



GULF COAST
VETERINARY
SPECIALISTS

**2024 SYMPOSIUM
TECH PROSPECTUS**





On behalf of the entire team at Gulf Coast Veterinary Specialists, I want to extend our deepest gratitude for attending our 19th Annual Symposium. As we continually strive to be one of the nation's leading veterinary hospitals, the success of our Symposium underscores our commitment and passion for our incredible veterinary community.

Your dedication to advancing veterinary medicine is what drives the success of events like this, and I want to thank you for your unwavering dedication to the field. Throughout this weekend, we will be offering more than 20 hours of RACE-approved continuing education, and we hope you find the experience both enriching and inspiring.

It is our honor to host you this weekend, and we look forward to welcoming you back in the years to come as we continue this shared journey of learning, growth, and excellence.

Warmest regards,

Carley Giovanella, DVM, DACVIM
Medical Director
Gulf Coast Veterinary Specialists





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SUNDAY, 8/25 TECH STAFF SCHEDULE



9:00 AM -
10:00 AM

REGISTRATION & BREAKFAST

10:00 AM -
10:10 AM

OPENING REMARKS
SAMANTHA HULBIG, LVT
EDUCATOR



10:10 AM -
11:05 AM

**CALCULATING CARE: MEDICAL MATH FOR THE
VETERINARY TECHNICIAN**
SAMANTHA HULBIG, LVT
EDUCATOR

11:05 AM -
12:00 PM

**LIQUID TISSUE AND THE CELLULAR COMMUNITY
THAT POPULATES IT**
CATHERINE HUFF, LVT
PROCEDURAL SERVICES MANAGER



12:00 PM -
1:00 PM

LUNCH

1:00 PM -
1:55 PM

**DIAGNOSING AND TREATING OSTEOARTHRITIS: A
CLINIC WIDE APPROACH**
JEANNA WENDT, DVM
ZOETIS



1:55 PM -
2:50 PM

PAWSITIVE PRESSURE: CANINE MASSAGE TECHNIQUES
CATHERINE PAMPIGLIONE, CCRP, AVCA CERTIFIED
REHABILITATION SPECIALIST



2:50 PM -
3:05 PM

SNACK BREAK

3:05 PM -
3:55 PM

THE BASICS OF AN ECG
APRIL WHATLEY, LVT
CARDIOLOGY TECHNICIAN



3:55 PM -
4:45 PM

**WHEN DRACULA VISITS OUR PATIENTS: HOW TO
HANDLE THE ANEMIC PET**
CAROLINA GARCIA, DVM
EMERGENCY MEDICINE



ALL PRESENTATIONS ARE RACE APPROVED AND WORTH 1 HOUR OF CONTINUING EDUCATION

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Calculating Care: Medical Math for the Veterinary Technician

A review of medical calculations commonly used in
veterinary medicine

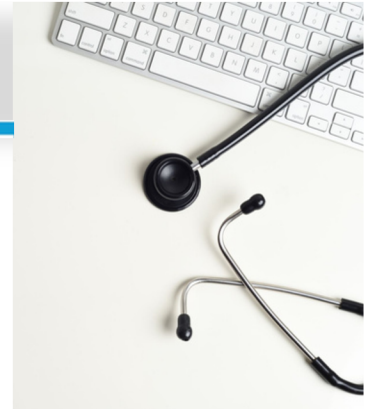


Samantha M Hulbig, LVT

Why Math At All?

- Google can't always help you!
- Always rely on yourself – doctors make mistakes also!
 - Important to double check each other
- Units are detrimental for calculating accurately to ensure patient safety and efficacy
- Improves success of treatments and patient outcomes

Remember YOU are the patient's advocate!



