undesirable behaviors.

Integrating a kitten to a multi-cat household
Integrating a new cat to a multi-cat household can be stressful for the new cat as well as the resident cats. In order to provide for the most harmonious integration possible, it is best to take a proactive approach and systematically provide for a gradual introduction. Although the process may seem tedious, it often can progress quickly. However, if owners decide to “just see what happens,” a negative initial introduction could result in a much longer acclimation process or even worse, an inability for the cats to cohabitate.

The kitten or new cat should be set up in one room. The room should have all necessary resources, including a litter box, scratching station, food, water, bedding and toys. It is also a good idea to include a large multilevel cat cage. The kitten should be provided with numerous opportunities to interact and play with the owner throughout the day. For the first few days the new cat should be kept confined in a room. This will give the resident cats the opportunity to become accustomed to the new cat’s scent through a closed door. The procedure can be helped along by exchanging bedding between the animals. The scents of the cats can also be mixed by allowing the new cat to explore other parts of the house while confining the resident cats to a room. Another method to mix the scents of the cats is called artificial allomarking; a small towel can be rubbed on one cat, then the other, then again the first one, then the second one, etc. This helps to “mix” the odors and makes a communal scent between the cats.

Ideally the resident cats and the new cat should become acclimated to their own individual multilevel cat cage. This will aide in the visual introductions of the cats. All cats should be managed in their cage for a special meal time twice a day. Alternatives to the multilevel cat cage are either a travel carrier or a harness and leash. However, all the cats must be comfortable with the confinement method or harness prior to starting the introduction process.

Start at a distance that the cats can see each other but are not dissuaded from eating their special meal (the furthest distance possible for the layout of the house is best). Each day move the cages a foot closer, until they can be next to each other while eating. Once this has been accomplished, if the resident cats are not overly interested in the new cat, the owner may consider keeping the new cat in the cat cage for supervised periods of time (if using a travel carrier, place the carrier up on a table or elevated surface) while allowing the resident cats to be loose in the room. This will help to facilitate habituation to the presence of each other. The next step would be to allow the new cat to be loose in the room and the resident cats to be confined to their cat cage. Once it has been determined that amicable interactions are occurring between the cats and they are relaxed in each other’s presence, supervised periods of time loose together can be allowed.
If any direct staring, hissing, growling, or other threats are observed, a towel should be placed over the cage to interrupt the threat and the cats should be separated. Aggressive responses should be dealt with by ending the session and waiting 24-48 hours before attempting again. With the next session increase the distance between the cats and progress more gradually. Ideally, avoid all negative experiences while introducing the cats. Slower is actually faster because negative experiences will be remembered and will take time to overcome. Pheromone products such as Feliway® may also be useful if the resident cats or the new cat are stressed during the process. The entire process may take 2-6 weeks to accomplish new introductions depending on the individual cats. A quick progression of the same techniques can be used when re-introducing cats after one of the household cats has had a visit to the veterinary clinic. The cat that remained home will often reject the returning cat. Simply mixing their scents and doing a controlled special meal time and gradual introduction over a few hours can be effective in preventing a long lasting negative re-introduction.

Resources
Prevention is Easier than Treatment!
The Importance of Preventive Behavioral Service
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Undesirable behavior in pets results in a weakened human-animal bond. Behavior concerns are the number one cause for pet relinquishment. Forty percent of pets were relinquished to shelters for behavior issues.¹ The number one behavior reason in one study for relinquishment was house soiling in both dogs and cats.² Through preventive behavior services, we can educate clients on proper techniques for addressing normal behavior challenges in their pets. Thus, keeping pets in their homes, saving lives, and retaining a patient. The prevention of behavior issues is easier than the treatment of them.

An overview of several preventive services that can be offered within the hospital and implemented by or with the assistance of the veterinary technician or other trained professional will be discussed. These services include: pet selection counseling, puppy socialization classes, kitten classes, fun visits, private training or behavior modification sessions, (behavioral) wellness visits.

**Pet selection counseling**
Pet selection counseling is the first defense against preventing behavior problems and the first offense in influencing a strong human animal bond. Educating and preparing the prospective pet owner are the primary goals of this service. Misconceptions can be discovered and addressed. Not only will the new pet owner be better prepared but they can also set their new companion up for success.

**Puppy socialization classes**
In a true puppy socialization class, puppies should be in their socialization period. A good puppy socialization class will provide a safe environment for exploration and exposure to a variety of stimuli in a controlled and positive manner. The main focus at this age is not on manners training but on creating positive experiences for the puppy and teaching puppy owners appropriate and humane techniques for addressing normal puppy behavior. The benefits of puppy socialization classes include:

- Preventing behavior problems
- Decreasing pet relinquishment
- Bonding the client to the puppy and your facility
- Educating puppy parents on normal canine development and humane training techniques
- Acclimating puppies to handling and routine veterinary procedures
- Providing a controlled and safe environment for exploration
- Allowing for early intervention for high risk puppies
- Facilitating all puppies reaching their full potential

A good resource regarding the importance of puppy classes is available at [www.avsabonline.org](http://www.avsabonline.org) under position statements.

**Kitten classes**
Kittens attending a class should be under 14 weeks of age. The benefits of offering Kitten Classes in your hospital include:

- Creating a strong bond between the owner and the kitten as well as your hospital
- Educating owners regarding normal feline development and behavior
- Coaching owners on responsible cat ownership and management
- Providing a safe and controlled environment for exposure and desensitization to veterinary procedures
- Identifying and preventing behavior problems

**Fun and victory visits**
A fun visit refers to the pet visiting your hospital just for fun. No procedures are performed. Kitten and puppy classes in your hospital are fun visits. However, once the dog/cat has graduated from the class, it is equally as important that they continue to return to your hospital for good experiences. This helps build a positive emotional response and memories with your facility. This is generally considered a complimentary service, when it is a preventive. Victory visits involve a veterinary team member assisting with desensitization to gentle control and medical treatments or with changing an already established fear of the veterinary office. Victory visits are a service that should be charged and is considered a private training/behavior modification session.

**Private training and behavior modification sessions**
Private training and behavior modification sessions are scheduled appointments with a qualified team member to address manners and preventive training. Generally, behavior modification implies the treatment of an already existing fear or anxiety. Pending the situation, this may require a veterinary behavioral diagnosis and treatment plan prior to addressing. However, if preventively
addressing a mild apprehension, such as avoidance of the nail trimmers, a behavior modification session to coach owners on how to appropriately condition a dog or cat to nail trimming would be considered preventive.

(Behavioral) preventive care visits
You are already doing preventive care visits! Incorporating behavior questions into the history taking is imperative. Clients are not always forthcoming with behavioral concerns. They may be embarrassed that their cat is peeing on the carpet or that their 1-year-old dog is chewing the couch when home only. By screening for common behavior concerns, we can identify situations early before irreparable damage to the human animal bond has been done. Consider adding a specific preventive care visit for dogs and cats that are between 9-12 months of age, to address behavior concerns that have developed since the routine puppy and kitten examination series. The majority of pets are relinquished to shelters between 5 months and 3 years of age (dogs 47.4% and cats 40.3%) and have been owned between 7 months and 1 year (dogs 37.1% and cats 30.2%). This is a time we often do not see them in the veterinary hospital. By reaching out and suggesting a behavioral checkup during this time, early intervention can be provided.

References

Resources
1. American Veterinary Society of Animal Behavior (AVSAB) www.avsabonline.com
2. Society of Veterinary Behavior Technicians (SVBT) www.svbt.org
3. Puppy Start Right Instructors Course www.puppystartright.com
5. Canine and Feline Behavior for Veterinary Technicians and Nurses. Co-editors Julie Shaw and Debbie Martin
Being able to assist clients by providing appropriate recommendations for species specific behaviors, is a vital skill for all technicians to possess. Providing outdated or inappropriate recommendations could result in further damage to the human-animal bond, relinquishment, and even euthanasia.

After reviewing a brief explanation of learning theory, a step by step behavior solution model will be analyzed. We will put problem prevention and behavior solutions into action with some common normal canine behaviors. Understanding that there is a difference between a training problem and a behavior disorder is crucial to providing guidance to our veterinary clients. A training problem can be defined as a normal behavior of the pet/species that humans find undesirable. In contrast, a behavior disorder occurs when the pet suffers from an underlying emotional disorder, unrelated to training. Behavior disorders, as well as training problems, can be detrimental to the human-animal bond and compromise the welfare of the pet and/or the owner. The focus on this presentation will be to provide attendees with the knowledge and skills to provide behavior solutions to normal training issues and behaviors of puppies and dogs.

**Learning theory**

Thorndike’s Law of Effect states: behaviors that have a pleasant consequence will increase in frequency and behaviors that have an unpleasant consequence will decrease in frequency. Anything that increases the likelihood of a behavior occurring again is considered a reinforcement. If it decreases the frequency it is considered a punishment. Reinforcement and punishment can be further broken down to positive (adding something) and negative (removal of something). Positive punishment can be defined as adding something aversive to decrease future behavior. Positive reinforcement is adding something desired to increase future behavior. Negative punishment is withdrawing something desired to decrease future behavior. Negative reinforcement is withdrawing something aversive to increase future behavior. With training, any species of animal, but especially companion animals, focusing on rewarding desirable behaviors (Positive Reinforcement) and ignoring (extinction) or removing reinforcement (negative punishment) if necessary, are generally the most humane training techniques. Our training focus is heavy on positive reinforcement. Negative punishment (removal of reinforcement) may be utilized but rarely is it necessary if the environment is managed well to help the animal be successful.

**Problems with aversives**

Although aversives can be used to inhibit behavior or change behavior, it is riddled with problems. Examples of positive punishment (and negative reinforcement depending how they are used) are correction based training collars (pinch collars, choke chains, electric collars) and verbal or physical reprimands. Positive punishment inhibits learning, reduces creativity, and induces fear, anxiety and conflict. It is difficult to apply consistently and is inappropriate for puppies/kittens, pets with behavior problems, teaching new behaviors, or appeasing the pet’s underlying motivation.

In order to use positive punishment effectively, it should be applied every time the behavior occurs, within a half second of the behavior beginning, at a proper intensity, and not be associated with the owner. It is difficult to meet all these criteria. Reasons to avoid positive punishment are that it does not teach the pet what to do, the trainer is focused on bad behaviors, it does not appease the pet’s underlying motivation for the behavior, and it often damages the human-animal bond. It has also been associated with owner-directed aggression.¹

**Characteristics of dogs and successful “pet parents” or trainers**

The two most influential books for me that changed my perspective on dogs and training are The Culture Clash, by Jean Donaldson and Don’t Shoot the Dog, by Karen Pryor. In The Culture Clash Ms. Donaldson discusses the characteristics of dogs. The list below of general dog characteristics has been modified from The Culture Clash (James and Kenneth Publishers, 1996).

- Dogs are amoral. They do not know right from wrong. They know safe and unsafe. For example, it is safe to get into the trash when people are absent but unsafe when they are present.
- Dogs are opportunistic and self-centered. It is about what is in it for them.
- Dogs are social. Therefore they make good companions.
- Dogs are constantly learning from their actions. Learned behaviors may be appropriate or inappropriate for human counterparts. So even when we are not actively training they are still learning. Evaluate their behavior from a learning perspective.
- Dogs explore the world with their mouths. They lack thumbs. Everything is a potential chew toy.

To be a successful ‘pet parent’ there are some simple rules to follow:
1. Be fair; understand the pet’s perspective. Pets are amoral, opportunistic, self-centered, highly social (dogs), constantly learning, and everything is a chew toy!
2. Be a good teacher. Control what the pet learns through management and supervision. Guide them into making the right decisions. Don’t waste time telling the pet what not to do. Instead, teach him the correct behavior. Set the pet up to succeed.
3. Clearly communicate to the pet when he is performing the correct behavior. Catch him doing things right and reward him for it. A high occurrence of positive reinforcement will help your pet learn quickly.
4. Be consistent. Inconsistency and unpredictability cause fear and anxiety which can be a precursor to behavioral problems. Set the rules of the house and make interactions predictable and consistent.
5. Be your pet’s advocate. He can’t speak for himself.

Meeting the social, physical, and exploratory needs of the dog
Maintaining a schedule and routine with puppies and adult dogs makes their lives more consistent and predictable. Ideally, all dogs should be meal fed twice a day (very young or small puppies may require 3 times a day initially), walked off the property twice a day for 10-20 minutes, and trained using positive reinforcement twice a day for 5-10 minutes. The pet owner should incorporate play with training. A variety of toys should be available to the dog and the toys should be rotated, so it appears that there are always “new” toys. Providing an appropriate outlet for exploratory behavior, such as “sniff” walks and food exploratory activities, provides for mental stimulation. If dogs are not provided scheduled/routine outlets to meet their social, physical, and exploratory needs, they will often find less desirable ways, from the owner’s point of view, to meet those needs.

Behavior solutions model
By following these steps, you can learn to prevent, modify, or decrease unwanted behaviors. The first step in changing behavior is to decide whether this is a normal behavior for the age of the pet and species? Puppies chew things and usually do not come completely house trained. If the undesirable behaviors have a fear, aggression, or anxiety component, then the issue may be a behavior disorder rather than a training issue.

ABC’s
Once it is determined that this is a normal behavior, just one the pet parent finds undesirable, then the ABC’s (Antecedent, Behavior, Consequence) of the behavior should be identified. The antecedent sets the occasion for the behavior to occur. Examples might be environmental stimuli (the mail man approaches the house, the owner returns home) or internal (bladder is full, dog is hungry). The behavior is what the pet does in response to the antecedent. The consequence is what happens during or immediately after the behavior, which will then affect whether the behavior will be more or less likely to occur again in the same situation.

Motivation
By looking at the ABC’s of a behavior, we can often determine the motivation, which is step 2. What is the pet getting by performing the behavior? Is the behavior self-reinforcing? In an attempt to simplify things, when using the term self-reinforcing, I actually mean reinforcement by something other than the owner’s attention. The consequence is not under the control of the owner. Am I rewarding the behavior in some way? To simplify motivation think of it in terms of it is either self-reinforcing (reinforced by something other than human attention) or reinforced by human interaction (or socially motivated).

Management/Prevention
Once the ABC’s and motivation have been determined, the ability to prevent or manage the behavior should be explored. Step 3 is can you prevent or manage the behavior in a humane way? For example: can you supervise your puppy or confine him so the majority of eliminations are only on a preferred substrate (outside)? Can you prevent the dog’s access to the front door, where he sees and hears the mailperson every day? Can we control or avoid the antecedents?
Management and controlling what the dog learns is important to prevent the learning of undesirable behaviors. Puppy owners should puppy proof the house, use baby gates, an exercise pen, and/or a crate to help manage the new puppy and set him up for success.
Also, proactively reinforcing the dog for desired behavior rather than being reactive to undesirable behavior, helps the dog learn quickly what behaviors are desired by the owner. This takes some training of the person, because in general we all tend to be more reactive than proactive. Management and prevention include being proactive and reinforcing desired behaviors, controlling the antecedents, and supervision.
Solve it!

If the behavior cannot be prevented or managed (or our management system has failed), then we have to proceed to step 4: Solve it! There are two options depending on the motivation; Ignore the behavior or Response substitution. If the motivation and consequence has been socially motivated for human attention, the behavior should be ignored if possible. Behaviors that are not self-reinforcing or rewarding to the pet will cease to occur if ignored (i.e. no reinforcement is provided). If the reward for the behavior is human attention, i.e. he jumps on you and you push him away, he nudges you and you pet him, he barks and you toss a toy, it is likely that ignoring the pet in these situations will cause the learned behavior to cease. Ignoring means; not looking at, talking to, or touching the pet at these times. Initially, the attention getting behavior will worsen because in the past it has resulted in a desired consequence, but if you continue to ignore the behavior it theoretically should extinguish. However, the implementation of extinction can be difficult for owners to implement and can produce stress or frustration for the animal. Ignoring (avoiding reinforcing) generally works best if it is not a long-established behavior. It is also important to recognize that the emergence of numerous undesirable behaviors, may reflect a lack of adequate social, physical, and exploratory outlets for the dog. Rather than using extinction, the owner can instead proactively (before the dog does the undesirable behavior) direct the dog to a desired behavior that can be reinforced.

Behaviors that are self-reinforcing cannot be ignored. For example: to the dog, barking at the mailperson at the door makes the mailperson leave and it works every time. Some socially motivated behaviors may also not be able to be ignored and allowed to extinguish. For these behaviors, it may be necessary to use response substitution:

1. **Interrupt the behavior** by getting the pet’s attention. Clap your hands or call the pet’s name in an upbeat tone of voice. The interrupter should not be frightening, an indicator of impending punishment, or be given in a negative tone. The use of “Ah-Ah” or “No” should be avoided.

2. Give your pet a **cue for an alternate appropriate behavior** that has been previously taught to the dog with positive reinforcement training. The alternate behavior should be incompatible with the undesirable one. For example, if your dog is barking at the mail person, clap your hands or call the dog’s name (upbeat, calm tone) and ask him to come and sit. You may gently prompt the appropriate behavior with a flat collar and leash if necessary. Ideally, be proactive, get the dog’s attention before he is already in full swing of the undesirable behavior. If you hear the mailman approaching, proactively call your dog to you and reinforce with a treat. Keep him busy with play or training until the mailman leaves.

3. **Reinforce** your pet for the appropriate behavior with a food treat or other high value reinforcer. You may keep the pet busy with a food stuffed toy or several different behaviors (sits and downs) or redirect him to an appropriate activity.

**Problem solving in action**

Even after setting up an ideal environment for learning with appropriate management and a consistent routine, there will still be normal behaviors that a canine will exhibit that may be problematic for canine parents. Through interactive discussion with the audience, some common canine behaviors will be examined and the prevention and problem solving model will be applied.

**Conclusion**

By understanding normal canine characteristics and recommending to our clients appropriate humane techniques for addressing undesirable behaviors, we can enrich the relationships canine parents have with their dogs and enhance the human-animal bond.

**References**


**Resources**


Choosing the right rebreathing bag and tubes for your patient

Tidal volume is the volume of air inhaled and exhaled during each breath. Tidal volume is often estimated at 10-15mL/kg of lean body weight. Rebreathing bag size should be 3 to 5 times tidal volume. Remember to round up on the size of your rebreathing bag. For example a 20kg dog would have a tidal volume of approx. 300mL, so if we calculated 5 x 300 = 1500mL which we would round up to 2L.

When to use the rebreather vs. non-rebreather

Non-rebreathing circuits depend on high oxygen flow to remove exhaled carbon dioxide from the circuit between breaths. The decision to select a non-rebreathing circuit is often made by the weight of the animal with many clinics using a non-rebreather system for any patient weighing less than 10kg, but it is actually a decision that the patient is too small to overcome the resistance of a rebreathing circuit.

Calculating O2 flow rates

There is no universal agreement as to the proper flow rate for the various anesthesia breathing systems. The AAHA recommended flow rate of 200ml/kg/min for non-rebreathing systems is generally accepted as appropriate. That flow rate is 33 times more oxygen than is needed to meet a patient’s metabolic oxygen consumption each minute, but that high flow rate assures the patient will not rebreathe any of its exhaled carbon dioxide. The flow rate for rebreathing systems traditionally falls within 20 – 40ml/kg/min, most often settling at 30ml/kg/min.

Leak test the anesthesia machine

Before any anesthetic event it is important for you (the awesome technician anesthetist!) to do a leak check to ensure the system can properly deliver anesthetic gas and oxygen as well as properly remove CO2 and anesthetic waste gases.

- With the correct anesthesia hoses and reservoir bag attached to the anesthesia machine, ensure that the machine is correctly connected to your oxygen source and waste gas scavenging system.
- Close the pop-off valve or occlude the quick release valve. The pop off valve prevents the inadvertent buildup of pressure in the system, and should remain open except during positive pressure ventilation.
- Occlude the end of the anesthetic delivery hose with your thumb or palm of your hand.
- Fill the system by using the oxygen flush valve, fill the reservoir bag until the pressure manometer reads 20cmH2O, then stop. You can also turn on the flow of oxygen to fill the reservoir bag until the pressure reaches 20cmH2O.
- Hold pressure in the bag by continuing to occlude the end of the anesthetic delivery hose.
- Watch the pressure manometer—it should remain steady at 20cmH2O for at least five seconds.
- Open the pop-off valve to relieve the pressure in the system.

If the anesthesia machine failed the leak test, check the anesthesia delivery hose and reservoir bag for holes, and the scavenging/CO2 scavenging system for leaks. Another common location for leaks is the connection and housing for the absorber assembly, which contains the absorbent for CO2. Soda lime granules on the gaskets can sometimes prevent a tight seal. Repair or replace components as necessary, then try again until the machine passes the leak test before connecting the patient to the anesthesia machine.

What opioids do and why we love them

Opioids are considered by many to be the prototype analgesic. They have a wide range of analgesic action from ultra-short acting agents such as remifentanil to longer acting agents such as hydromorphone. Their general reversibility makes them especially attractive in higher risk cases. And in some cases they are relatively inexpensive. They are also extremely versatile in that they can be administered via many different routes. Opioids can be given as oral tablets, intermittent injection, constant rate infusion, transdermally, or epidurally.

The effects of opioid analgesics are dependent upon the receptors at which they act. Currently, there are three major classes of opioid receptors recognized within the CNS. They are as follows mu, delta, and kappa. All three classes of opioid receptors produce some level of analgesia.

Drugs acting on opioid receptors are also classified as being agonists, partial agonists, mixed agonist/antagonists, and antagonists.

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Anesthesia Basics and Beyond: Things You Learned in School But Have Forgotten
Tasha McNerney, BS, CVT, CVPP, VTS (Anesthesia/Analgesia)
Veterinary Anesthesia Nerds
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**Opioid agonists**

These drugs have high affinity for the mu opioid receptors responsible for analgesia and sedation. Opioid Agonists include: Morphine, hydromorphone, oxymorphone, fentanyl, methadone, etc.

**Partial Agonists**

These drugs by definition are only partially as effective as agonists. This is because its binding with the mu opioid receptor produces an effect that is less pronounced than that of an opioid agonist such as fentanyl. An example of a partial agonist would be buprenorphine.

**Mixed agonist/Antagonists**

These opioids work by exerting an agonist effect at the kappa receptors being responsible for sedation and some analgesic properties. They also act as an opioid antagonist at mu receptor sites. Agonist/antagonist opioids can include butorphanol and nalbuphine. These drugs can also be used to reverse some of the unwanted side effects of full agonist opioids such as excessive sedation. (Wagner, 2009)

**Antagonists**

These drugs work to fully antagonize and reverse the effects of opioids at the mu and kappa receptors. Drugs in this category include naloxone and naltrexone. These drugs will cause increased alertness. They will also reverse the analgesic effects of opioids so opioid antagonists should be used with caution in the painful patient.

**Local blocks are your friend!**

Local blocks are a cheap and easy way to add additional analgesia. Local blocks can be considered for all procedures from dentistry to surgery. Specific local blocks will be discussed in depth during the lecture.

**HR & ECG**

**CATS**: under anesthesia HR 120bpm- 250bpm. **Small Dogs** under anesthesia: 80-140bpm **Large Dogs** under anesthesia: 50-80bpm.

It is important to keep in mind what the heart rate, respiration and / or ECG were on the on PRE-OP exam. Also keep in mind what anesthetic drugs were given, as will they effect HR. The ECG is simply a recording of the electrical activity in the heart. The following are a few important ECG waveforms you should know:

- **Sinus Arrhythmia**: Variation in sinus rhythm related to respiration and resulting from vagal tone inhibition. Heart rate increases with inspiration and decreases with expiration.
- **Sinus Tachycardia**: A regular sinus rhythm with a heart rate above 160 bpm in adult dogs (220 bpm in puppies, 180 bpm in toy breeds, and 140bp in giant breeds) and above 240 bpm in cats.
- **Atrial Tachycardia**: A supraventricular tachycardia where the P wave configuration differs from sinus P waves. The rate is rapid, but the rhythm may be irregular.
- **Atrial Fibrillation**: Numerous unorganized ectopic foci in the atria discharge impulses at very high rates causing uncoordinated activity of the atria and loss of effective muscular propulsive movement. Atrial complexes appear as erratic fibrillatory waves.
- **Ventricular Premature Complexes (VPC’s)**: An ectopic beat originating in the ventricles. You will see no P-wave associated with the QRS complex. This can be a problem because it decreases cardiac output because of decreased filling time for the ventricles. VPC patterns that require special attention are; Bigeminy (when every other beat is a VPC) and pairs or triples of VPC’s.

**Blood pressure management**

Blood pressure is typically recorded as two numbers, written as a ratio like this: 110/80 mmHg. **Systolic**: The top number, which is also the higher of the two numbers, measures the pressure in the arteries when the heart beats (when the heart muscle contracts).

**Diastolic** is the bottom number, which is also the lower of the two numbers, measures the pressure in the arteries between heartbeats (when the heart muscle is resting between beats and refilling with blood).

Hypotension is one of the most common anesthetic complications; Hypotension is usually defined as mean arterial blood pressure less than 60mmHg or systolic pressure less than 90 mmHg. If blood pressures are too low (hypotension) you can start by decreasing your inhalant anesthetic level if possible. Often when lowering your inhalant, you will need to provide additional sedatives or analgesics to maintain the patient at an acceptable level of anesthesia. Discuss with your doctor an IV bolus of your pre-medicant opioid or benzodiazepine. A second step should be to increase the fluid rate if possible. If the patient has no underlying cardiac issues, consider a quick bolus of 10 ml/kg (5 ml/lb) over 5 minutes. Also, verify proper cuff selection, a cuff that is too large will result in falsely low readings. If the pet is somewhat bradycardic, consider a dose of an anticholinergic such as glycopyrrolate. A next step may involve adding a colloid. Vetstarch (hydroxyethyl starch) is made from natural sources of starch. Vetstarch increases the volume of blood plasma. You can also consider discussing with your attending clinician administering dobutamine or dopamine infusion.

**ETCO2 considerations**

Capnography indicates how much CO2 is being eliminated from the lungs by measuring exhaled CO2 with a device that senses the CO2 level. It is a sensitive indicator of lung function and may help guide the doctor, nurse, or respiratory therapist to adjust the breathing machine or it may provide an early warning that the lungs are not functioning properly.
Post op patient management
There are many ways that post-op pain can be treated. The most important aspect of managing chronic pain is to work with a multi-modal treatment protocol. The principle of multimodal therapy is to use analgesic drugs and physical therapy modalities that target several different steps of the pain pathway, allowing more effective pain control with fewer side effects.

NSAIDs remain the mainstay of therapy for chronically painful patients. Their principal mode of action is to block prostaglandin production by binding and inhibiting cyclooxygenase (COX). The result of this effect is mainly a reduction in inflammation.

Opioids are useful in a variety of painful conditions (though they may have limited effectiveness in some forms of neuropathic pain). Opioids may be particularly useful for chronic pain management, as they are available in oral and transdermal versions.

NMDA receptor antagonists are often used as adjunctive drugs (i.e. in combination with other analgesics) to improve the control of pain. Intense and/or chronic painful stimuli result in changes in the central nervous system’s response to input, leading to an increase of pain intensity. NMDA receptor antagonist drugs help to control and treat this “amplification”. Amantadine is the most commonly used oral NMDA receptor antagonist. It was originally developed as an antiviral compound, and has also been used to treat Parkinson’s disease in humans.

Gabapentin has been used for many forms of pain, though its best application may be for neuropathic pain. Gabapentin is an ant-convulsant medication with significant adjunctive anti-hyperalgesic action. Gabapentin is commonly used in conjunction with opioids for analgesic treatment options in post-amputation patients.

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A veterinary clinic’s curb appeal does not stop at the clinic door. It extends all the way into exam room and, most importantly, to the entire team! Every person our clients interact with will receive a “snap judgment” from their first impression. How long does this take? For years the general rule has been 7 seconds, but a few years ago a group of psychologists found that it takes about one tenth of a second to form an impression of a stranger, simply from their face (1). They also found that longer exposure to the stranger does not significantly alter the impression; it only boosts confidence in the initial judgment.

What does this mean to a veterinary team? It means that we have a very, very small amount of time to make a positive impression on our clients. This positive impression is not only essential from a business standpoint (you want them to come back!), but also from a medical one. Our clients need to trust us; they need to believe that we care about their pet the same way they do. Without the belief and trust that the client and the doctor have the same desired outcome, trust and rapport will not be established and the client may not accept the treatment plan that the veterinary professional team has offered. Which is, after all, the reason we are in business; to care for, treat, heal, and support animals.

Of course, the importance of body language or non-verbal communication is not a new concept. The “7-38-55 Rule” was first developed in 1971 by UCLA psychology professor Albert Mehrabian (2): 55% of what we convey when we speak comes from our body language, 38% from our tone of voice, and a mere 7% from the words we choose. This study has been widely misinterpreted by stating “97% of what we convey is non-verbal” instead of garnering a greater understanding of vocal (tone, cadence, etc.) and body language cues, which are inappropriately combined to come up with the “97%”.

Mehrabian more clearly states the following on his website:

Total Liking = 7% Verbal Liking + 38% Vocal Liking + 55% Facial Liking. Please note that this and other equations regarding relative importance of verbal and nonverbal messages were derived from experiments dealing with communications of feelings and attitudes (i.e., like–dislike). Unless a communicator is talking about their feelings or attitudes, these equations are not applicable.

Although this landmark study is riddled with criticism and misinterpretation, it remains an important and highly cited illustration of the value of nonverbal communication. Many other studies have arisen since, each with a new methodology, and with the continued conclusion that non-verbal cues are 3 to 4 times more influential than verbal cues.

Before we dive into the real content of this talk, it’s important to understand that reading body language is not the same as mind reading. This is the difference between “observation” and “evaluation.” Reading someone’s non-verbal cues is about observation; we want to find natural tendencies in someone’s physical behavior (called their “baseline”), then look for deviations from their baseline, and finally ask open ended questions to find the root cause of the change.

For example, you may walk into a room and find two people seated, both have their arms crossed while one has both feet flat on the floor and the other has her legs crossed at the knee. You might assume that the closed off body postures mean they are both upset, and perhaps the female is even more upset because her legs are crossed as well. This may be true, but probably not. Jumping to conclusions so quickly and, for example, immediately putting your guard up or responding with your own closed off body language may start you off on a bad foot (no pun intended) by eliciting defensive behavior from these clients. In this example, crossed arms might be this gentleman’s natural baseline, and the female may simply be cold!

Remember, reading body language is about observing someone’s baseline, finding where there are deviations from that baseline, and using powerful questions to find the underlying cause of the deviation.

The basics

The basics of body language are pretty simple. Across species lines, animals (human and non-human), use adaptations to increase or decrease their physical presence. A bear stands on his back legs to appear taller, cobras expand their hood when they are threatened, and the mantis lifts her front limbs while displaying a conspicuous eyespot in order to scare or distract a predator.

Humans present similar non-verbal “tells” by puffing their chest and standing taller when an attractive woman walks by or throwing both hands up in the air after accomplishing a huge milestone (even humans who have been blind since birth exhibit these behaviors).

The opposite is true as well; a dog cowers in the back of a cage or tucks his tail, an embarrassed child covers her face. We tend to minimize our physical presence when we want to disappear!

Each unique area of our body displays our emotions differently. The face is the most important when it comes to first impressions, and the feet most important when you want to know whether a negotiation is being tipped in your favor.
Personal curb appeal
When you want to make the most positive impression possible on a client, there are 4 main areas to consider: Initial facial expressions, the introduction to the client, non verbals while speaking, and physical appearance. Each of these areas have been proven to influence the impression someone has on another person.

Facial expressions
Judgments based on facial appearance or expression play a very powerful role in how we get treated (2). In fact, in a court of law, it’s been shown that “mature faces” receive harsher judicial outcomes than those with a “baby-faced,” and having an face that is thought to be “competent” (as opposed to trustworthy or likable) may be highly predictive of whether a person gets elected to public office (3). Also, like it or not, attractive people are more favorably viewed in general, leading to overall better outcomes in life in addition to being thought of as more trustworthy (4).

What is a good way to use your facial expressions to improve your curb appeal? Smile. Yes, simply smile. Of course we have all been subjected to the “fake smile” versus “genuine smile”! This distinction has been researched for quite some time; so much so that a genuine smile is now described with the name “Duchenne smile” after the French physician Guillaume Duchenne, who studied the physiology of facial expressions in the nineteenth century (5).

The Journal of Personality and Social Psychology described the difference from the anatomical perspective (5):

- The Duchenne smile involves both voluntary and involuntary contraction from two muscles: the zygomatic major (raising the corners of the mouth) and the orbicularis oculi (raising the cheeks and producing crow’s feet around the eyes).
- A fake smile involves the contraction of just the zygomatic major since we cannot voluntarily contract the orbicularis oculi muscle.

Interestingly, the fake smile is controlled by the motor cortex while more complicated emotion-related expressions, like the Duchenne smile, are controlled by the limbic system.

Yes, our clients can tell the difference! A genuine, warm, sincere expression of happiness that conveys a welcoming greeting is related to emotion, while the cheesy grin is simply a forced muscle action. So make sure your greeter (whomever that might be) smiles because they are happy to be there, not because they are forced to!

The non-verbals of introduction
Upon being greeted with the warm, genuine smile, the customary introduction ensues. Even if this is a long-standing client, there is still a formal greeting ritual we all engage in. The first 7 seconds may be too long for a first impression, but it’s the perfect amount of time for a good introduction.

In our current Western society, the handshake occurs first and, as long as it’s a good one, is the universally accepted sign of professionalism, politeness, and confidence. A good handshake is an art! Whether you’re the veterinarian or the support staff, make sure you initiate the handshake before the client does to show a confident welcome. Remember, they are coming into your “home” (the clinic) and you want them to feel that you genuinely appreciate their presence. Make hand contact palm-to-palm, web-to-web (the “web” is the flap of skin between your thumb and pointer finger) while keeping the angle of your hand either perpendicular to the ground, or palm facing slightly up. Palm down in a handshake indicates power. Don’t squeeze too tightly, nor too loosely, and maintain consistent tension as you say your greeting. Also, make sure to shake everyone’s hand in the pet’s family, not just the primary owner, even the children. (What a way to inspire a new generation of veterinarians!)

While shaking the client’s hand, maintain good eye contact and introduce yourself, even if you believe they know your name (but not with close friends of course!). They may have forgotten your name since their last visit, and setting your client up for success by knowing your name helps build their confidence. (More on verbal techniques, including how to say the client’s name, in another lecture.)

Since the introduction is about 7 seconds long, make sure it’s meaningful. Step in front of the receptionist’s desk to shake their hand, use a two-handed handshake (both of your hands around their one hand), lean gently forward to show appreciation for them coming in, and/or bend down to pet their dog (cats may not appreciate this though!).

Non verbals to gain rapport
After you’ve made an amazing first impression, followed by a confident introduction, it’s times to complete the circle so that the client builds the trust, rapport, satisfaction, and connection with the entire veterinary team. These skills all enforce the concepts of active listening, engaged interaction, and supporting the client’s concerns.

These concepts are broken into 3 anatomical areas, top, middle, and lower body regions.

A- Body language in the top ⅓
Eye contact is incredibly important! But how much is too much? At what point does it start to become creepy? One study in the Royal Society Open Science (6) found that, when asked to stare at a video of an actor staring back at them, participants had a “preferred gaze duration” of 3.3 seconds (give or take 0.7 seconds). They also found that the rate of pupillary dilation (an automatic reflex) was a good indicator of how long they wanted to gaze; the longer their preferred gaze, the faster their pupils expanded. (Don’t
get too attached to this difference, however. The change was so subtle that it was only seen with eye tracking software, which would be awkward to follow in real life!

Make your eye contact consistent by looking only inside the imaginary triangle between the two points about 1 inch above each eye and the tip of the nose; going further down to the mouth or chin is more indicative of a social or amorous relationship.

Aside from the eyes, do not bite, tense, purse, or conceal your lips. Janine Driver, re-known body language expert, says “when we don't like what we see or hear, our lips disappear.” This is evidenced by turning both lips into our mouth, similar to spreading Chap Stick once it’s been applied.