Common Conversions and Abbreviations

1 kg = 2.2 lb
1 lb = 0.454 kg
1 kg = 1,000 g
1 g = 1,000 mg
1 mg = 1,000 mcg
1 L = 1,000 mL
1 cc = 1 mL
1 fluid ounce (fl oz) = 30 mL
1 Tablespoon (Tbsp) = 15 mL
1 teaspoon (tsp) = 5 mL

1,000,000 mcg = 1000 mg = 1 gram = 0.001 kg



Name	Abbreviation
Pound(s)	lb(s)
Kilogram	Kg
Millimeter	mL
Liter	L
Gram	g
Milligram	mg
Microgram	Mcg, ug, or µg
Cubic Centimeter	cc

Knowledge check...



Concentration of Drugs = mass (weight)
and volume of medication per unit



mg/mL is an example of a concentration.
The mass of the drug in powder form (mg)
in a volume of liquid (mL)

Powder: Solute
Liquid: Solvent

Mixing together to create a **SOLUTION**

Dose: Refers to a specific amount of drug taken at one time

Dosage: Refers to a specific amount of drug administered at a specific frequency, and over a specific duration

Conversion factor: a number used to change one set of units to another, by multiplying or dividing

Most veterinary medications are calculated in kilograms
Be comfortable with conversions!

85 lb dog weighs how many kilograms? 1 kg = 2.2 lb

$$\frac{85 \text{ lb}}{2.2 \text{ lb}} = ? \text{ kg} \quad \frac{85 \text{ lb}}{2.2 \text{ lb}} = ? \text{ kg} \quad \frac{85 \text{ lb}}{2.2 \text{ lb}} = 38.64 \text{ kg}$$

One more – but in reverse!

3.4 kg cat weighs how many lbs? 0.454 kg = 1 lb

$$\frac{3.4 \text{ kg}}{0.454 \text{ kg}} = ? \text{ lb} \quad \frac{3.4 \text{ kg}}{0.454 \text{ kg}} = 7.49 \text{ lb}$$

Alternatively, you could multiply 3.4 kg by 2.2 = 7.48 lb note decimal changes*

Let's start with something simple...

How many **mg** does a 10kg dog need for a 10mg/kg dose?

Multiply 10mg by 10kg to find the dose for that patient:

$$10 \text{ kg} \times \frac{10 \text{ mg}}{1 \text{ kg}} = 100 \text{ mg}$$



Finding the Dose...

How many **mg** does a 5lb dog need for a 2mg/kg dose?

Dose is per kilogram - Need to convert lbs to kg first:

$$5 \text{ lb} \times \frac{1 \text{ kg}}{2.2 \text{ lb}} = 2.27 \text{ kg}$$

Now find the dose by multiplying kg (2.27) by the mg (2):

$$2.27 \text{ kg} \times \frac{2 \text{ mg}}{1 \text{ kg}} = 4.54 \text{ mg}$$

Oral Medications...

Your 23kg canine patient is prescribed: Carprofen PO 2.2mg/kg

$$23\text{kg} \times \frac{2.2\text{mg}}{\text{kg}} = 50.6\text{mg}$$

The doctor wants the carprofen given BID for 14 days. How many tablets should we send home?
(Carprofen comes in 25mg, 75mg, and 100mg tablets)

$$50.6\text{mg} \times 2 = 101.2\text{mg per day}$$
$$\frac{1}{2} \text{ tablet q 12 hours} = 1 \text{ tablet/day}$$
$$1 \text{ tablet} \times 14 \text{ days} = 14 \text{ tablets}$$

When it gets more complex...

State the facts
Set Up Equation
Cross Out Units
Calculate!

- Identify the conversion factor(s)
- Remember your units
- State the facts
 - o What do you have
 - o What do you need
 - o What do you know

How many seconds in a day?

$$\frac{24 \text{ hours}}{1 \text{ day}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} = \underline{\quad} \times \text{ seconds}$$
$$\frac{24 \text{ hours}}{1 \text{ day}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} = 604,800 \text{ seconds}$$

Breathe, Keep it simple!

Stick to the facts...



Your doctor asks you to give a 65lb lab mix a 22mg/kg dose of Cefazolin to be given IV. The Cefazolin concentration is 100mg/mL.

How many mLs of Cefazolin does this patient need?