When nodding your head, a gentle, 1 second nod implies active listening, whereas faster head nods may tell your listener “hurry up, I don’t have time for this.” Make your nods slow and small with a closed mouth (which indicates you are listening).

Gestures of the Open Hand Prone or “palm down” family are used in contexts where something is being denied, negated, interrupted or stopped, whether explicitly or by implication. Open hand Supine (or “palm up”) family gestures, on the other hand, are used in contexts where the speaker is offering, giving or showing something or requesting the reception of something.

When auditing the body language of your own hands and arms, use open, offering palms when escorting a client to an exam room, offering to take their coat, or asking if there’s “anything else you need?”

Where someone’s torso is facing may be one of the most important indicators of where they want (or don’t want!) to be. The “Belly Button Rule” dates back to the 1930s. Since then, numerous scientists and body language experts have reinforced the theory. Most notably, Dr. Albert Mehrabian, professor Emeritus of Psychology and UCLA has said “the belly button rule is the most important indicator of reading a person’s intention.”

During an introduction, face your belly button towards them. This indicates genuine interest and engagement. While you’re writing in the patient’s chart as they actively describe their pet’s history (or anything else they feel is important to you), you may turn your shoulders slightly away in record notes as long as your belly button remains mostly pointed towards the person that is talking.

Many experts feel that it’s easier to read someone’s feelings by looking at there feet than any other part of their body. In fact, this concept especially applies to interactions when one party is attempting to “convince” another, which can be the case when a veterinarian (or anyone else on the team) is presenting an estimate to a client. Studies have actually shown that crossed legs can have a devastating effect on a negotiation.

In How to Read a Person Like a Book, authors Gerard I. Nierenberg and Henry H. Calero reported that the number of times settlements were reached increased greatly when both negotiators had uncrossed their legs. In fact, they found that out of two thousand videotaped negotiation transactions, not one resulted in a settlement when even one of the negotiators had his or her legs crossed.

So what is “good” body language in this lower part of the body? Since building a rapport with clients is our main goal, you want to be perceived as interested and actively listening. UNCROSS your legs, both feet flat on the ground, sit on the edge (but not too far) of the seat, and lean slightly forward. (This is a great stance to take when writing the clinical history while listening to the client.) For the best effect possible, don’t jiggle your feet, wrap your toes around the edge of the chair, or cross your legs or your ankles. And if you see the client doing any of these unwanted behaviors, it might be a good time to audit your own body language or other communication styles (tone or phrasing, more in another lecture on these) in order to compensate for the potential misalignment. Of course the client might simply be cold!

Physical appearance

You may not be into fashion or up on the latest trends, but that’s not what having a “nice” appearance is all about. Being well dressed has everything to do with appearing put-together, not being a mannequin for the latest crop top or fringe boots. Just as our clients will judge the veterinarian’s surgical skills by the neat row of sutures, the will also judge our entire team’s knowledge, professionalism, compassion, and overall trustworthiness by the way we choose to dress ourselves that morning.

We’ve all heard the saying “dress for the job you want” or “clothes make the man.” Well, those sayings have real research, and lots of it, to back them up! In 1955 a group of researchers had a man cross a city street against traffic (8). When this man was dressed in a suit, 3.5 times as man people followed him as when he was wearing a “work shirt and trousers.” Regardless of background demographics, a business suit is universally seen as a form of authority.

Taking this one step further, not only is being well-dressed seen as a reason for others to follow you, but also a reason for others to do what you ask them to do. In another study (9), an experimenter would stop someone on the street, point to a person about 50 feet away (this person far away was an accomplice), and say “You see that guy over there by the parking meter? He’s over parked but
doesn’t have any change. Give him a dime!” The experimenter would then leave. When dressed in a uniform (anything relating to authority), most people complied with the instruction to give the other person money. When dressed in regular clothes, however, compliance was less than 50%!

But how does this translate into the exam room? What about the white coat hypertension we hear so much about? It appears this may be an overreaction, making it the exception, not the norm. In a written survey in 2005, patients were asked to review pictures of physicians in four different dress styles, then answer questions relating to their preference as well as their willingness to discuss sensitive issues (10):

On all questions regarding physician dress style preferences, respondents significantly favored the professional attire with white coat (76.3%, P < .0001), followed by surgical scrubs (10.2%), business dress (8.8%), and casual dress (4.7%). Their trust and confidence was significantly associated with their preference for professional dress (P < .0001). Respondents also reported that they were significantly more willing to share their social, sexual, and psychological problems with the physician who is professionally dressed (P < .0001). The importance of physician’s appearance was ranked similarly between male and female respondents (P = .54); however, female physicians’ dress appeared to be significantly more important to respondents than male physicians’ dress (P < .001).

The conclusion from this study was obvious: “Respondents overwhelmingly favor physicians in professional attire with a white coat. Wearing professional dress (ie, a white coat with more formal attire) while providing patient care by physicians may favorably influence trust and confidence-building in the medical encounter.”

More recently in 2015 (11), a comprehensive international review of studies on physician attire was published in the British Medical Journal Open, adding to the previous study’s findings. The authors confirmed the idea that, yes, most people prefer their doctor to be dressed formally, and also stressed that how you feel about your doctor’s attire can depend greatly on your age and/or culture. For example, in general, Europeans and Asians of any age, and Americans over age 50, trusted a formally dressed doctor more, while Americans in Generation X and Y tended to accept less-dressy physicians more willingly. Doctors in other roles, such as surgery or emergency however, appear more insulated from this effect and patients much more willing to see their doctor in scrubs.

Even if you are not the doctor, pick your attire carefully. What you chose to put on your body says more to the client about your professionalism and trustworthiness than you may think!

Conclusion

Curb appeal does not stop at the clinic’s entrance. And fortunately for veterinary professionals, those clinic doors are human sized, not small doggy-doors (until pets earn a monetary income, this will be the case)! We have to interact with, connect with, and ultimately, win the trust of our clients if our professional knowledge is to be put to good use. Without that rapport with our clients, something every person of the veterinary team is responsible for upholding, our treatment plans may not be accepted and/or compliance may not be achieved. Only through immediate, consistent, and appropriate maintenance of this bond will the patients receive the best possible medical care, and our clients happy to see us again!

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Cats Are Not Small Dogs…and I’ll Show You Why
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As the old saying goes… “cats are not small dogs!” The question remains, what does that really mean? They can both be small. They can both be fluffy. Catch them at the wrong time and they can both bite! But what does it mean when we say, “cats are not small dogs”? What we are referring to is the medical response to disease as we compare our feline and canine patients. Our feline patients have unique physiologic responses to shock, medications, fluid therapy, and even neoplasia as compared to the canine patient. As a result, it is crucial that the veterinary team understands these unique feline characteristics!

Shock and the cardiac response
If you have ever attempted to resuscitate a feline patient in shock, you appreciate that this is a challenge. In shock (or sepsis), as compared to the tachycardic canine patient, the feline patient is often bradycardic. When evaluating these feline patients, it was noted that their compensatory response to shock is blunted. Moreover, they tend to not have the hyperdynamic signs of shock seen in other (canine) species. As compared to the canine patient, shock in our feline patients is commonly decompensatory. These characteristics include normal to bradycardic heart rates, hypothermia (< 98 F), poor peripheral pulses, pale mucous membranes, and mental depression.

Fluid therapy
The blood volume in the dog is approximately 90ml/kg. In comparison, the blood volume in the cat is 60ml/kg. This is an important difference as fluid rates and volumes, notably shock fluid volumes, vary significantly between species. Feline shock doses of crystalloid fluid therapy (10-20ml/kg) are lower than canine shock crystalloid fluid volumes (10-30ml/kg). Our feline patients also appear to be much more sensitive to fluid therapy with the concern for fluid overload, pulmonary edema, and pleural effusion developing.

Stress response-biochemistry panel
While both canine and feline patients can be stressed, the stress response in the cat common leads to (transient) hyperglycemia. This should be recognized and differentiated from diabetes mellitus (historical polyuria, polydipsia, polyphagia, weight loss, glucosuria). If there is a concern for pathologic hyperglycemia, repeat blood glucose levels at a later, less stressful time can be considered. A fructosamine level can also be considered.

Cardiac disease
As compared to the common valvular disease seen in canine patients, feline cardiomyopathy is more commonly hypertrophic, dilated, or restrictive in nature. Although careful auscultation of the heart is required to detect murmurs and gallop rhythms, subclinical heart disease may be missed on auscultation as a murmur is not a hallmark early characteristic of these cardiac conditions. Chest x-rays can be considered in any feline patient, especially older feline patients to look for evidence of cardiac disease including cardiomegaly prior to an echocardiogram.

Blood types
Our canine patients are assessed for the DEA 1.1 antigen prior to transfusion with a universal donor considered to be the DEA 1.1-patient. Cats do not have a universal donor, and more specifically have 3 major blood types: A, B, and AB. Just like B students hate A students in school (humor), cats with type B erythrocytes hate receiving A blood. In fact, in can be fatal! Cats with type B blood have strong, naturally occurring anti-A antibody. Because of the strong possibility of a potentially fatal transfusion reaction, a blood type and cross-match is recommended prior to a feline blood transfusion.

Drug doses and metabolism
Our feline patients metabolize and generally tolerate certain medications differently as compared to their canine counterparts. Cats lack many of the hepatic glucuronyl transferases that are important for drug metabolism, conjugation and excretion. As a result, toxic levels of these drugs or metabolites can accumulate. Medications which we must recognize as unique include (but are not limited to) morphine, chloramphenicol, aspirin, primidone, acetaminophen, phenols, barbiturates, and benzodiazepines.

Nutrition
Cats need to eat! Inappetance and anorexia in our feline patients should be taken seriously. Lack of nutrition for as little as 2-3 days may result in hepatic lipidosis. Lack of nutrition results in catabolism and development hepatic lipidosis. While less concerning with modern nutritional preparations, our feline patients also require taurine and arginine.
Analgesia and pain assessment
Pain assessment in both cats and dogs can be a challenge based on their stoic nature. Cats, if possible, are even more challenging in the author’s experience to assess pain. Cats may be lethargic and reluctant to interact or they may be aggressive. Potential signs of discomfort to consider may include dilated pupils, hyperthermia, inappetance, lethargy, and hiding.

Oncology
Cats have a few unique oncology related differences as compared to their canine counterparts. A lame feline patient should have their digits checked. Swollen, painful digits may be the presenting complaint for cats with primary lung cancer. Commonly known as feline 'lung-digit syndrome,' this describes an unusual pattern of metastasis that is seen with various types of primary lung tumors, notably bronchial and bronchioalveolar adenocarcinoma.

Cats may also be more likely to have neoplasia manifest as dermatological disease including thymoma, lymphoma, pancreatic, and liver cancer. This may be primarily neoplastic or dermatologic disease that is paraneoplastic.

Finally, malignancy-associated hypercalcemia in cats is common, seen with squamous cell carcinoma or, to a lesser degree, lymphoma. This differs from the etiology in dogs, in which lymphoma predominates as the underlying cause of paraneoplastic hypercalcemia.

Orthopedics
Anyone who has ever attempted to do an orthopedic examination on a cat understands the challenge of this examination. They are flat-out uncooperative! Rather than a great hands-on examination, the veterinary team member may need to observe and analyze their gait from a distance, such as through the examination door or window. Another option would be to have the owners provide a video of the abnormal behavior for evaluation and analysis.

Seizures
As compared to canine patients, in which idiopathic epilepsy seems to be quite common in dogs ranging from 1-6 years of age, true idiopathic epilepsy in cats is less common. Whether infectious, inflammatory, metabolic, or neoplastic, the veterinary team member should be more concerned when a feline patient presents with a history of seizure behavior. For this case, following initial bloodwork and radiograph evaluation, advanced imaging and CSF analysis should be considered in all seizing cats. Treatment options are similar to dogs, our feline patients should not receive bromide as this may result in a fatal pulmonary disease.

References
It is not a secret that diabetes mellitus is a common endocrinopathy seen in the canine and feline patient. Studies have shown that the frequency of this disease has increased over the years. Defining the type of diabetes, proper treatment and obtaining remission are now reachable goals with feline diabetes mellitus and the veterinary team.

There are two types of diabetes mellitus. Type I is typically seen in dogs and is caused by insulin deficiency due to either destruction or reduced to secretion of insulin by the beta cells in the pancreas. Type II diabetes is typically seen in a cat. It is caused by either insulin resistance or the inability of the beta cells to function normally. It can also be some degree of both dysfunctions in a cat.

Insulin is a hormone is produced in the islets of Langerhans in the pancreas and is essential for life. Its functions in the body include, to lower the level of glucose in the body, it causes blood glucose, amino acids, and fatty acids that are in the blood to be absorbed into body cells and used for energy. The pancreas is primarily an exocrine gland responsible for the secretion of pancreatic fluid into the digestive tract following a meal. The islets of Langerhans, scattered throughout the pancreas, contains hundreds of thousands of cluster cells. The islets are endocrine tissue which contains four different cell types. The most numerous are beta cells which are responsible for secreting insulin and amylin, followed by the alpha cells which produce glucagon, the delta cells which produce somatostatin and lastly, the gamma cells which produce pancreatic polypeptide. Housed within the cell membrane of the beta cells are channels that detect the presence of glucose. The normal response of the beta cell, based on the channels ability to detect glucose, is to produce/release insulin when an increase in circulating blood glucose is detected to maintain a normal circulating level. So the pancreas is made up of both exocrine and endocrine tissue.

Glucagon aids in metabolism and the use of glucose in the pancreas. It stimulates the liver to convert glycogen, the storage form of glucose, to glucose also stimulating glucogenesis. The end goal of glucagon is to raise the level of blood glucose in the body. Glucagon, produced by the alpha cells of the pancreas, may be thought of as a “counter-signal” to insulin. Simply stated, glucagon is secreted by the pancreas in response to insulin falling below normal levels.

Insulin sensitivity and/or dysfunction beta cells can be the cause. Insulin sensitivity is the inability of insulin to lower blood glucose levels. If insulin sensitivity is lowered the body will need more insulin to meet the same goal as a normal body. Insulin sensitivity is also known as insulin resistance. So, insulin resistance and beta cell dysfunction is type II diabetes.

Risk factors for diabetes mellitus include; obesity, breed, sex, age, medication and lifestyle. Multiple studies have shown that obesity is a huge risk factor due to abnormal hormonal release and inflammatory mechanisms. Male cats are more predisposed but females can also develop diabetes mellitus. If patients are on medications such as glucocorticoids it will put them at risk of developing diabetes mellitus.

So if the body is not functioning correctly, constant hyperglycemia occurs in becomes toxic to the beta cells. This is glucose toxicity and causes further dysfunction. Of glucose levels are closely regulated and glucose toxicity is resolved, diabetic remission can occur.

A CBC, chemistry, urinalysis, and urine culture are recommended to diagnose diabetes mellitus in the canine and feline patient. Hyperglycemia and glucosuria in patient with clinical signs of diabetes mellitus is confirmation of the diagnosis. A blood glucose concentration above 250 to 300 mg/dl is diagnostic and clinical signs are present.

A high-protein, low carbohydrate diet, such as Purina DM, can be helpful in treating diabetes mellitus and can minimize postprandial increases in blood glucose and reduce insulin requirement in some cases. Avoiding high, simple carbohydrate foods such as semi moist foods can make treatment successful. Some cats may not need insulin therapy at the time of diagnosis and only require diet therapy. Those patients should be monitored closely because most will progress to needing insulin. Feeding and insulin administration should always be done at the same time to help eliminate a hypoglycemic episode. Correction of body weight can help reduce insulin resistance and in type II diabetes mellitus, it will improve insulin secretion. In some cases weight control and feeding a proper diet can properly control the blood glucose levels.

In the canine patient nutrition is important as well since almost all canine diabetics are insulin dependent their dietary management will not remove the need for insulin like their feline counterpart. However, nutrition in the canine diabetic can help improve glycemic regulation. A high carbohydrate and fiber diet will minimize postprandial fluctuations of glucose after meals.

**Interesting facts about insulin dosing**

Insulin will be absorbed more quickly in a warmer environmental temperature due to increased peripheral blood supply. Insulin is broken up into categories, they include: short acting insulin, intermediate acting insulin, and long acting insulin. In veterinary medicine, studies show that each patient is different when it comes to duration of action and peak times. This is why it is so important to do in clinic and at home monitoring.
**Intermediate acting insulin**
Protamine zinc insulin, PZ I, is composed of a mixture of beef and pork insulin. In the feline patient PZI has previously been indicated as long-acting insulin but a study showed that they can be used every 12 hours at 0.25-0.5 U/kg for adequate control of diabetes mellitus. (7)

**Long acting insulin**
Glargine insulin, Lantus, is a human insulin that is marketed a long acting, peak less insulin. The duration of action is typically 18 to 24 hours with a peak at around 7 hours. The dose used is 0.25-0.5 units/kg every 12 hours. This dose can be changed on an individual basis by the veterinarian based on home and in clinic monitoring. Some studies have shown that newly diagnosed cats on Glargine insulin have a higher probability of remission and better glycemic control than patients on PZI insulin by day 17 of treatment.

Detemir or Levemir is a long acting human insulin that can be used in cats with diabetes mellitus. Detemir can be used in cats at the same recommendations as glargine.

**Remission**
Diabetic remission is achievable in the feline patient. The individual’s therapy should be tailored with permission as the therapeutic goal. It has been shown that remission rates can be as high as 90%. If remission for the individual is not achievable, control of clinical signs (polyuria, polydipsia and weight loss) along with glycemic control should be obtained. Close monitoring at home and at the clinic, insulin therapy and proper diet will achieve the goal of remission. All patients can come out of remission at any point. Concurrent infection and other systemic illnesses will make remission harder to achieve.

Frequent visits to the clinic for glucose curves or home monitoring is important. After starting therapy, glucose levels may need to be checked daily with weekly complete glucose curves at home or at the hospital. Glucose curves should last 12 hours and be checked and recorded every 3 to 4 hours.

**Monitoring**
Complete glucose curves when adjusting insulin doses can be as often as every seven days. Order compliance and attention to detail is important to help monitor the progress or decline of the patient. Frequent exams to monitor progress and ensure no concurrence illnesses will help keep the patient in good health. Lab work such as, CBC, biochemistry panel, urinalysis and urine culture may need to be performed with exams if indicated. Fructosamine can be used if the patient is stressed or if the glucose curve results do not match the client’s history. The fructosamine is a blood glucose average over the past 2 to 3 weeks. This number is only an average and does not indicate the severity of daily fluctuations so therefore it should not be used to adjust insulin doses.

**Home care**
Home care for the feline diabetic patient is very important. The technician will play a huge role in client education and helping the clients become accustomed to home care for their diabetic cat. Insulin administration, dosing of insulin, buying insulin syringes, buying a glucometer, clinical signs of hyperglycemia and hypoglycemia, proper diet and home monitoring are the main topics of client education. The clients keeping a journal of eating and drinking habits, glucose readings and dosage administration will help them communicate with the veterinary staff on recheck visits. The technician will need to teach clients how to give insulin injections and choose proper locations for blood glucose checks. If the patient is in need of a new diet or a weight loss program, the technician will need to educate them of proper feeding protocols.

**References are available upon request.**
The definition of “Triage” is the following, to the art and practice of being able to assess patients rapidly and sort them accordingly to the urgency of treatment required. Management of multiple emergencies is always a challenge to the complete staff of a veterinary clinic. It is very important to be able to assess or “triage” a patient accurately and quickly in these situations. Developing a process in the clinic is a must. All support staff should know their roles with emergencies and be comfortable with them. Role playing and drills are important before this arises so each person can practice their skills. A receptionist should know how to give clear directions to the clinic and ask appropriate questions when the owner calls the clinic to pass on pertaining information to the doctor and technician.

Taking a quick scan of the room when you enter will help direct you to which patient needs assessing first. Immediate recognition of a life threatening emergency is the key to successful treatment. Always treat the patient with the most life threatening condition first. As a technician taking a brief but direct history is essential as you assess the patient. Asking the owner the following questions are a good start for the history and a complete history can be taken after the patient is stable, what happened to your pet? How long ago did this happen? Does your pet have any known allergies? Has the pet had any past medical problems? Is your pet on any medications? If yes, what dose and when was the last dose given?

A patient that is having a seizure is more critical than a patient that hasn’t been eating for 5 days. A patient that has been hit by a car and is standing in the lobby with abducted elbows needs medical attention before the cat that is straining in the litter box. As you can see all of these conditions need medical attention and it is your duty as a technician to triage the patients appropriately.

Patient assessment
(The following section is adapted from the author’s contribution in writing from the VSPN Notebook ®, A CRASH PLAN)

A - Airway

- Evaluate if the patient has a patent airway
- Is there any type of foreign body or obstruction?
  - Use the “finger sweep” method and/or suction to evaluate an obstruction of the airway
  - Use caution if patient is conscious
  - When an upper airway foreign body is present, it is necessary to perform an emergency tracheotomy

B – Breathing

Is the patient breathing?

- No- intubate immediately and start life saving measures
  - First, breathe 2 large breaths for the patient with 100% oxygen
  - Then, breathe 8-10 bpm for the patient with 100% oxygen

- Yes- evaluate the patient for dyspnea
  - What are the patient’s mucous membrane colors?
  - (Refer to C-Circulation for descriptions)
  - What is the patient’s pulse oximetry status?
  - If below 90%, provide oxygen supplementation.
  - What is the patient’s Partial Pressure of Oxygen (PaO2) in the arterial blood?
  - An arterial/venous blood gas will need to be drawn and evaluated
    - 80-110 mmHg = normal
    - >80 mmHg = hypoxic
    - >/= 60 = initiate oxygen therapy
  - When oxygen concentration is above 21% (room air) the PaO2 values are different. The expected PaO2 should be 5 times the fraction of inspired oxygen (FiO2). For example if the FiO2 is 40% then a Pa O2 of 200 mm Hg would be considered normal.
  - Venous levels of oxygen will always be lower than arterial.

What is the respiratory rate and pattern?

- Normal- dog 15-30 and cat 20-30
- Rapid and shallow- also known as choppy or “dys-synchronous” respiratory pattern- pleural space disease
- Slow and deep- also known as “Kussmaul” respiration- may indicate metabolic acidosis in patients with diabetic ketoacidosis or renal failure
Postures and patterns that indicate dyspnea

- High pitched stridor on inspiration - may indicate an upper airway obstruction, i.e. laryngeal paralysis/edema, foreign body aspiration
- Head Extension - trying to elongate the airway to maximize each breath.
- Abducted Elbows - allowing more movement from the chest cavity to maximize each breath.
- Abdominal Breathing - on expiration abdominal muscles will push the remainder of each breath out if the chest wall is not functioning correctly.
- Cheyne Stokes - normal or hyperventilation followed by periods of apnea or hypoventilation, indicative of a disorder of the central respiratory center.

Auscultation

- Crackles - suggestive of pneumonia, pulmonary edema, pulmonary contusions or fluid overload
- Muffled - suggestive of pleural effusion, pneumothorax or hemothorax
- Wheezes - suggestive of feline bronchitis, obstruction, lower airway disease or feline asthma

C- Circulation/Cardiovascular

What is the patient’s mucous membrane color?

- Pink - normal
- Cyanotic (blue) - lack of oxygen
- Icteric (yellow) - liver disease
- Red - toxins, shock
- Pale Pink - hemorrhage or anemia
- Brown - intravascular hemorrhage or acetaminophen toxicity

What is the patient’s circulation status?

What percent is the patient dehydrated?

- Less than 5% - history of fluid loss but no significant findings on physical exam
- 5%-7%- oral mucous membranes are dry without panting or tachycardia
- 7%-10%- mild to moderate degree of decreased skin turgor, dry oral mucous membranes, tachycardia with normal pulses.
- 10%-12%- moderate to severe degree of decreased skin turgor, dry oral mucous membranes, tachycardia and decreased pulse pressure.
- 12% or greater - severe degree of decreased skin turgor, dry and pale mucous membranes, tachycardia, severely decreased pulse pressure.

What is the patient’s heart rate and rhythm?

- Palpate pulses
  - What is the patient’s pulse quality, and are they synchronous with the heart rate?
    - Pulses should be synchronous with the heart rate
    - Non-synchronous pulses with heart rate can suggest an arrhythmia or obstruction in circulation
  - Perform non-invasive blood pressure
    - Feline normal (mm Hg) - Systolic 100-160, Diastolic 60-90, MAP 80-120.
    - Canine normal (mm Hg) - Systolic 100-160, Diastolic 60-90, MAP 80-120.
  - Perform an electrocardiogram; if any abnormalities are found notify the veterinarian on duty immediately.

Is the patient presenting with a form of shock?

- Hypovolemic Shock - most common form of shock - due to fluid loss of any type (hemorrhage, volume loss or third spacing of fluids)
  - Clinical signs of canine shock- 1st stage (Compensatory Shock) - tachycardia, hyperthermia, hypertension, injected mucous membranes, rapid capillary refill time and normal pulse quality. Second stage (Early Decompensatory Shock)- pale mucous membranes, tachycardia, prolonged capillary refill time, hypotension, hypothermia and dull mentation. Third stage (Late Decompensatory Shock) - pale to cyanotic mucous membranes, bradycardia, severe hypotension, pulses weak or absent, hypothermia, stuporous mentation, organ failure and cardiac arrest.
  - Clinical signs of feline shock- Clinical signs of the 1st stage not generally seen. 2nd stage (Early Decompensatory Stage)-bradycardia, hypothermia and hypotension, weak peripheral pulses, pale mucous membranes, weakness and general collapse. The 3rd stage (Late Decompensatory Shock)-same as canine.
- Cardiogenic Shock - seen in any heart failure that impedes cardiac output, characterized by pump failure and increased central venous pressure
  - Pump failure- due to cardiomyopathy arrhythmias and valvular dysfunction
Clinical signs include heart murmurs, jugular distention, collapse, rails or crackles noted on thoracic auscultation, systemic hypotension, tachycardia, increased central venous pressure, increased oxygen needs and decreased cardiac output.

- Distributive Shock - seen in sepsis, anaphylaxis, neurologic diseases and pharmacologic or toxic reactions
  - Normal phases of hypovolemic shock occur.
- Traumatic Shock - seen with extensive tissue trauma
  - Can be seen in conjunction with hypovolemic shock

Is there any arterial bleeding?

- Note any external wounds
- Place pressure bandages to any hemorrhaging wounds

Place a large bore intravenous catheter to administer fluids and necessary medications

Institute treatment if hypovolemic or traumatic shock is present

- Shock doses for crystalloid fluids
  - Canine - 90 ml/kg/hr
  - Feline - 45 ml/kg/hr

- Administration of shock fluids
  - Start with ¼ shock dose over 15 minutes
  - Reassess the patient’s heart rate, respiratory rate, mucous membranes, capillary refill time and non-invasive blood pressure
  - If patient is still dehydrated, start the 2nd, ¼ dose over 15 minutes and reassess
  - Repeat until patient is rehydrated or until “shock dose” is complete

CPR

Recognition of a patient in cardio-pulmonary arrest is very important. After recognizing that the patient is not breathing, the first thing to do is to capture an airway. After establishing an airway either by endotracheal intubation or emergency tracheostomy it is important to ventilate for the patient correctly. Ventilate the patient at a rate of 10 breaths/minutes with a tidal volume of 10 ml/kg. The oxygen flow rate should be 150 ml/kg/min.

External chest compressions should be started next by placing your hands over the fourth and fifth rib space. Compressions should displace the chest wall by 25-50%. They should be done at a rate of 80-120 times/min. Most dogs and cats can be in left or right lateral recumbency, if the dog is barrel chested, they should be in dorsal recumbency. If only one team member is present CPR can still be done, breathing twice then doing 30 chest compressions and repeat cycle until further help arrives. Internal chest compressions should be done in specific situations only, such as with a penetrating thoracic trauma or if the patient is in the operating room.

Monitoring the effectiveness of chest compressions during CPR is essential. This can be done by palpation of pulses in the femoral artery or by applying a Doppler monitor to the eye of the patient and listening for blood flow. If femoral pulses are not palpated or noise heard on the Doppler the technique must be adjusted. Repositioning the patient or changing the person doing compressions are the first things to do with inadequate compressions. Remember maintain blood flow and oxygen to the brain and vital organs is the goal in CPR. The most accurate way to monitor the effectiveness of CPR is end tidal carbon dioxide (ETCO2). The capnograph, which monitors the ETCO2, fits between the end of the endotracheal tube and oxygen source. The ETCO2 will be slightly elevated with effective compressions.

Indications for the use of drugs in CPR are, to control life threatening emergencies, increase heart rate, and to improve myocardial oxygenation. Routes of administration vary with each drug. Common routes include, intratracheal (IT), intracardiac (IC), intravenous (IV), and intraosseous (IO).

There are several cardiac rhythms that are common with CPR. They are the following, ventricular asystole, pulseless electrical activity and ventricular fibrillation. Ventricular asystole is characterized by the absence of both mechanical and electrical activity. Treatment is to use epinephrine and atropine. Pulseless electrical activity is without adequate mechanical activity to cause sufficient cardiac output (pulses). It can be caused by insufficient myocardial oxygenation. Treatment includes Naloxone, epinephrine and atropine. Ventricular fibrillation is when chaotic, disorganized ventricular activity is seen.

No perfusion to the body takes place when this arrhythmia occurs. Treatment includes external defibrillation at a dose of 2 joules/kg. If that dose does not convert the rhythm, it can be increased. If fibrillation does not convert the rhythm, then epinephrine is administered.

Defibrillation is more successful when used early in CPR. It eliminates the arrhythmia by sending an electrical current through the heart. This allows the cardiac cells to depolarize and then repolarize all at the same time then ideally the heart will return to normal function. To defibrillate a patient paddles are used and one paddle is placed on each side of the patient’s chest over the heart. Gel is placed on the paddles before placing them on the patient. The person holding the paddles must yell “clear” to inform all the other team members of what is happening, then making sure no one is touching the patient, they can discharge the defibrillator. If someone
is touching the patient when it is discharged, they WILL be shocked as well. Remember isopropyl alcohol is flammable and metal tables will carry the electrical charge. If the patient is on a metal surface they must be removed before defibrillation occurs. Prolonged life support includes any complications after successful resuscitation. In most cases reoccurrence of cardiopulmonary or respiratory arrest is high with in the first four hours. Cerebral resuscitation is a huge concern due to the lack of blood flow to the brain during CPR. During CPR, hypoxia and ischemia occur which leads to cerebral edema.

Monitoring the patient is critical following CPR. Using an EKG to monitor electrical activity of the heart, SPO2 monitor the oxygen status of the patient and supplying oxygen if necessary. Monitor either invasive or non-invasive blood pressures, and regular physical exams including pupillary light responses, motor function and breathing patterns are done frequently to monitor the patient’s cerebral function. Almost always these patients will need oxygen supplementation via an oxygen cage, flow by, or nasal insufflations. The heart will almost always need support in the first 4 hours following successful CPR.

Practicing with a case scenario is a good way to get you ready for that day when more than one emergency comes through the door at the same time. Use the following questions to help guide you through those situations:

• What is most likely wrong with the patients?
• Does one or both of these emergencies have a life threatening condition?
• Which emergency needs medical attention first?
• What do we do with the other emergency for the time being?
• What should we be concerned with for the top priority emergency?
• What should we be concerned with for the other emergency?

References available upon request.
Infectious diseases

Infectious diseases are commonly seen in the ICU. Infectious disease is a disease that can be transmitted by a specific kind of contact. There are many infectious diseases that the feline patient can have. They include; parasite, virus, fungal and bacterial. Written protocols should be in place for infectious disease. Proper personal protective equipment (PPE) should be worn with these patients. It should be mandatory for all personnel to follow that plan. The plan should include what PPE to wear, where to house the patient, how to deal with their wounds (if they have any) and how to clean up after them.

Proper cleaning protocols and adhering to them is a must. The author’s place of employment uses bleach to wipe everything down and then use a steam cleaner and allow surfaces to air dry each time after treating a known multi drug resistant (MDR) patient. Everything that the infected patient comes into contact with must be cleaned properly.

If the patient has open wounds, transporting patients around the hospital in a designated carrier will help eliminate contamination. Also don’t forget to protect patients from nosocomial infections by keeping all wounds and incisions clean, dry and covered at all times when in the hospital.

The veterinary staff wearing gowns, gloves and booties at all times when in contact with the MDR patients and keeping them in a separate ward are common standard protocols for MDR patients. If the patient is considered critical and needs to be in ICU or a fluid ward, proper precautions are made. Proper PPE is worn at all times, they are kept in a cage that is considered a low traffic area, so at our hospital they are kept in the back of the room with an empty cage between them and another patient, just to help establish a barrier. Separate laundry and trash cans are used with MDR labels on them. The laundry is washed separately and the use of laundry detergent with bleach is necessary to properly disinfect the laundry.

A large draped area is placed on the floor in front of their cage so when they need to come out of the cage for exams, treatments they are placed on the draped area and not the floor. That drape is changed at least every 24 hours. If they have open wounds, a designated area should be used to perform examinations and treatments to not contaminate multiple areas of the hospital. Separate instruments, stethoscopes and thermometers are used and kept for these patients. In the author’s place of employment, an infectious patient receives a set of instruments while hospitalized that is used on them and when they leave they are disinfected and sterilized.

Patient assessment

Assessment of the airway, breathing and circulation when triaging a patient is important. Evaluate if the patient has a patent airway. Obvious foreign body or obstruction can sometimes be seen while approaching the patient. Use the “finger sweep” method and/or suction to evaluate an obstruction of the airway. Use caution if patient is conscious. When an upper airway foreign body is present, it is necessary to perform an emergency tracheotomy.

Assessment of breathing can also be done while approaching the patient. A technician should immediately note if the patient is breathing. If they are not, intubate immediately and start life saving measures and breathe 8-10 bpm for the patient with 100% oxygen. If the patient is breathing, things to consider are “What are the patient’s mucous membrane colors?” (Refer to C-Circulation for descriptions) “What is the patient’s pulse oximetry status?” If below 90%, provide oxygen supplementation. “What is the patient’s Partial Pressure of Oxygen (PaO2) in the arterial blood?”

An arterial/venous blood gas will need to be drawn and evaluated. Values below reflect normal on an arterial blood gas; Hg = normal, >80 mmHg = hypoxic, >/= 60 = initiate oxygen therapy. (When oxygen concentration is above 21% (room air) the PaO2 values are different.) The expected PaO2 should be 5 times the fraction of inspired oxygen (FiO2). For example if the FiO2 is 40% then a PaO2 of 200 mm Hg would be considered normal. “What is the respiratory rate and pattern?” Normal- cat 20-30 rpm. In the hospital it can elevate to 40 rpm. Rapid and shallow- also known as choppy or “dys-synchronous” respiratory pattern- pleural space disease
Postures and patterns that indicate dyspnea in a patient include high pitched stridor on inspiration. This may indicate an upper airway obstruction, i.e. laryngeal paralysis/edema, foreign body aspiration. Head Extension an indicate trying to elongate the airway to maximize each breath. Abducted elbows can indicate the patient is trying to allow more movement from the chest cavity to maximize each breath. Abdominal breathing on expiration abdominal muscles will push the remainder of each breath out if the chest wall is not functioning correctly. Cheyne Stokes is a breathing pattern that is identified by normal or hyperventilation followed by periods of apnea or hypoventilation, indicative of a disorder of the central respiratory center.

When auscultating a patient, abnormalities will include crackles, wheezes or muffled heart sounds. Crackles are suggestive of pneumonia, pulmonary edema, pulmonary contusions or fluid overload. Muffled cardiac sounds are suggestive of pleural effusion, pneumothorax or hemothorax. Wheezes are suggestive of bronchitis, obstruction, lower airway disease or feline asthma. When assessing circulation, it is important to note the mucous membrane color, heart rate, pulse quality and dehydration status. Pulses should be synchronous with the heart rate. If the pulses are not synchronous it is suggestive of an arrhythmia or obstruction in circulation.