Keep it simple...

What do you have?

$$W = 65 \text{ lb} \quad D = 22\text{mg/kg} \quad C = 100\text{mg/mL}$$

What do you need?

Total volume in milliliters (mL)

What do you know?

Patient weight in pounds (lb) and we need to convert to kilograms (kg) for dose; we need to cross out units to find mLs

Your doctor asks you to give a 65lb lab mix a 22mg/kg dose of Cefazolin to be given IV. The Cefazolin concentration is 100mg/mL.

Match your units and complete conversion:

$$\frac{65 \text{ lb}}{2.2 \text{ lb}} = ? \text{ Kg} \quad \frac{65 \text{ lb}}{2.2 \text{ lb}} = 29.54 \text{ kg}$$

$$29.54 \text{ kg} \times \frac{22 \text{ mg}}{1 \text{ kg}} \times \frac{1 \text{ mL}}{100 \text{ mg}} = ? \text{ mL}$$



Your post-op patient, a 6kg feline, has orders for a 3mcg/kg Fentanyl bolus; then a 3mcg/kg/hr CRI for 6 hours, undiluted. The Fentanyl concentration is 50mcg/mL.

What do you have?

W = 6kg D = 3mcg/kg, 3mcg/kg/hr C = 50mcg/mL

What do you need?

mL for bolus and mL for CRI

What do you know?

Two doses are needed, CRI orders are for 6 hours, undiluted

Facts: 6kg feline, 3mcg/kg bolus. Concentration is 50mcg/mL

First, let's calculate the bolus

Set up your equation:

$$6 \text{ kg} \times \frac{3 \text{ mcg}}{1 \text{ kg}} \times \frac{1 \text{ mL}}{50 \text{ mcg}} = ? \text{ mL}$$

Facts: 6kg feline, 3mcg/kg/hr CRI for 6 hours, undiluted. Concentration is 50mcg/mL

Now let's calculate the CRI:

$$6 \text{ kg} \times \frac{3 \text{ mcg}}{1 \text{ kg}} \times \frac{1 \text{ mL}}{50 \text{ mcg}} \times 6 \text{ hours} = 2.16 \text{ mL per 6 hours}$$

Cheat:

Since the bolus dose matches the CRI dose per hour, you could simply multiply 0.36mL by the number of hours needed.

If the bolus dose differs than the CRI dose, you must math it out

DiLuTiOnS.....



The same patient now needs a diluted CRI. How much Fentanyl needs to be added to a 250mL bag of NaCl for a dose of 3mcg/kg/hr that is running at 15mL/hr?

What do you have?

$$W = 6\text{kg} \quad D = 3\text{mcg/kg/hr} \quad C = 50\text{mcg/mL} \quad V = 250\text{mL} \quad R = 15\text{mL/hr}$$

What do you need?

Total mL to add to bag

What do you know?

This is a diluted solution; volume of medication added needs to be removed from starting volume – CRI is calculated on TOTAL volume.

Facts: 6kg feline, 3mcg/kg/hr CRI, diluted in 250mL, running at 15mL/hr. Concentration is 50mcg/mL

- 1) Organize your information
Use the acronym: DVM Really Cares
Dose Volume Mass Rate Concentration
- 2) Plug-in the facts to the equation
- 3) Cancel your units
- 4) Follow through math



$$\frac{3\text{ mcg}}{\text{kg} \times \text{hr}} \times 250\text{mL} \times 6\text{ kg} \times \frac{1\text{ hr}}{15\text{mL}} \times \frac{1\text{ mL}}{50\text{mcg}} = \frac{?}{10} = 6\text{ mL}$$

Remember, keep it simple...

How long will a 250mL bag last running at 15mL/hr and what is the dose per hour?