Lastly to assess circulation status it is important to determine if the patient presenting with a form of shock? Hypovolemic Shock is the most common form of shock and is due to fluid loss of any type (hemorrhage, volume loss or third spacing of fluids) Clinical signs of feline shock- Clinical signs of the 1st stage not generally seen. 2nd stage (Early Decompensatory Stage)-bradycardia, hypothermia and hypotension, weak peripheral pulses, pale mucous membranes, weakness and general collapse. The 3rd stage (Late Decompensatory Shock)-pale to cyanotic mucous membranes, bradycardia, severe hypotension, weak pulses, stuporous mentation, organ failure or cardiac arrest. Clinical signs of canine shock include; 1st stage (Compensatory Shock) - tachycardia, hyperthermia, hypertension, injected mucous membranes, rapid capillary refill time and normal pulse quality. Second stage (Early Decompensatory Shock)-pale mucous membranes, tachycardia, prolonged capillary refill time, hypotension, hypothermia and dull mentation. Third stage (Late Decompensatory Shock)-pale to cyanotic mucous membranes, bradycardia, severe hypotension, pulses weak or absent, hypothermia, stuporous mentation, organ failure and cardiac arrest.

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Immediately placing a large bore intravenous catheter to administer fluids and necessary medications will be indicated in these patients. Patients with heart murmurs should be assessed carefully and fluids are administered at a lower rate to not further their condition. Under the guidance of the veterinarian starting crystalloid fluid therapy is first line treatment for hypovolemic shock. The canine shock dose of crystalloid fluids is 90 ml/kg/hr. The feline shock dose of crystalloid fluids is 45 ml/kg/hr. Administration of shock fluids will include starting with ¼ shock dose over 15 minutes, at the end of the first 15 minutes reassess the patient’s heart rate, respiratory rate, mucous membranes, capillary refill time and non-invasive blood pressure. If patient is still dehydrated, start the second, quarter dose over 15 minutes and reassess. Repeat until patient is rehydrated or until “shock dose” is complete

CPR

The following recommendations for CPR are adapted from the RECOVER Initiative from AVECC and VECCS. Recognition of a patient in cardio-pulmonary arrest is very important. After recognizing that the patient is not breathing, the first thing to do is to capture an airway. After establishing an airway either by endotracheal intubation or emergency tracheostomy it is important to ventilate for the patient correctly. Ventilate the patient at a rate of 10 breaths/minutes with a tidal volume of 10 ml/kg. The oxygen flow rate should be 150 ml/kg/min

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Monitoring the patient is critical following CPR. Using an EKG to monitor electrical activity of the heart, SPO2 monitor the oxygen status of the patient and supplying oxygen if necessary. Monitor either invasive or non-invasive blood pressures, and regular physical exams including pupillary light responses, motor function and breathing patterns are done frequently to monitor the patient’s cerebral function. Almost always these patients will need oxygen supplementation via an oxygen cage, flow by, or nasal insufflations. The heart will almost always need support in the first 4 hours following successful CPR.

Burnout
This is something to no take lightly. It can sneak up on you and before you know it you are ready to look for a new career. All of us have had a hard week or a rough spell and this isn’t quite the same thing. Burnout is by definition long term exhaustion and reduced interest in work. It was thought originally that the stress from work only caused burnout but it has been proven that burnout can be caused by many stressors including your personal and work life. It is important to recognize the difference between stress and burnout. They are not the same. Stress is characterized by over engagement; doing too many things in your life at once (aka, too many irons in the fire.) Burnout is characterized by disengagement; not caring, depression or no longer being motivation (aka, my give a damn is busted, seriously!)

There have been several studies done on burnout, first being studied in the 1970’s. Since then several studies have been done and a “standard” has been reached in the psychology world to determine if someone is exhibiting signs of burnout. This is called the Maslach Burnout Inventory. It has been shown that most people exhibiting signs of burnout also meet the criteria for clinical depression. Although a topic like burnout is highly controversial, the Maslach Burnout Inventory is one proven approach to burnout. It is a nice thorough guideline that can be used to help assess burnout. In the past burnout has been solely regulated by the amount of exhaustion one is feeling. This theory is based on not only exhaustion but cynicism and inefficacy as well.

Signs of burnout include exhaustion, getting 8 hours of sleep in important to keep yourself rested and relaxed. If you work an off shift, such as nights or weekends, it is important to still get appropriate amounts of sleep. Black out curtains, sleeping masks or other sleep aids will help you feel rested and ready for your day at work. Relaxation is important in preventing burn out. Taking time off periodically to rest and restore will prevent burn out. Lack of motivation, if you are dragging yourself into work and thinking you hate your job the entire way there, which is a sign of burn out. Complications at home or work, relationships with the people around you, either at home or work can cause stress in your life. Find someone to talk to, friend, family member, supervisor, that can help you with interpersonal relationships. Not taking care of yourself, each day it is important to eat properly, exercise, rest and take time for yourself. Health problems, health problems can contribute to burn out if you do not feel you are getting enough rest or the job you are performing causes anxiety or pain in your ever day routine. Don’t be afraid to ask for help. Take time for doctor’s appointments so you can be healthy and enjoy your life.

Tips to help with burn out include starting the day with a relaxing ritual, do something you love every day, adopt healthy eating, exercising, and sleeping habits, set boundaries, take a daily break from technology, nourish your creative side and learn how to manage stress. Everyone’s stress level is different, you have to learn how to manage yours and figure out what is best for you.
Common calculations commonly used by the ICU technician include the following:

- **Drug calculations:**
  - Units needed = weight (kg) x dose
  - Amount needed = dose/concentration of drug

- **whole blood transfusion mL needed**
  \[
  \text{CAT} = \text{patient weight (kg)} \times 70 \times (\text{desired PCV} - \text{current PCV})
  \]
  \[
  \frac{\text{PCV of donor blood}}{}
  \]

- **RER (Resting Energy Requirement) = 70 x weight (kg) to the 0.75 power**
- **MER (Maintenance Energy Requirement) = activity or illness factor x RER**
- **Food dosage = kcal required/caloric density of food**
- **Fluid deficit (L) = % dehydration (decimal) x weight (kg) x 1,000 mL**
- **drip rate = volume of solution mL x drops/mL \times \frac{\text{volume in drops/minute (or ggt/min)}}{\text{Time (in minutes)}}**
  - Need to know the dose rate of the drug
  - Need to know the patient's body weight
  - Need to know the fluid administration rate
  - Need to know the drug concentration

References available upon request.
Administration of blood products can be beneficial to critical patients. The blood products should come from a trustworthy program, either commercial or private. The benefits of the transfusion should outweigh the risk for the recipient. Potential risks to the recipients would include transmission of infectious diseases from the donor if not properly screened or a transfusion reaction. Even though you may in the trenches there are a few key tools to know about transfusion medicine, all of those will be discussed here.

Component therapy has become important in veterinary medicine and is used today instead of transfusing whole blood to every patient in need. Fresh Whole Blood (FWB) is a unit of blood that has been obtained less than 8 hours prior to administration. It contains all the cellular and plasma components of the blood. It is to be administered to patients who are in need of red blood cells, plasma and platelets. Stored whole blood still contains all the cellular and plasma components of the blood except platelets. It is to be stored at 4 ºC and has an expiration date of 28 days. It is used in patients that are anemic and hypoproteinemic.

Packed Red Blood Cells (pRBC) is a unit of blood that has had the red blood cells separated from the plasma content within 8 hours of collection. This blood component should be stored at 4º C and has an expiration date of 42 days. The most common indication for a pRBC transfusion is anemia.

Fresh Frozen Plasma (FFP) is a unit of blood that has been separated from red blood cells and the plasma components are remaining. FFP is viable for up to 1 year when it is stored in temperatures of -20 to -40 ºC. All coagulation factors, albumin and protein are present in this component. A common indication for use is primary or secondary coagulopathies. FFP transfusions have also been proven to benefit patients with acute pancreatitis, disseminated intravascular coagulation (DIC), liver failure, rodenticide toxicity and parvo virus. Frozen or Stored Plasma (SP) is frozen plasma that has been stored at temperatures of -20 to -40 ºC for greater than 1 year. It is viable for up to 2 years. Stored plasma no longer contains clotting factors. Indications for this component include hypoproteinemia and hypoalbuminemia.

Other blood products such as cryoprecipitate, cryoprecipitate-poor plasma and platelet rich plasma are also available as component therapy. Commonly those types of components are obtained from commercial blood banks due to the infrequency of use and cost associated with preparation of the product. Cryoprecipitate contains high levels of fibrinogen, fibronectin, factor VIII and von Willibrans’s factor. It is indicated in patients with coagulopathies due to any of the above plasma protein deficiencies. Cryoprecipitate-poor plasma is indicated in patients that are hypoproteinemic but the risk of synthetic plasma expanders outweighs the benefit. Platelet rich plasma is only viable for 5 days at a constant agitation. Most commercial blood banks make platelet rich plasma available.

Blood typing can be an important step in the transfusion process. A canine blood donor that has never received a blood transfusion is considered to be a universal donor if they are DEA 1 negative. It is thought that the most important canine blood type is DEA 1 because it has a strong alloantibody response after sensitization. Other canine blood types include DEA 1.1, 1.2, 1.3, 3, 4 and 7.

Feline blood types include A, B and AB. Feline blood type A is the most common and feline blood type AB is the rarest. Feline blood types A and B have naturally occurring alloantibodies that can cause severe, life threatening transfusion reactions. The blood type AB does not have naturally occurring alloantibodies but should receive type A blood if they need a transfusion. Simple blood typing cards can be purchased to be used in the clinic to determine the blood type of the recipient. Even though a blood type has been performed on the recipient and donor, it should never take the place of performing a crossmatch before the transfusion to ensure the two are compatible. Bedside agglutination cards are available from DMS laboratories, The Rapid Vet Company©, Rapid Vet-H Canine and Feline. This is a rapid cross matching system that can be done reliably when performed properly.

Cross matching can be a fast and useful tool to help determine if the patient will have a transfusion reaction. A crossmatch will look for the presence of alloantibodies of the recipient’s blood or plasma against the donor’s blood or plasma. A major crossmatch will look for alloantibodies in the recipient’s plasma against the donor’s red blood cells. A minor crossmatch will look for alloantibodies in the donor’s plasma against the recipient’s red blood cells. The presence of agglutination will determine an incompatible crossmatch. If the patient is already exhibiting auto agglutination or hemoglobinemia, some cross matching methods may be undiagnostic.

Administration of blood products should be through a commercially made filtered administration set. The rate should start out at approximately 25% of the calculated dose for the first 30 minutes to one hour of the transfusion. The patient should have a temperature, pulse and respiratory rate (TPR), blood pressure, mucous membrane color and capillary refill time (CRT) performed before and then every 10 minutes for the first hour. At the end of the introductory period the rate can be increased to the calculated rate and vitals should be performed every 30 minutes to 1 hour for the entirety of the transfusion. To reduce the risk of bacterial contamination of the transfusion, it should be administered over a four hour period.
Transfusion reactions can be divided into immunologic and non-immunologic reactions. The febrile nonhemolytic transfusion reaction (FNHTR) is a common immunologic reaction noted. Non-immunologic reactions include; transmission of infectious diseases from the donor to the recipient and sepsis induced bacterial contamination from the unit or volume overload.

If the reaction is mild the treatment therapy can consist of stopping the transfusion and monitoring the patient’s vitals. Restarting the transfusion in approximately thirty minutes at a reduced rate can usually be handled by the patient. Other clinical signs seen in a mild transfusion reaction include; fever, urticarial and facial edema.

Moderate transfusion reactions can include clinical signs of fever, tachycardia, tachypnea or vomiting. The transfusion should be stopped and glucocorticoids can be administered. Supportive care such as fluid therapy should be assessed individually in each patient. The patient’s vitals should be monitored closely and the transfusion can be restarted if necessary. Severe transfusion reactions can be life threatening but are rare. Clinical signs will include tachypnea, hypotension, collapse, fever, bradycardia or even sudden death. The transfusion should be stopped immediately and administration of epinephrine intravenously. Supportive care for the patient can include intravenous fluids, oxygen therapy or CPR. If bacterial infection or sepsis is suspected in the patient, blood cultures of the patient and the product should be performed.

Transfusion medicine is an important part of critical care medicine. Even though risks are present with administration of blood components, lives can be saved.

References available upon request.
So how does the patient get from the uncomplicated diabetic patient to the complicated diabetic? There are many different reasons why a patient could suddenly have a complication of diabetes. The common complications are diabetic ketoacidosis (DKA), insulin resistance, hyperglycemic hyperosmolar syndrome and hypoglycemia.

Getting to the bottom of it will take good history taking skills and a little detective work. Some things to consider are insulin ineffectiveness due to the following:

- Inactive insulin: Be sure to ask the owners how the insulin was stored. There are some general guidelines for insulin storage and handling. Insulin should never be frozen, used beyond the expiration date or exposed to direct heat or light. Each insulin formulation has specific guidelines and should be included on the product insert.
- Diluted insulin: Insulin dilution is a popular practice with the very small patients because their dose is tiny and hard to accurately pull up in a syringe do to the volume of the dose. This should not be done unless absolutely necessary and dilution should only be done by a licensed pharmacist.
- Improper administration technique: ask the owner to show you where on the pet they are administering the insulin dose.
- Improper dose: ask the owner to show you on the appropriate syringe how much insulin they are pulling up.
- Incorrect frequency of dose: always ask the owner what time(s) the insulin is administered, not just how many times daily. There can be a large variance between “twice a day” and 6am and 6pm.
- Impaired insulin absorption: dehydrated patients do not have adequate tissue uptake of drugs injected by the subcutaneous route.

Once insulin ineffectiveness is ruled out, possible insulin resistance should be considered in the patient.

Insulin resistance is a condition when a normal dose of insulin produces a less than ideal clinical response. Many diseases can cause insulin resistance, some common causes in dogs may include:

- Hyperadrenocorticism – Cushing’s syndrome is a result of too much circulating cortisol. The effects of cortisol on the metabolism of carbohydrates will decrease the cellular utilization of glucose and increases glucose output from the liver.
- Exogenous steroids – administration of corticosteroids for the treatment of another disease can result in the same physiological response as a patient with Cushing’s syndrome.
- Concurrent systemic infections – Diabetics may have underlying renal compromise due to the increase in protein in the urine brought about by elevated blood glucose which can cause urinary tract infections.
- Hyperthyroidism - The thyroid gland affects the metabolic rate as well as the rate of energy use, and the absorption of nutrients. Hyperthyroidism causing insulin resistance is actually rare in the feline patient. (1)
- Acromegaly - There has been documentation of elevated growth hormone secretion as well causing insulin resistance in the feline patient.
- Concurrent systemic illness- It has been proven that pancreatitis, renal disease, liver disease or cardiac disease will cause insulin resistance in the feline patient.

Common diseases that cause insulin resistance in cats include:

- Acromegaly
- Exogenous steroids
- Concurrent infections
- Hyperthyroidism
- Concurrent renal, liver or cardiac disease

**Diabetic ketoacidosis**

DKA is a result of an improper balance of concentrations of all the hormones insulin, catecholamines, glucagon, cortisol and growth hormone. An insulin deficiency in the body is counter regulated by an excess of the catabolic hormones, especially glucagon. Now there is hyperglycemia present in the body, when the concentration of glucose exceeds 260-310 mg/dl in cats it exceeds the renal threshold, spilling into the urine. Osmotic diuresis is present with significant calorie loss, polyuria and polydipsia. Lipase is activated by the improper insulin: glucose ratio in the body so it then mobilizes adipose. Adipose is stimulated for the primary energy source because of the loss of calories and unavailability of glucose and insulin to the body.

Long chain free fatty acids then transport the fat to the liver. Liver ketone formation is preferred over transformation into triglycerides due to the increase of glucagon. Ketone bodies produced by oxidation of free fatty acids change into acetone and acetoacetate becoming an acid. In a normal body, ketone are then metabolized by tissue to form carbon dioxide and water then used...
to form bicarbonate. The bicarbonate is then used to help buffer another ketone in the extracellular fluid. In a diabetic body the ketone formation in the liver will exceed the muscle’s ability to metabolize the ketone which will cause accumulation in the blood. So then the excessive production of ketone combined with the reduced production of bicarbonate will result in ketonuria and eventually metabolic.

During osmotic diuresis the body will lose not only glucose but sodium, potassium and water in the urine. The body will compensate for all the negatively charged ketone loss in the urine by excreting additional positive charged electrolytes, those include sodium and potassium. More sodium will be lost through the kidney due to lack of insulin in the body. Sodium is the primary extracellular electrolyte that holds water within that space. The regulation of sodium balance in the kidneys and the maintenance of effective circulating volume are closely related. The changes in effective circulating volume are triggered by specific volume receptors in the cardiopulmonary circulation, the carotid sinuses, aortic arch and the kidneys. This activates a series of effectors throughout the body to correct the volume depletion. Most of the receptors will then sense a change in pressure and dilate or constrict to compensate for the change in circulating volume. The receptors that are located in the renal afferent arterioles then activate the renin-angiotensin-aldosterone system (RAAS). The non-renal receptors will help govern the activity of the sympathetic nervous system.

Now total body water is significantly decreased and the patient is hypovolemic and if left long enough untreated in a state of hypovolemic shock. This will lead to prerenal azotemia and a decreased glomerular filtration rate increasing the amount of ketones and glucose in the blood even more and finally resulting in metabolic acidosis. With circulating cortisol and epinephrine in the blood because the body is in a “stressed” state, this will increase the level of glucose in the blood even more, exacerbating the patient’s condition. Metabolic acidosis is the result of the exchange of a hydrogen ion for intracellular potassium. Insulin is required to drive potassium back into the cell so with the decreased amount of insulin, potassium will then become extracellular. Most serum chemistry profiles only measure extracellular levels and the total body concentration of potassium is not considered to be decreased.

The most common acid/base abnormality in DKA is metabolic acidosis. It develops because of several different reasons but almost always causes an elevated anion gap. Anion gap is the mathematical difference in measured cations and anions and represents the unmeasured anions. The anion gap is increased in DKA because the concentration of unmeasured anion in the blood is increased due to the production ketoacids and the decrease of bicarbonate concentration. The most important cause for metabolic acidosis in DKA is the production of acidic ketones. Fatty acids that are released can be used for energy in most tissues including the liver but without insulin free fatty acid conversion to triglycerides is impaired. When this process is impaired triglycerides are converted to ketones instead of being oxidized to carbon dioxide. So the liver is then reset to metabolize free fatty acids due to the lack of insulin and increased glucagon to favor ketone production instead of oxidation of fatty acids to carbon dioxide. The other reason for acidosis is the overproduction of lactic acid due to the impaired tissue perfusion from dehydration, shock and reduced renal excretion of hydrogen ions. If the disease has progressed far enough, mixed acid/base disturbances will be seen in the patient. Neurological compromise will lead to depressed respiration (respiratory acidosis) or metabolic alkalosis can be seen with vomiting and diarrhea.

Some clinical signs that the owner may report are, polyuria, polydipsia, lethargy, weakness, hyperventilation, anorexia, vomiting, diaphoresis, weight loss, depresed, or coma. Many of these patients have some type of underlying or secondary disease. Other clinical signs include, abdominal pain, neurological abnormalities ranging from depressed mentation to abnormal gait to a coma. Weight loss, muscle wasting, and cataracts can be seen. Some people report a “fruity” odor in the patient’s breath due to the overwhelming amount of ketones in the patient. This is not a reliable clinical sign to use for diagnosis.

Initial database for an emergency patient should include blood glucose, PCV/TS, urinalysis, venous or arterial blood gas and a biochemistry panel. Quick analyzers can be purchased to run some of these tests while waiting on full panels. A glucometer will have results in a matter of seconds if your clinic does not own bed side analyzers. Urine glucose and ketone reagent strips are available for fast results while waiting on full urinalysis. A PCV/TS will give information on your patient’s dehydration status and can be read in just a few minutes. Some bed side analyzers now have the capabilities to run venous or arterial blood gases for your convenience. The diagnosis of DKA is confirmed by the presence of hyperglycemia, glucosuria, ketonuria, and metabolic acidosis. Other abnormalities can include hyponatremia, hypochloremia, hypokalemia, increased anion gap, and azotemia. Treatment of DKA patient can be tricky and time consuming. Correcting dehydration and electrolyte imbalances should be done first. A large bore peripheral intravenous catheter should be placed immediately. When the patient is stable a long indwelling jugular catheter, which fluids can be administered and blood samples can be drawn from should be considered. Hypoperfusion and dehydration should be replaced immediately with crystalloid fluid boluses and colloid fluids if needed. The typical shock dose of crystalloids is 60 ml/kg/hr in the feline patient. Remember that if your patient has concurrent heart disease, the rate of fluids may need to be tailored to fit that patient. Once hypovolemia is corrected, the fluid rate will need to be adjusted to correct the total fluid deficit.

Monitoring any patient that is receiving intravenous fluids is important. Any acute changes in body weight can be a sign of improper changes in water. Any patient that is losing weight while on fluid therapy is not receiving adequate amounts of fluid. Monitoring blood pressure, heart rate, respiratory rate is essential as well. Central venous pressure can be measured and used as a guide for fluid therapy replacement. Readings under 5 cmH2O are indicators of inadequate fluid replacement. Patients that still have
proper renal function, a dehydrated animal will have a urine specific gravity of >1.025. On the other hand fluid overload should be monitored as well. In patients that are experiencing fluid overload or over hydration you will see an increase of nasal discharge, chemosis, increased respiratory rate, pulmonary congestion, crackles, and eventually pulmonary edema will develop.

Knowing which type of fluid to pick off the shelf and why is important. Typically, 0.9% Sodium Chloride is the fluid of choice in the emergency phase of DKA. It is an isotonic fluid and has the highest concentration of sodium compared to other fluid types, which is important to correcting the sodium deficit. Lactated Ringer’s Solution should be avoided at this time due to the presence of lactate in the solution. The hepatic metabolic process to make bicarbonate from the lactate is the same process used to metabolize ketones, reducing the liver’s ability to correctly metabolize lactate. Poor perfusion will also aide in the retention of lactate because it is negatively charged and in the effort of the body trying to maintain electrical neutrality will dump even more sodium and potassium into the urine to be excreted.

Rehydration alone will improve hyperglycemia, acid/base status and electrolyte imbalances. Supplementation of electrolytes may need to be provided additionally due to the dilution effect of fluid administration. Tissue perfusion will be restored and proper urine production will be restored improving metabolic acidosis. Proper tissue perfusion will also help reduce the amount of lactate in the body helping to reduce the amount of sodium and potassium the body puts in the urine. All of this will help the body to restore normal amounts of electrolytes. Rehydration will also help reduce the concentration of ketones and glucose in the body because of the dilution effect. So as you can see the dilution effect of fluid therapy is important to remember in patients it helps reduce the high concentrations but can reduce them too much. Frequent chemistry panels should be ran on these patients, in the beginning it may be necessary to run chemistry panels every 4 to 6 hours and then as your patient becomes more stable, decreasing the frequency to every 12 hours and eventually to every 24 hours. In the author’s experience, a daily chemistry panel is performed until the electrolytes stay within normal ranges; the patient is considered euvolemic and eating on their own.

Regular insulin is suggested in the initial treatment of DKA and is continued until the patient is stable and ketosis has resolved. Therapy is adjusted to reach blood glucose of 250 – 300 mg/dl in approximately 24 hours. Insulin therapy should begin approximately 2 – 4 hours after fluid therapy. Fluid therapy alone will help decrease the concentration of glucose from dilution effect and urine production in the body. If the glucose is dropped too quickly it can result in cerebral edema and a coma. The maximum drop in blood glucose should not exceed 75 – 100 mg/dl/hr. There are several different recommendations to administration and dosage of regular insulin in the initial treatment of a DKA patient. The advantages of regular insulin are, it can be administered intravenously (IV), intramuscularly (IM), and subcutaneously (SQ), it has a rapid onset of action and a short duration of action.

Intramuscular and especially subcutaneous injection may not be absorbed properly if the patient is hypovolemic. Hourly IM injections of regular insulin can be done successfully if needed. The initial dose would be 0.2 – 0.25 U/kg with follow up doses of 0.1 – 0.2 U/kg hourly. The regular insulin is continued until the patient’s ketosis is resolved. When blood glucose drops <250 – 300 mg/dl the hourly dose is decreased by as much as 50%. At that point a 2.5 – 5% dextrose containing solution is started and if the blood glucose drops <100 mg/dl, insulin is temporarily discontinued until it rises above 150 - 200 mg/dl. If the blood glucose drops below 60 mg/dl a 1-2 ml/kg bolus of 25% dextrose should be administered and glucose measurement taken every 30 minutes to 1 hour until rises above 100 mg/dl. Blood glucose measurements are performed every 1 -2 hours until it is continuously in the 250 – 300 mg/dl range.

Regular insulin can be successfully administered IV as well. A popular treatment method is to add the dose of insulin into a 250 ml bag of 0.9 % NaCl to administer it to your patient. The dose of insulin to be added to the 250 ml bag of saline is 1.1 U/kg for the feline patient. This concentration will be started at a rate of 10 ml/hr and infused only with an infusion pump. 50 mls of the solution should be ran through the line and discarded to allow insulin to properly bind to the plastic in the tubing. This will allow for immediate, proper dosing of insulin to the patient. Monitoring the patient is the same as with IM injections of regular insulin that was described above. Once the patient’s blood glucose is stable and they are eating, the insulin can be switched to intermediate acting insulin.

**Hyperglycemic hyperosmolar syndrome (HHS)**

This is an uncommon complication of diabetes in the cat. HHS is diagnosed when the feline patient has hyperglycemia, above 600 mg/dl, hyperosmolarit, above 350 mOsm/kg, and dehydration without to ketosis. (5, 8) In HHS it is thought that hepatic glucagon resistance and small amounts of insulin prevents ketosis. It is not known specifically why some feline patients develop HHS instead of DKA as a complication of diabetes mellitus but most patients with HHA have a concurrent illness. Patients can show neurologic clinical signs with this syndrome. Some patients are non-responsive to anticonvulsants and only respond to insulin therapy and rehydration in these situations. Neurological clinical signs are assumed to occur due to cerebral dehydration secondary to the hyperosmolality. HHS will occur more commonly, with concurrent disease such as, cardiac or renal failure, pancreatitis, sepsis, and/or steroid therapy.

Treatment of HHS and DKA are similar with the goals to correct dehydration restore electrolyte losses and provide adequate insulin to correct any metabolic defects. Correcting dehydration and hyperosmolality with 0.9% NaCl is necessary before starting
insulin therapy. If the blood glucose is decreased to rapidly this it will cause a decrease in extracellular fluid osmolality, which will cause cerebral edema. The prognosis of HHS is poor due to the high incidence of serious concurrent disease.

**Hypoglycemia**

Hypoglycemia can occur with an insulin overdose. This can be avoided by a client education and making sure the client understands how to properly pull up and administrate the correct insulin dose. Clinical signs usually include ataxia, weakness, behavior abnormalities, depression, shaking, seizures, coma, or death. When the clinical signs of hypoglycemia are first recognized owners can offer food or apply Karo ® syrup to the mucous membranes of the patient until veterinary treatment can be performed. One the patient has arrived at the hospital, 50% dextrose can be administered per the request of your veterinarian. When an IV catheter is placed a dilution of 1:4 of 50% dextrose can be administered. This bolus can be repeated as necessary. A CRI of 2.5 % to 5% dextrose should be started to prevent recurrence and continued until the patient can eat.

References available upon request.
Feline Hyperthyroidism is a common disease seen in feline patients. Every technician should understand pathophysiology of the thyroid gland including how the gland affects the body in a normal and abnormal state. As well as diagnostic and treatment options which will help the technician become a better patient advocate and help educate clients on those options.

**Physiology of the thyroid gland**

The thyroid gland helps regulate many different parts of the body. It is one of many glands in the body that makes up the endocrine system. The thyroid gland is located below the larynx on each side of the trachea and is one of the largest endocrine glands in the body. Secretion of the hormones thyroxine (T4) and triiodothyronine (T3) is the primary function of the thyroid gland. These hormones control the rate of metabolism within the body. When the body secretes too much of the thyroid hormones it is termed “hyperthyroidism” and when the body does not secrete enough of the thyroid hormones it is termed “hypothyroidism”. When the thyroid gland needs to secrete more of the thyroid hormones, the anterior pituitary gland will release thyroid-releasing hormone (TSH). TSH will be secreted to the thyroid gland and in return the thyroid gland releases the hormones. Both T4 and T3 are as equally as important within the body even though T4 is secreted at a much higher rate than T3. T3 is four times more potent and but lasts a shorter amount of time than T4.

Iodine is needed to complete the formation of T4. Only a small amount is needed in the weekly diet. In humans, this was the reason why iodine was added to table salt. When iodides are ingested, they are secreted from the gastrointestinal tract into the blood and then thyroid gland will then transform it into an oxidized state and use them to complete the formation of T4. Once the hormone is released it binds with plasma proteins that are synthesized by the liver. The hormones are then introduced to the tissues of the body slowly. T4 is introduced every 6 days and T3 every day. Once they are introduced to tissue, they will bind again with intracellular proteins.

Calcitonin is the third hormone that is secreted from the thyroid gland. Calcitonin, Vitamin D and the parathyroid hormone (PTH) are all closely intertwined to help control the formation and regulation of calcium and phosphate metabolism as well as bone and teeth formation. Calcium specifically plays a role in this activity by decreasing plasma calcium concentrations and has opposing effects of PTH. (For the purposes of this lecture, specific effects of the PTH will not be discussed.) Increased calcium in the extracellular fluid is the primary stimulus for secretion of calcitonin. It only takes a 10% increase of calcium to cause secretion of calcitonin. The immediate effect of calcitonin is to change the amount of absorbed and deposited calcium, especially in the young animal. The long term effect of calcitonin is to decrease the amount of new osteoclasts being formed.

Functions of the thyroid gland include;

- Increasing metabolic rate in almost every tissue of the body
- Increases the amount and activity of the mitochondria that will cause an increase the rate of formation of adenosine triphosphate (ATP). So in return the body uses more energy
- Affects the Na-K-ATPase which will increase transportation of sodium and potassium ions through cell membranes of tissue in the body. This causes more energy to be used and will increase the core body temperature.
- Growth- promotes growth and development of the brain during fetal life and for the first few years after birth. Growth and maturation can be decreased in the event of not enough of the hormones and vice versa if there is too much of the hormones present.
- Carbohydrate metabolism- stimulation of most aspects of carbohydrate metabolism is effected by thyroid hormone secretion. Rapid glucose uptake of the cells, glycolysis, gluconeogenesis, rate of absorption of the gastrointestinal tract and insulin secretion are all affected by the rate of carbohydrate metabolism in which the thyroid hormones play a role in.
- Fat metabolism- they thyroid gland can alter almost every step of fat metabolism. The lipids will be mobilized rapidly from the fat tissue which will decrease the amount of fat stores in the body and this will affect the free fatty acid concentration in the plasma and cause oxidation of free fatty acids to increase with an increase in thyroid hormone secretion.
- Concentrations of cholesterol, phospholipids and triglycerides will be affected with increased amounts of thyroid hormones. And they will be increased with lesser amounts of thyroid hormones in the body.
- Increased blood flow and cardiac output- because the metabolic rate is increased in the body this will cause the oxygen consumption to increase as well. This will cause vasodilation causing an increase in blood flow peripherally.
Vasodilation will occur in the skin to aid in normalization of the increased body temperature. To compensate for the increased blood flow, the body will increase the cardiac output.

- Increased heart rate- The increased heart rate is not only due to the body trying to meet the needs of increased oxygen consumption and cooling the body. The rate at which the heart is beating is increased more than to be expected. It is believed that the increased secretion of thyroid hormone has a direct effect on the excitability of the heart.
- Increased heart strength- Enzymatic activity of the increased flow of thyroid hormone will increase the strength of the heart even if the hormone secretion is only slightly increased. With excessive amounts of hormone in the body the heart will become weak due to long term increased production of protein catabolism.
- Respiratory system- The respiratory system is affected due to the increase rate of oxygen consumption and formation of carbon dioxide. The rate and depth of respiration will be increased with hyperthyroidism.
- Gastrointestinal system- GI motility and rate of secretion of digestive enzymes will be increased to help aid the body in the increased metabolism.
- Central Nervous System- altered amounts of thyroid hormone will affect the patient’s ability to think. Hyperthyroidism will cause the patient to be nervous, fidgety or find it hard to sit still. Hypothyroidism will cause the patient to become dull or even lethargic.
- Muscles- a slight increase in hormone secretion the muscles of the body with react with increased reaction time. When the hormone secretion is excessive they will react slowly because the body is in a continuous state of protein catabolism. If decreased, the body will be sluggish to react.

**Feline hyperthyroidism**

Feline Hyperthyroidism is the most common endocrinopathy in feline patients over the age of 8 years old. It is a multi-systemic disease resulting in increased production and secretion of the thyroid hormone, T4 and T3 within the body. Typically lateral or bilateral small thyroid masses are palpable on physical examination. The mass causing the disease typically contains an adenoma or adenomatous hyperplasia cells. It is less common for the enlarged lobe to be caused by thyroid carcinoma. There is not a sex related predisposition to the disease. It has been reported that Siamese and Himalayans are at a decreased risk for development of Hyperthyroidism. And domestic long and short hair breed are most commonly affected.

Clinical Signs include the following;

- Weight loss
- Polyphagia
- Hyperactivity
- Increased vocalization
- Hair coat changes
- Polyuria
- Polydipsia
- Vomiting
- Diarrhea
- Behavior changes
- Tachycardia

Clinical signs can be variable and consist of the non-traditional findings listed above if the disease has progressed. The clinical signs of a progressed state could include anorexia, emaciation and severe dehydration.

Upon physical exam, it is important to do a thorough thyroid palpation. Not every patient with hyperthyroidism will have a palpable thyroid in the author’s experience. In the author’s opinion, a positive enlarged thyroid lobe and a matching history for hyperthyroidism is a positive start to diagnosis of the disease. Techniques for a proper thyroid palpation will be discussed during the lecture hour. Other physical exam findings can include; poor body condition, dull hair coat, dehydration, tachycardia and hyperactivity. In her experience, the author has noted that commonly the hyperthyroid cat will be aggressive, fidgety or vocalizing during examination.

Common abnormalities on a biochemistry panel include increased alanine aminotransferase, alkaline phosphatase, aspartate aminotransferase, BUN, creatinine and hyperphosphatemia. On urinalysis the urine specific gravity is typically greater than 1.035.

**Diagnosis**

Diagnosis of hyperthyroidism can be made on positive palpation of an enlarged node, matching history, clinical signs and documentation of an elevated total T4 on blood work. A total T4 should be run on serum and can be sent to any commercial laboratory for evaluation. In cases that the Total T4 levels are not conclusive other testing should be pursued to determine a definitive diagnosis.
A T3 Suppression test can be performed if the serum total T4 is indecisive. This test evaluates the responsiveness of TSH that is secreted by the pituitary gland and if the synthetic T3 that was given suppresses its secretion. When the synthetic T3 is administered it should suppress pituitary TSH secretion. This would then cause a decrease in the serum T4 concentration in a normal cat. But if the patient has hyperthyroidism it will still have secretion of the thyroid hormone that has is not related to the pituitary gland. So the administration of synthetic T3 will have no effect on the hyperthyroid patient. To perform the test, collect a baseline serum total T4 and T3, the owner will administer 25 mg of sodium liothyronine three times a day for 2 days starting the next morning. The morning of day 3 the last dose of sodium liothyronine will be administered and a final serum T4 and T3 will be collected 2-4 hours after administration of the last dose.

Lastly a radioactive thyroid scan can be done to diagnose an enlarged thyroid lobe and the presence or absence of metastatic cancer. At the author’s facility, the scan is performed by injecting 2 millicuries (mCi) of technetium intravenously. After waiting 20 minutes for the technetium to take effect, ventral, left and right lateral images of the thyroid and thoracic regions are acquired. A radiologist will read the scans and determine if I131 is an appropriate treatment for the patient.

Treatment

Treatment options for feline hyperthyroidism include; drug therapy, thyroidectomy and radioactive iodine therapy. The mode of treatment will ultimately be determined by several different factors including; the age and health status of the patient, owner wishes, renal function, cardiac function, the presence or lack of hyperplasia, adenoma or carcinoma, the allowance of the patient to receive oral medications, the availability of I131 treatment and the availability of a surgeon to perform a thyroidectomy.