Find your hourly dose: $6\text{kg} \times 3\text{ mcg/kg/hr} = 18\text{mcg/hr}$

Calculate mL per hour: $18\text{mcg} \div 50\text{mcg} = 0.36\text{mL}$

Calculate hours in bag: $250\text{mL} \div 15\text{mL/hr} = 16.67\text{ hours}$

Multiply mL by hours: $0.36\text{mL} \times 16.67\text{ hours} = 6\text{mL}$

Percent Solutions %

Shortcut: Multiplying the number of a percent solution by 10 will give you the mg/mL in the solution



A percent solution is a weight to volume relationship.

An expression of the weight in grams of a solute, dissolved in the volume of 100mL solvent

A 1% stock solution has 1g of solute per 100ml of solvent which is equivalent to 10 mg/ml.

$$\frac{1\text{g}}{100\text{ml}} \times \frac{100\text{mg}}{1\text{g}} = 10\text{ mg/ml}$$

Let's Practice Dextrose Solutions...

Dextrose commonly comes in a 50% solution and is diluted to appropriate dose per patient.

Remembering the short cut, a 50% solution is equivalent to 500mg/mL.

Dextrose is already a solution, so when making a fluid bag with dextrose, we are simply altering the concentration of the already existing solution.

Keep it simple! Think about what you have and what you want!

Your diabetic patient needs a Dextrose CRI added. The doctor orders a 5% solution. The patient has a new 1000mL bag of LRS. Concentration of your Dextrose is 50%.

Always start with the facts:

You need to make a 5% dilution for a 1000mL, using a 50% solution.

Long Math:

$$\frac{50\text{mg}}{\text{mL}} \times 1000 \text{ mL} \times \frac{1 \text{ mL}}{500\text{mg}} = ?$$

$$\frac{50\text{mg}}{\text{mL}} \times 1000 \text{ mL} \times \frac{1 \text{ mL}}{500\text{mg}} = 100 \text{ mL}$$

Shortcut:

$$\frac{\text{Needed \%}}{\text{Available \%}} \times \text{Total Volume} = ?$$

$$\frac{5\%}{50\%} \times 1000 \text{ mL} = 100 \text{ mL}$$

The hypovolemic puppy in isolation is on a Dextrose CRI at 2.5%. The doctor makes a change of orders to increase the CRI to a 5% solution. They have 500 mL of fluid remaining in their bag. Concentration of Dextrose is 50%.

Gather your information...

- A 2.5% solution that needs to be increased to 5%; difference of 2.5%
- 500mL remaining in the bag
- Dextrose concentration is 50%

$$\frac{25 \text{ mg}}{\text{mL}} \times 500 \text{ mL} \times \frac{1 \text{ mL}}{500 \text{ mg}} = 25 \text{ mL} \quad \text{OR} \quad \frac{2.50\%}{50\%} \times 500\text{mL} = 25\text{mL}$$

A 30kg Boxer presents with ventricular tachycardia. A 3mcg/kg Lidocaine bolus is given, and your doctor orders a Lidocaine CRI at 40mcg/kg/min. The CRI will be added to a 250mL bag of NaCl, running at 10mL/hr. The concentration of Lidocaine is 2%.

Facts:

$$D = 40\text{mcg/kg/min} \quad V = 250\text{mL} \quad M = 30\text{kg} \quad R = 10\text{mL/hr} \quad C = 2\%$$

Need:

mL of Lidocaine for the CRI

Know:

Convert concentration from % to mg (20mg/mL); Convert minutes to hours (60 mins = 1 hour)

Facts: W = 30kg D = 40mcg/kg/min C = 2%
R = 10mL/hr V = 250mL

LET'S TEST YOUR KNOWLEDGE!