Initially the patient should be treated with antithyroid drugs to help control the side effects of excessive amounts of the hormone in the body. If surgery was chosen it will help reverse the effects on the body and make that patient a better anesthetic candidate. Oral therapy will also help reverse any cardiac or renal hyperthyroid induced derangements. Renal function abnormalities can be masked in the face of hyperthyroidism so when treated with antithyroid drugs any renal abnormalities will be uncovered and will help aid in final treatment options for the patient.

Antithyroid oral drugs include methimazole, propylthiouracil and carbimazole. Methimazole is the drug of choice for daily oral hyperthyroidism treatment in the feline patient. It can be given orally or placed topically on the pinna of the ear. A typical starting dose of methimazole is 1.25 to 2.5 mg/cat every 12 hours. Methimazole does not block the release of thyroid hormone it blocks the oxidation of iodine once the hormone is released. It typically takes 2 to 4 weeks before T4 concentrations normalize after beginning treatment. Side effects of methimazole include; neutropenia, thrombocytopenia scabbing lesions on the pinna of the ear, hepatotoxicity, anorexia, vomiting, lethargy, renal decompensation and rarely Myasthenia Gravis. Monitoring the CBC, biochemistry panel and serum T4 levels should be done at weeks 2, 4 and 6 initially. If owners choose to give the transdermal methimazole, it is important to educate them on proper administration and the importance of wearing gloves to not allow the medication to absorb into their skin and alter their thyroid levels.

Advantages of I-131 for the treatment of feline hyperthyroidism include the following: eliminates the difficulty of administering twice a day medication, eliminates the possibility of reactions to anti-thyroid drugs and eliminates the risk of anesthesia during the thyroidectomy. Disadvantages of I-131 treatment includes; the availability of I-131 is limited, it requires knowledge and safety precautions of the radiation therapy, the patient must be hospitalized for a specific period of time to allow the I-131 to be eliminated from the body (the typical hospitalization time is 7 to 10 days), the patient has to be isolated for that period of time without owner visitations, cost, and the patient may not respond properly to a single treatment.

Patient selection for I-131 treatment is very important; the patient must be able to be isolated and unmedicated during the entire duration of hospitalization. If the patient has concurrent medical diseases such as cardiovascular, renal, gastrointestinal, other endocrine or neurological diseases they may be excluded from this particular treatment plan. Pre-radioactive iodine treatment work up should include the following; CBC, biochemistry panel, urinalysis, serum T4, thoracic radiographs, echocardiogram and have been off of methimazole for 7 days. If all requirements are met at that time the patient can have I-131 treatment.

Safety precautions should be followed during hospitalization. They would include the patient being confined to an isolated area of the hospital particularly a nuclear medicine isolation ward, trained personnel should only touch the patient, this team of people should be properly trained on radiation safety and know the proper PPE. Long laboratory coats, disposable plastic gloves and dosimeter monitors are the proper PPE for radiation patients. Every day the radiation level should be monitored and recorded in the patient’s chart to ensure the level of radiation is decreasing. In the author’s facility, daily readings are performed by trained personnel until a measurement of 2.5 millirem per hour (mr/h) is obtained. Upon discharge owners should keep the cat strictly indoors, limit the amount of contact time with the cat and dispose of the cat waste properly. Children and pregnant women should not come into contact with the patient for two weeks after discharge. Typically I-131 will restore euthyroid in a single dose. The hormone concentrations are normal within two weeks of therapy and typically the patient starts to feel better within days after treatment. However, there are approximately 5% of cats who do not respond appropriately to a single dose and must have a second dose of I-131 to become euthyroid.
Patients that are good surgical candidates are considered a low anesthetic risk, the availability of I-131 is low and the availability of funding is low. Advantages of a thyroidectomy are it is 90% efficacious and/or curative. The disadvantages of a thyroidectomy include; high initial expense, the risk of hypoparathyroidism, it is nonreversible and the anesthetic risk of the patient. Post operatively patients should be monitored for 7 days for clinical signs of hypocalcemia. Other post-operative complications include; Horner’s syndrome, laryngeal paralysis, damage to the laryngeal nerve and permanent hypothyroidism.

Iodine restricted diets are available for hyperthyroid patients. If the patient is put on this diet, it must be fed this diet exclusively; physical exams and rechecking blood work must be done every 6 months for the rest of the patient’s life and they must be taken off antithyroid drugs over a course of 2 weeks while the patient is introduced to the iodine-restricted food. Only cats that are diagnosed with hyperthyroidism can eat the iodine restricted diet.

**Euthyroid sick syndrome**

Euthyroid Sick Syndrome is diagnosed in a patient with a nonthyroidal systemic illness with concurrent decreased serum thyroid level. Severe nonthyroidal illness will decrease serum thyroid levels to the low or undetectable range even in patients without concurrent hyperthyroidism. With concurrent systemic illness, patients with serum thyroid levels in the normal to high range should be suspected to have hyperthyroidism. A second serum thyroid level should be checked approximately 1-2 weeks later. If total T4 levels are still suspicious but inconclusive other diagnostic methods for diagnosis of Hyperthyroidism should be pursued.

References are available upon request.
1. Working in a veterinary hospital has a list of struggles and often individuals make sacrifices on a number of levels to be present daily in that environment.

2. The team is what makes a hospital function and with that each individual brings their own unique strength to the overall goal of living the passion of helping pets and supporting the human animal bond.

3. Mud runs are mentally and physically difficult, requiring much of the same resources to complete as it takes to work as a team through the events of a day in a veterinary hospital.

4. Becoming aware of these similarities can help for each individual to recognize the needs of the individuals in making up the greater of the team.

5. Overview of the 10 points of what mud runs teach us about working in a vet hospital

6. One- Culture. We each openly accept ourselves to get “beat up” both physically and mentally for something that is bigger than ourselves.

7. Two- Each of us has a strength that is unique to us, rarely is one person “good” at everything.

8. Three- We readily assist others in need, as we recognize that we believe in the same vision.

9. Four- When an accomplishment is made from a commitment to significant training and focus, it feels great!

10. Five- Recognizing and learning to accept our personal limitations and how these do not define our dedication to our passion, is critical.

11. Six- Sometimes you are the motivator, other times you are the one in need of motivation.

12. Seven- We are willing to make sacrifices of ourselves in support of others on the team.

13. Eight- Sometimes we split up during the process to keep the event of the day moving, but in the end we all come together to celebrate the end result.

14. Nine- Spectators readily make sacrifices to support the spectators as they recognize the accomplishment the participants are working towards.

15. Ten- Although we all have the same goal in mind, it can come from different motivations.

16. People dedicated to mud runs are just as intense and focused as individuals that help to save pets lives every day. For we are all in the trenches, yet never alone!

17. 4 key points; (1) We control our response (2) We create our environment (3) We embrace our emotions (4) We find self forgiveness.
Stabilization and Monitoring of the Critical Patient
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Following triage of the critical emergency patient, the first few steps we take as technicians and veterinarians can be vital in providing life-saving stabilization as well as obtaining diagnostic information. With the guiding tenets of working efficiently and stressing the patient as little as possible, we will discuss tools such as the minimum database, electrocardiogram, pulse oximetry and blood pressure monitoring. Techniques behind these tools, troubleshooting and application will all be discussed, with relevant case examples provided.

Initial stabilization
For most emergent patients, initial stabilization will include obtaining intravenous access, supplementation of oxygen, fluid therapy if necessary, and administration of medications if indicated. General sites for IV access include the jugular, cephalic and saphenous veins; intraosseous (IO) access should also be considered and may allow more rapid access in patients with cardiovascular collapse. Oxygen therapy should be supplied via flow-by mask initially, and is able to achieve an FiO₂ between 30-40%. As these stabilization measures are taking place, the quick, easy diagnostics below should also be considered to guide further treatment.

Minimum database
The minimum database (MDB) generally consists of a packed cell volume (PCV), total solids (TS) and blood glucose (BG). These diagnostics can all be performed in the emergency room with a very small amount of blood, meaning that they can be completed rapidly and in patients of various sizes.

PCV and TS should always be interpreted together, and can allow for assessment of volume status as well as differentiation of causes of anemia if present. For example, there are three general categories of causes of anemia: loss (hemorrhage), which can be internal or external; destruction, such as with hemolysis; or lack of production, as with chronic disease or a bone marrow issue. By evaluating the PCV/TS together, one can narrow down the causes of a patients’ anemia. In cases of hemorrhage, both the PCV and TS should be low, since both red cells and proteins are being lost. In cases of destruction or lack of production, the PCV should be low and the TS should be normal, since protein values will generally not be affected. (*Pearl: In cases of acute hemorrhage, especially in dogs, it is common to see a low TS in combination with a normal or even slightly increased PCV. This is due to acute splenic contraction and release of red cells into the circulation when hemorrhage occurs). Evaluation of capillary tubes post-centrifugation can also be helpful in looking for evidence of hemolysis, icterus or lipemia.

In most emergency rooms, glucometers are used to determine blood glucose levels. These small handheld tools are convenient, inexpensive, and can be used with serum, plasma or whole blood. Recent research has shown that measurement of whole blood glucose using a glucometer generally results in values that are roughly 30 mg/dl lower than serum glucose values in both dogs and cats.1 In critically ill patients, hyperglycemia (>180 mg/gl in dogs, > 220 mg/dl in cats) can occur secondary to stress or trauma, or can be directly related to the patient’s problem, such as with diabetes or diabetic ketoacidosis. In general, patients with hyperglycemia should be stabilized with fluids and other supportive as indicated, and the blood glucose rechecked before considering direct treatment of the hyperglycemia with insulin therapy. Hypoglycemia (< 60 mg/dl in dogs or cats) can occur with sepsis, endogenous or exogenous insulin release as with insulinomas, accidental insulin overdose in diabetic patients, secondary to xylitol toxicity, hypoadrenocorticism, and decreased production in neonatal patients. (*Pearl: In general, hypoglycemia does not occur in adult dogs or cats secondary to anorexia, and should instead be an indication to look for other more serious causes.) Hypoglycemia can be life-threatening and should be treated immediately upon recognition with intravenous dextrose (0.25-0.5 g/kg of 50% dextrose, diluted to 1:2 to 1:4 and given IV over 5 minutes).

Electrocardiogram
Electrocardiogram (ECG) allows for assessment of the electrical rhythm generated by the heart and sensed at the body surface. ECG monitoring can be helpful not only for patients presenting with cardiac arrhythmias, but also for any patient that presents with a history of trauma, weakness, collapse, or requires monitoring during resuscitation and beyond.

The majority of ECGs used in emergency room settings have three bipolar limb leads: I, II and III. Newer devices also offer wireless and telemetric options. While ECGs should ideally performed with patients in right lateral recumbency, this may not be possible in patients with dyspnea or other critical illness. The leads should be attached to the distal or proximal caudal elbow and over the stifle, and wetted with 70% isopropyl alcohol to ensure electrical contact. Keep in mind that activity of the patient and electrically operated equipment such as clippers can cause interference, so they should try to be minimized while a reading is being obtained. For patients that require longer monitoring, adhesive electrodes may be used to reduce patient discomfort.
ECG readings can be used to evaluate patients for bradyarrhythmias or tachyarrhythmias that may be noted upon triage; irregular rhythms can also be evaluated. ECG is also useful in CPR situations to guide resuscitation techniques. For critically ill patients who are hospitalized, ECG can be incredibly useful in a busy setting to monitor the patient while other things are happening. For example, a patient who comes in with pericardial effusion and has a pericardiocentesis for stabilization should have an ECG placed during hospitalization as the redevelopment of tachycardia may be one of the first indications of re-effusion.

**Pulse oximetry**

Pulse oximetry devices allow for assessment of oxygenation via measurement of the percent of hemoglobin that is saturated with oxygen (SpO2 or SaO2). The pulse oximeter probe is attached to an area of non-pigmented skin or mucous membrane, and sends two wavelengths of light into the blood circulating through the capillaries. These wavelengths reflect the amount of oxygenated hemoglobin in the blood, expressed as a percentage (an SpO2 of 95-100% is considered normal). The device should also report a pulse rate, which should match that of the patient (confirmed via palpation or your ECG) to ensure that the measurement is accurate. (*Pearl: If you are getting a pulse ox reading but no pulse reading, or an incorrect pulse reading, the pulse ox value is likely inaccurate!*)

SaO2 is directionally (but not linearly!) related to PaO2, which is the partial pressure of oxygen dissolved in the arterial blood (normally around 100 mmHg). It is important to remember that because of this non-linear, sigmoid characteristic of the oxygen-hemoglobin dissociation curve, small drops in SpO2 can equate to major changes in PaO2. For example, an SpO2 of 94% is equal to a PaO2 of roughly 80 mmHg, and an SpO2 of 90% is equal to a PaO2 of roughly 60 mmHg, which indicates severe hypoxemia.

Pulse oximetry readings can be very helpful in assessing critically ill patients during triage, and monitoring them over time for response to therapy. However, the devices can be finicky, and many of the problems seen in patients presenting emergently, including hypothermia, hypotension and vasoconstriction, can make it difficult to obtain a reading. (*Pearl: Don’t depend too heavily on your pulse ox if you can’t get an accurate reading! If your patients appear to need supplemental oxygen, just treat them!* It is also important to remember that pulse oximetry does not tell us about the ventilation side of respiration; measurement of end-tidal, arterial or venous CO2 is required.

**Non-invasive blood pressure monitoring**

While direct arterial blood pressure monitoring is the gold standard, non-invasive methods are commonly used in veterinary medicine and are a rapid, relatively easy to perform way to assess blood pressure. Normal systolic blood pressures for dogs and cats are 150 ± 20 mmHg and 125 ± 10 mmHg, respectively, with average mean pressures of 105 ± 10 mmHg for both species. Hypertension is defined as a systolic blood pressure greater than 160 mmHg in dogs or cats, is usually secondary to stress, pain, or an underlying disease process rather than a primary problem.

The two most common non-invasive methods of measuring blood pressure are via Doppler or oscillometrics. Both techniques rely on inflation of a cuff to occlude arterial blood flow, with the blood pressure measured when flow returns. Cuff size is important in both methods, and is a common source of error: a too small cuff will result in a falsely high blood pressure, and a too large cuff will result in a falsely low blood pressure. Recommended cuff sizes are approximately 40% of the limb circumference for dogs, and 30% for cats.

The Doppler method of measuring blood pressure relies on a 10-MHz ultrasound probe to detect blood flow in an artery, and is usually used over the dorsal metatarsal artery in the hind leg or over the palmar aspect of the metacarpals in the front limb; the ventral base of the tail can also be used. With the cuff attached and inflated proximal to (above) the probe, Doppler sounds become audible when the pressure in the cuff is less than the pressure in the artery, and a reading can be obtained using a sphygmomanometer. Doppler blood pressure readings are commonly obtained in small patients, especially cats and small dogs. It is also useful in patients with arrhythmias, since oscillometric readings will be inaccurate in these patients.

The oscillometric method involves an automated system in which a cuff is applied to the patient’s limb and blood pressure readings are obtained by the machine. The machine alternates between inflating and deflating the cuff, and during deflation, pulse pressure changes are sensed by the transducer. The machine reads the mean arterial blood pressure, and systolic and diastolic pressures are calculated. Similar to the pulse oximetry device, oscillometric monitors read and report the heart rate, which should match that of the patient to suggest an accurate reading.

**References**

Allergies Explained:
How to Help Your Clients Understand Why Their Pet is Itchy and How We Can Help
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Why do animals itch? I like to explain to my owners that there are three main reasons that their pet might be itchy: parasite allergy, food allergy and environmental allergy.

Parasite allergy
Fleas cause itching and hair loss due to the irritation caused by their bites, secondary bacterial infections, or to a flea bite allergy (FAD or flea allergy dermatitis). Symptoms are often worse in warm weather when fleas are most numerous. Animals will often itch and lose hair on their back near their tail. Cats may also develop small crusts on their skin that are similar in appearance to tiny millet seeds (miliary dermatitis). In flea-allergic animals, even one fleabite can cause a reaction.

Mite hypersensitivity can also cause itching. There are two common types of mange (microscopic skin mites), demodex and scabies/sarcoptes. Another, less common mite that can cause itchy skin disease is called Cheyletiella. Scabies infection is extremely itchy and contagious to other dogs, and may cause hair loss and a crust to form on their ears and elbows. Scabies mites can be very difficult to find, and often we will trial-treat for scabies based on the dog’s symptoms and appearance, even if we cannot find mites on the skin scrapes. With scabies, all dogs in the household must be treated at the same time, even if they are not showing signs yet, because some dogs can carry the mites and have no symptoms. Dogs with scabies may also have secondary bacterial or yeast skin infections, which contribute to the itch. Cheyletiella mites cause itchy skin and dry scaling on the back, and can infect dogs, cats, people, and rabbits. They can also be difficult to find on skin scrapings, and so trial treatment for Cheyletiella is warranted if symptoms are consistent with infection. Treatment options are the same as for scabies mites, and all animals in the household have to be treated at the same time, or they will pass the mites back and forth.

Allergies
Environmental allergies or canine atopic dermatitis (CAD) is one of the most common diagnoses in general veterinary practice, is a progressive condition that decreases the quality of life in 10% of companion dogs worldwide. CAD's most common sign is pruritus, most often affecting the ears, face, ventral neck, distal limbs, and ventrum, as well as the perianal and perivulvar regions. Secondary bacterial and yeast infections are also common. CAD may begin seasonally and progress to nonseasonal pruritus. CAD is thought to be a polygenic disorder involving immune dysregulation and epidermal barrier dysfunction. The atopic immune response causes increased production of allergen-specific IgE, while barrier dysfunction facilitates transcutaneous allergen and microbe penetration. CAD is diagnosed by exclusion of other causes of pruritus; it cannot be accurately diagnosed by allergy testing alone. Once CAD has been diagnosed (by ruling out parasite and food allergy), skin allergy testing can be helpful. Skin allergy testing tests the actual organ that is involved in the allergy (the skin), so is more accurate than blood testing, and is typically performed by veterinary dermatologists. Once the allergy test results are known, allergic pets can receive allergy shots (just like people!) to desensitize them to the pollen. Although not a cure or a quick-fix, allergy hyposensitization injections help 70-75% of allergic pets to decrease symptoms and need for other medications, and address the cause of the allergies, not just the symptoms.