Using the DVM RC acronym, set up your equation:

$$\frac{40 \text{ mcg}}{\text{kg} \cdot \text{min}} \times \frac{60 \text{ min}}{1 \text{ hour}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} \times \frac{250 \text{ mL}}{1} \times \frac{1}{30 \text{ kg}} \times \frac{1 \text{ hour}}{10 \text{ mL}} \times \frac{1 \text{ mL}}{20 \text{ mg}} =$$

Cross out the units:

$$\frac{40 \text{ mcg}}{\text{kg} \cdot \text{min}} \times \frac{60 \text{ min}}{1 \text{ hour}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} \times 250 \text{ mL} \times 30 \text{ kg} \times \frac{1 \text{ hour}}{10 \text{ mL}} \times \frac{1 \text{ mL}}{20 \text{ mg}} = \frac{18,000,000}{200,000}$$

Calculate:

= 90 mL

Facts: W = 30kg D = 40mcg/kg/min C = 2%
R = 10mL/hr V = 250mL

SAME MATH, PRESENTED DIFFERENT...

Let's figure out the mg/hr, first set up your equation:

$$\frac{40 \text{ mcg}}{\text{kg} \cdot \text{min}} \times 30 \text{ kg} \times \frac{60 \text{ min}}{1 \text{ hour}} \times \frac{1 \text{ mg}}{1000 \text{ mcg}} = 72 \text{ mg/hr}$$

Next, let calculate how many hours the bag will last:

$$\frac{250 \text{ mL}}{10 \text{ mL}} = 25 \text{ hours}$$

Multiple to find total mg:

$$72 \text{ mg} \times 25 \text{ hours} = 1,800 \text{ mg}$$

Divide by concentration:

$$\frac{1,800 \text{ mg}}{20 \text{ mg}} = 90 \text{ mL}$$

A 36.4 kg patient is prescribed a 2 mg/kg/day dose of Metoclopramide to given as an undiluted CRI. The concentration of Metoclopramide is 5 mg/ml. What dose would we run this patient at in ml/hr?

- A. 1.4 mL/hr
- B. 0.61 mL/hr**
- C. 14.6 mL/hr
- D. 3 mL/hr

$$36.4 \text{ kg} \times \frac{2 \text{ mg}}{\text{kg} \cdot \text{day}} = 72.8 \text{ mg/day}$$

$$\frac{72.8 \text{ mg}}{\text{day}} \times \frac{1 \text{ day}}{24 \text{ hours}} = 3.03 \text{ mg/hr}$$

$$\frac{3.03 \text{ mg}}{\text{hour}} \times \frac{1 \text{ mL}}{5 \text{ mg}} = 0.606 \text{ mL/hr} \text{ Rounded to } 0.61 \text{ mL/hr}$$

Thank you!

Resources:
<https://www.ncbi.nlm.nih.gov/books/NBK560924/>
<https://www.chem.purdue.edu/>
<https://plumbs.com/>





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Catherine Huff, LVT



Hematology Overview

Liquid Tissue and the cellular community that populates it

Catherine Huff, LVT, BAS

* **Hematopoiesis** is the production of ALL blood cells that occur as a continuous process throughout an animal's life.

– Where does that happen?

- Fetus:

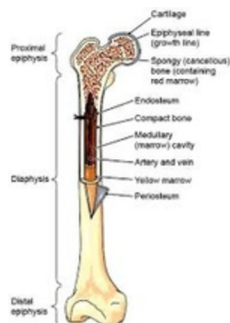
- Liver and spleen

- Newborn animal:

- Red bone marrow

- Adult:

- Red bone marrow (skull, ribs, sternum, vertebra, pelvis, proximal femur)



Erythropoiesis

- This is the process by which RBCs are created.
- Unipotential stem cells are stimulated to differentiate into proerythroblasts.
- The rate at which this happens is controlled by hormones, mainly **Erythropoietin; EPO** and the availability of the materials needed to make RBCs: iron, folic acid, vitamin B12 and protein
- Where is EPO produced? **kidneys**

- Regulated by blood O₂ levels in the kidney

Classification of Erythrocytes

What were the five ways we learned how to classify erythrocytes as normal or abnormal??