Food allergy (cutaneous adverse food reaction)
Animals with food allergy can show very similar signs as pets with environmental allergies, but the itching is not seasonal and animals can develop a food allergy at any time in their life—even if they have been eating the same food all along. Cats may develop crusty dermatitis or hair loss similar to pollen allergy. Besides itchiness, food-allergic dogs may also have ear or skin infections. The symptoms of food allergy usually do not improve much with anti-itch medications, and the diagnosis and treatment is to feed the pet a hypoallergenic diet using a protein source that they have never been exposed to before. Switching to another commercial diet usually does not help, because most of these diets have similar ingredients. A better alternative is a hypoallergenic diet with single unique protein ingredients such as fish, rabbit, duck, or venison, with a single carbohydrate such as potato or rice, and no other treats, table scraps, rawhides, milkbones, chewable supplements or other foods for at least 6-8 weeks. Some food allergic dogs require home cooked hypoallergenic diets. Blood or skin testing or hair and saliva for food allergy is unfortunately not accurate in dogs and cats because of the high number of false positive and false negatives. If present, secondary bacterial or yeast infections also need to be treated. If the itchy symptoms have resolved in 6-8 weeks, new food allergens can be added one at a time every 2-3 weeks (ie. beef, chicken, lamb, wheat, corn, egg, milk etc.) to determine what the pet is allergic to and what other foods they may tolerate.
How to communicate with your clients about allergies—which require LONG TERM treatment
For the initial allergy work up, we need to explain to the client the long and often frustrating process of first trying to exclude any other causes of the pet’s signs (such as food allergy or parasites). This may include treatment trials of the pet and its environment for parasites, various diagnostic steps, and a hypoallergenic food trial.

Once CAD has been diagnosed, we need to make sure the client has appropriate and realistic expectations. The first and most important point to make with your client is that atopy is managed, and NOT CURED. Your main goal is keep the pet as comfortable as possible during flare-ups.

Treatment of atopic pets includes developing an individual treatment plan. Clients need to be taught to recognize signs of flare-ups early so that they can be managed before becoming too frequent or intense or before their pet develops a secondary infection.

Since treatment of allergies usually involves multiple modalities (oral medications, shots, and topicals), which can get expensive. There needs to be a conversation with the client about what is affordable for them and what they are physically able to do. For example, a senior may not be able to bath their 150 pound German shepherd every other day.

Communicating with clients who have allergic pets is often like being a cheer-leader. Trial and error therapy is tedious, can be expensive, and is often frustrating. There will often be failures or break-through flare ups with atopic patients. Clients need to understand that this will happen and that they can come to you when they experience problems or frustrations. Sometimes, all they really want is an ear and some reassurance. By facing up to this reality, you will better help your client through difficult times and better ensure they will continue trying to manage their pet’s atopy.

Longer appointment times might be necessary to teach owners about managing their allergic pets and reviewing often complicated treatment plans. Extra time with clients is the single most important diagnostic advantage veterinary dermatologists have over primary-care doctors, whose new clients often say that they wished their veterinarian had spent more time explaining what was wrong with their pet, so use this advantage. It is important for the veterinarian to explain the need for longer appointment times for several reasons: clients know well in advance that they should allow extra time in their schedules; reception team members know to reserve the extra time, so the appointment schedule is not affected; and appointments can be avoided during the practice’s busy times, such as the middle of Saturday mornings, which makes the visit less stressful for everyone.
Beat Back Bullies in Your Practice

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Bullying has become more prevalent in today’s society, not only among school children, but within the workplace as well. Younger generations have been moving away from face-to-face communication with the overuse of social media and texting, so their ability to have direct communication tends to be less constructive. When faced with these situations, it may be harder to know how to communicate that this is unacceptable and stand up for themselves.

The repercussions can range from a lowered morale to intense emotional damage to the victim. Victims of bullying often experience feelings of depression and anxiety, and feel isolated. Sleep and eating patterns can be disrupted, and psychosomatic symptoms such as headaches, abdominal pain, and chest pain can arise. These individuals begin to dread coming into work, which results in increased absenteeism and decreased productivity. The employee is made to feel that nothing they bring to the table will be appreciated or recognized, so they stop trying. Highly talented, hardworking employees can appear to become complacent in the face of bullying behavior.

In more and more states, it is also becoming illegal to behave this way in the workplace. Currently, in 30 states, the Healthy Workplace Bill has been introduced. This bill defines what is considered an abusive work environment, and gives employers a more direct reason to terminate offenders. It also allows employees a path for legal compensation for health harming harshness at work. This bill holds the employer accountable for setting up internal correction and prevention procedures, and seeks to recover lost wages and benefits for the employee. Beyond protecting your employees because it’s the right thing to do, with this bill, it’s important to protect your practice by ensuring proper preventative procedures are put into place. This starts with an anti-bullying policy, which communicates to all employees that bullying behavior will not be tolerated. It is clearly defined and examples are provided. There is a focus on the effects felt by the disrespected individual, not on the intent of the offender. Regardless of intentions, perceived incivility will not be tolerated and the offender will undergo a corrective process.

In the workplace, individuals should be assessing their mental health and wellbeing on a regular basis, and be able to label bullying behavior when it’s occurring. When faced with bully-like behavior, individuals are often constantly criticized. It doesn’t matter what the employee does to try to improve or fix their work, instead of coaching or positive reinforcement into better performance, bullies will hold the individual to a higher, unfair standard and continue to criticize. While it sounds completely unprofessional to even fathom, another tell-tale sign of workplace bullying is using raised voices or even outright yelling to express concerns. Often times this is done while insulting or humiliating the individual in front of their coworkers.

Combating bully-like behavior starts with identifying it and eliminating any self-blame. Utilize mental health professionals for additional healing support if needed. Finding emotional stability is very important prior to making a decision as to how you will combat the problem at work. While in most circumstances speaking directly to the individual is recommended, with bullies this tends to be less effective. Research your company’s employee handbook for any internal policies on harassment, respect or specific bullying behavior. Speak to your manager and/or the owner of the practice regarding the issue, backing up your case with specific examples, and include reference to any relevant company policies. Quality employers will not stand for this behavior and will squash the problem quickly. However, if you find that your employer does not take action and/or the retaliation from the bully is ignored, it may be time to plan an escape route into new employment.

It’s important to keep an eye on your own mental wellbeing in any job, especially if you feel you are the target of bullying behavior. The stress can have negative effects not only on your mental health, but physical as well. Encourage your employer to create an anti-bullying policy before it personally affects you. Having new hires review and understand that this behavior is unacceptable will help build positive morale and eliminate bullying behavior before it starts. Not only will the employees be happier and more productive, the employer will not waste excessive time and financial assets in dealing with high turnover and corrective processes.
Employees under high stress equal lower productivity and increased turnover. Our field naturally produces high levels of stress at work, between sick patients, client demands, and coping with euthanasia. The expectation of our team members and doctors is to be able to go into a room to discuss end of life decisions, then be able to hop into a new puppy room with a smiling face an hour later. It can be emotionally draining and it wears on everyone. It’s important to be proactive as an employer and ensure team members are taking care of themselves. When a supportive culture is created, you will keep valued employees for much longer, and deal with much less absenteeism. You may also find that employees become devoted ambassadors of your company and brand in the community.

Prioritize health and wellbeing of the employees by implementing regular programs that promote a healthy lifestyle. Offer twice monthly activities for the employees to join in on, such as yoga or kickboxing. Not only will it enrich their health lives, it will also serve as a team building experience. Other concepts include wellness challenges such as trying to drink a certain amount of water each day, or consuming a certain serving amount of veggies and fruits. Wellness challenges are also often centered around performing a certain amount of exercise on a regular basis. The employer can establish a point system for increments of healthy choices, with a small prize at the end. Other programs include offering full health assessments, along with coaching and support to create individualized plans for your employees. Nutrition and exercise wellness lectures can be offered as part of your team meetings, or on a semi-annual basis.

Managers also should take some responsibility for their employees’ wellbeing and stress levels. Regularly check in with staff one on one to see how their job is going, and where there could be improvement not only in performance, but their level of contentment as well. There may be times that certain assigned tasks do not lend themselves to an individual’s work style or strengths in the workplace, so reassignment to an alternative task may make them feel more fulfilled and less overwhelmed. When employees see that their fulfillment is a priority of the organization, they are more likely to produce their highest quality work. While not always possible to immediately fulfill, the opportunity for growth should be available to employees so that they can envision a plan for their future and feel more invested in their position.

Fulfillment in an employee’s position at work is also correlated to the extent of staff development offered by the organization. Offer regular training and educational opportunities, whether it be clinical CE, or leadership CE for those interested in pursuing management opportunities one day (even if it is unlikely there will be an opening with your company specifically- if you invest in them, they will be more invested in you in the present). Outside of company created CE, it’s advisable to allow for a CE budget for all staff- assistants, client service representatives, and technicians. Not only does this help them grow and better themselves in their positions, it empowers them and makes them feel valued by their employer.

Ensure that the new employees you are trying to win over and engage are not left in the dark. For new hires, be sure to include phase training programs, and regular training check-ins that include seeking their feedback on how to improve the process. Offering cross training opportunities will not only help employees better understand all sides of the company’s operations, but will also help match up their personal strengths and goals with their job duties.

Those in leadership roles should set a positive example for the staff. When their supervisors value a positive work/life balance, and don’t stay late every night, and choose not to order fast food for lunch and skip out on exercising, the staff is more likely to prioritize their health as well. Creating a culture that checks in on each other and genuinely cares, on a personal level, how their coworkers are functioning will promote regular self-care in the workplace.
Solve the Bermuda Triangle of Triangulated Conversations
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Most staff members are terrified of the concept of direct communication. There are so many “what if”s that take over an individual’s psyche. What if the person on the receiving end gets angry? What if they retaliate against you? Or even what if it ends up being a wasted discussion? While these are all possibilities, and potential challenges, the benefits far outweigh the pitfalls.

Team members who are willing to tackle direct conversations are more likely to see desired outcomes come to fruition. It is much easier to communicate a concern, and back it up with examples, when it’s coming directly from the person who was effected by the behavior. While a discussion led by a manager on a team member’s behalf may stall with excuses and retorts, this is less likely to occur when the team member approaches their coworker on their own. An employee will not push back and argue whether or not something actually occurred with the individual who was also present during the incident.

Moreover, even if the information received is hard to hear, employees feel respected when their coworkers come to them directly to solve problems versus going above their head to management. The team member feels that their coworkers are giving them a chance to fix the problem on their own before “getting in trouble” with the higher-ups. The individual leading the conversation also gains respect within their workplace as someone who is clear about where they stand in situations.

On the opposite end, the repercussions of triangulated conversations are dangerous to the success of a business. Often times, the message is distorted or misinterpreted by the third party relaying the information.

Implementation of a direct communicative culture starts with management and owners. New hires should be encouraged to speak directly to their coworkers (and management as well) when they have ideas or concerns. Managers must achieve a balance of ensuring the staff knows when they are stuck in a communication barrier with an employee, they can come to you for assistance, but the first step is never to immediately go above their coworker’s head.

When team members need help further resolving the problems they have between each other, management should help facilitate direct face-to-face communication with a supervisory employee as the moderator. Ensure both team members are equally heard and no sides are taken by managerial staff.

A culture of direct communication can also be achieved in part by conducting regular surveys on various issues that arise within the workplace. Whether it be opinions on protocols, training methods, or assessing morale, employees should feel comfortable voicing their opinion, and have a platform to do it. Equally important, the data obtained from employee surveys should be transparently utilized by the organization and not just collected, then ignored.

Management should also promote an open door policy with team members so that they are encouraged to directly communicate, even when they have a concern with management. There should never be fear of retribution, or losing their job, if a team member brings a concern, or even complaint, to management. Some methods to avoid team members shying away from these conversations include offering regular 360 reviews that allow staff to evaluate and comment on management’s performance in an anonymous manner. Having more than one “boss”, but rather a few individuals on the management team also allows employees to feel that there isn’t just one person in control of all elevated decisions. Therefore, if an employee has a concern with one of the supervisors, they understand it’s less likely if they bring up these issues that they will be treated differently or even terminated.

Unfortunately, in many veterinary practices, since the teams tend to be small, gossip and pent up hostility tend to take the place of honest conversations. When team members observe management or owners exhibiting this behavior, it makes it all the more difficult to turn a new page and switch to direct communication. Often in these environments, the “problem employee” is ganged up on, gossiped about, and alienated until they decide to move on. Not only does this approach create toxicity and lower productivity in the workplace, but it also does not even give the employee a chance to improve. We must remember that we go through a time-consuming, expensive process to select, hire and train new staff, so we should protect that investment. Not only is it the right thing to do by the employee, but also the smarter business move. If we can have a few more conversations and a little more coaching to get the employee back on track, it will increase morale for staff to see the investing nature of their employer, as well as save on rehiring processes.
Spinal cord injury can occur from a variety of etiologies ranging from primary trauma, severe intervertebral disc disease and vascular events or more chronic pathologies that lead to fracture/subluxation such as infection (diskospondylitis) or neoplasia. Differentiating these pathologies is often initially identified through signalment, acuteness of the onset, rapidity of the progression and presence of spinal hyperesthesia. Signalment aids in that young dogs are more likely to suffer from infectious/inflammatory disease as opposed to neoplasia which is seen in predominantly geriatric patients. In like kind there are breed predispositions; Chondrodystrophic breeds are predisposed to degenerative intervertebral disc disease and not fibrocatillagenous emboli (FCE). Certain conditions cause more “spinal pain” such as diskospondylitis or trauma as opposed to vascular events because the main nociceptors are located in the structures that surround the spinal cord as opposed to the neuroparenchyma itself. Some etiologies are quite acute and improve more rapidly (vascular events) compared to others that are more slow and insidious (neoplastic).

Regardless of the etiology, initial triage of these patients should involve rigid stabilization of the entire spine. This is common practice in human medicine but is often overlooked in veterinary medicine because of the presence of compressive myelopathies that do not involve major spinal instability (IVDD). However, should gross instability be present, the risk of iatrogenic injury and worsening of the primary condition is high due to concern of worsening compression of even spinal cord transection. Rigid stabilization involves a backboard and Velcro ties or tape that prevents major spinal movement. It is recommended that the backboard weight is known and the board be radiolucent so diagnostic can be performed with the patient immobilized.

After/during spinal stabilization, systemic evaluation including cardiovascular function should be assessed. Neurologic evaluation is likely to be abridged as proprioception and gait will not be assessed. Nocioceptive function in all limbs can be assessed by pinching the limbs and monitoring for a conscious response—essentially turning around to bite or vocalize at the offender. Withdrawal of the limbs is a reflex and not indicative of conscious perception/spinal integrity. Nocioceptive function is considered a prognostic indicator and in its absence outcome will likely be worse. The value of this test is variable based on disease process as varying degrees of injury will cause this change, from temporary nerve injury (neuropraxia) to more permanent damage (neuronotmesis). Cases of IVDD with absent nocioception may have a prognosis as favorable as 50% chance return to function compared to traumatic cases where the chances are less than 2%. Cutaneous trunci reflex can be a valuable test in the stabilized patient and in its absence, may reveal the level of the injury. The patients can be gently palpated for the presence of spinal hyperesthesia.

Initial diagnostics generally involve radiographs of the affected spinal cord segments. Sometimes this can be reduced to a certain spinal cord section while in other cases the entire spine must be imaged. When taking radiographs of the spine, a lateral projection with minimal obliquity is the primary radiograph. A VD view may be challenging in the immobilized patient, but horizontal beams views can be acquired. Concurrent radiographs of the thoracic cavity are often acquired to rule out concurrent trauma and as a pre-anesthetic evaluation.

Radiographs may reveal fractures or subluxations, neoplastic processes or diskospondylitis. Though intervertebral disc disease can be suspected, radiography is inadequate to definitively diagnose it and the site of compression. Vascular events cannot be seen on traditional radiography.

Upon confirmation that the spinal column is stable, the patient can be removed from the spinal board. Recommendations at this point will diverge into advanced imaging with CT or MRI vs. supportive care. Variables in this decision will include severity of the neurologic condition, availability of advanced imaging and surgical intervention and financial commitments. MRI is a preferable modality to CT because of its soft tissue contrast but in its absence CT +/- myelography may be diagnostic. More often than not, decompressive surgery is indicated in these cases.

Conservative care is essentially supportive care as directed medical therapies to treat acute spinal cord have little evidence based support. Though steroids are potent anti-inflammatory and there was a suggestion that they led to a favorable recovery from spinal cord injury, their use has fallen out of favor. There is no good evidence that steroids improve neurologic outcome in dogs or human patients with acute spinal cord injury. Methylprednisolone sodium succinate has been looked at in several large trials in human patients with acute spinal cord injury: NASCIS 1, NASCIS 2, and NASCIS 3, Otani in Japan, and Petitjean in France. These were all negative studies. Studies in dogs yielded similar results. Steroids may have utility as an analgesic but should not be considered a variable in return to function. Similarly, polyethylene glycol has minimal evidence to support its use.

Intravenous fluid likely play a positive role in acute spinal cord injury. Maintaining spinal cord perfusion minimizes local ischemia and furthering inflammation. Bladder management is of major importance. Dogs with loss of inhibition to the bladder will be unable to voluntarily urinate and should be emptied three times per day either manually or by catheterization. This will minimize high pressure within the bladder which could lead to permanent loss of detrusor muscle tone (atony). It will also minimize stagnant urine which will increase the risk of lower urinary tract infection.
Rehabilitative techniques serve to improve spinal cord function through neuroplasticity while at the same time maintain muscle strength and joint laxity. Of course, they should be used conservatively if there is a concern of worsening pathology. Common techniques include water treadmill therapy, electrical stimulation, low level laser therapy and acupuncture. Many spinal cord injuring events can have favorable outcome with supportive care alone. Case selection based on the presumptive diagnosis and disease progression will dictate for which cases this is true.