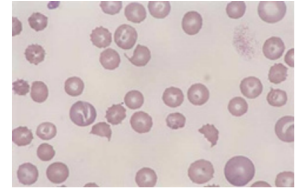
1. Arrangement on a blood film
2. Color/chromasia : blood loss or anemia
3. Size/Anisocytosis : immature cells regenerative anemia
4. Shape/poikilocytosis : various
5. Structures in/on the erythrocyte/ morphology



RBC fragments resulting from shearing of red blood cell by intravascular trauma

Schistocytes "Fragment Cell"

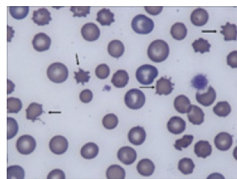
§ May be seen with Disseminated Intravascular Coagulopathy (DIC) or with iron deficiency



Acanthocytes Spur Cells

§ Patients that might have an increased number of acanthocytes:

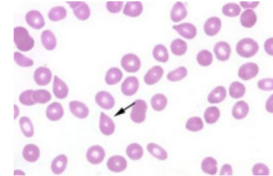
- § Cats with hepatic lipidosis
- § Dogs with liver disease
- § Hemangiosarcoma of the liver



Dacryocyte "Teardrop cells"

§ How to identify:

- § Teardrop shaped RBCs with a single elongated or pointed ends
- § Can be an artifact; check to see if the "tails" are all pointing in the same direction
- § Kidney and splenic disorders



Presence of Structures on/in Erythrocytes

Many different abnormalities caused by variety of different conditions:

- § Howell-Jolly Bodies : splenic disease
- § Basophilic stippling : lead poisoning
- § Heinz Bodies : acetaminophen/onion ingestion
- § Reticulocytes : Immature rbc

Refresher: Granulocytes & Agranulocytes

- § Granulocytes
- § neutrophil
- § basophil
- § eosinophil



- § Agranulocytes
- § monocyte
- § lymphocyte

Phagocytosis: engulfing of a solid particle, bacteria or other material, to form an internal compartment known as a phagosome.

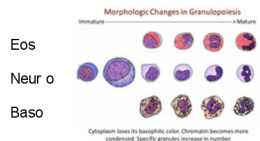
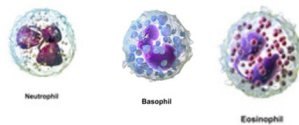
All leukocytes except lymphocytes perform phagocytosis?



Functions of the Granules

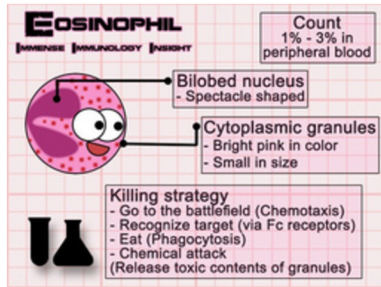
§ Specific granules contain different substances depending on the type of cell they are.

- § **Neutrophil** granules contain lysosomal enzymes.
 - § What does this aid the leukocyte in doing? Kill microorganisms after phagocytosis
- § **Eosinophil** granules contain anti-inflammatory substances.
 - § What does this allow the cells to do? Degranulate at the site of allergic reaction to reduce swelling
- § **Basophil** granules contain histamine and heparin.
 - § histamine reduce inflammation
 - § Inflammation draws eosinophils to the site
 - § heparin acts as a local anticoagulant to keep blood flowing to injured or damaged areas.

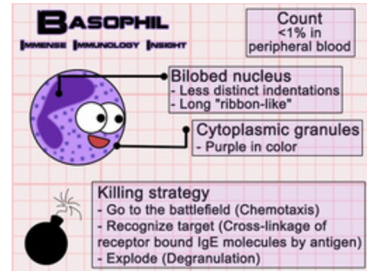


- **Neutrophilia: An increase in the number of neutrophils**
- Possible causes of neutrophilia:
 - Inflammation: mild inflammation yields a response to stress
 - Bacterial infections
 - Extensive tissue damage
 - burns
 - necrosis
 - trauma
 - Extensive surgery
 - neoplasia
 - Cancer/parasitic infections
- **Neutropenia: a decrease in the number of circulating neutrophils**
- What would this indicate?
 - The infection is out of control and all reserves of neutrophils are used faster than the bone marrow can create them
- (What is it called if we have a total WBC count decrease? leukocytopenia)
- If a critically ill patient has both neutropenia and leukocytopenia, what is their probable prognosis? poor

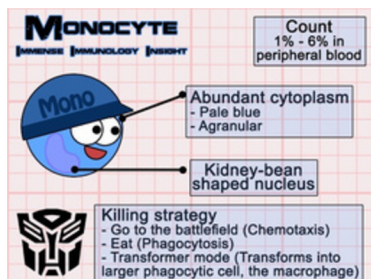
Eosinophils



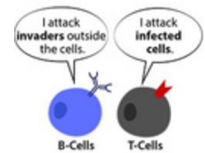
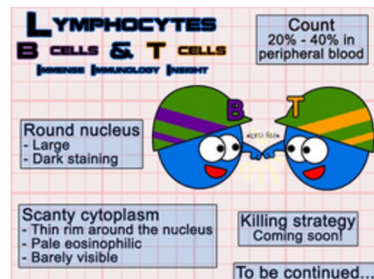
Basophils



Monocytes




Lymphocyte Family



Specialized T Cell Flashcards

HELPER T CELL

Warrior types



Expresses
CD4 glycoprotein (CD4+ T cells)

Th1 cells
Activates:
• Macrophages
• Killer T cells
• B cells
Secretes:
• IFN - γ
• IL - 2
• TNF - α


Th2 cells
Activates:
• Eosinophils
• Mast cells
• Basophils
Secretes:
• IL - 4
• IL - 5
• IL - 13

Th17 cells
Recruits:
• Neutrophils
Secretes:
• IL - 17

Treg cells
Inhibits dendritic cells:
• Prevents autoimmunity
• Suppresses T cell

NATURAL KILLER

Killing strategy



Expresses
CD16 glycoprotein
CD 56 glycoprotein

① Recognize antigen combined with class I MHC (altered self cells)

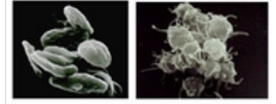
② Signal for activation:
• IFN - α
• IFN - β
• IL-12

③ Releases cytotoxic proteins:
• Perforin: Forms a pore for delivery of granzymes
• Granzymes: Programmes cell to die

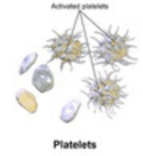
Activated vs Non-activated Platelets

* Resting platelets will appear as small disks

* Activated platelets utilize pseudopodia to move to the area of bleeding.



Resting platelets Activated platelets



Stopping the bleeding, where it begins...

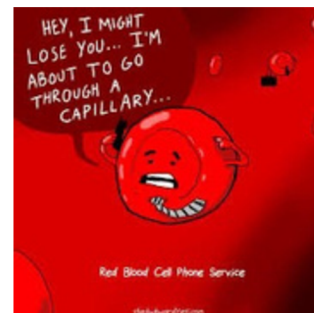
§First the blood vessel gets smaller

The first thing the body does is make the blood vessel smaller so less blood is going through it and leaking out. Muscles in the wall of the blood vessel make this happen.

§Second, a platelet plug is made

The next step in stopping the bleeding is making a platelet plug. This is a temporary patch over the leak.

§A platelet plug is only a temporary fix. It can't last long on its own. A fibrin clot is needed.





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Jeanna Wendt, DVM



Librela
(gabapentin injection)

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Osteoarthritis – a Clinic
Wide Approach

JEANNA WENDT,
DVM

PROFESSIONAL
SERVICES
VETERINARIAN,
ZOETIS

JEANNA.WENDT@ZOETIS.COM

469-921-1365



Feline Osteoarthritis: A Quiet Epidemic



- Most common musculoskeletal disease in cats
- 40% of all cats have clinical signs¹
- >90% of cats older than 12 showed radiographic evidence of OA²
- Not exclusive to older cats
- Clinical studies have shown that even cats as young as 2 years old can suffer from OA³
- Strongly associated with age ($P < .0001$)⁴

Solensia
(meloxicam)

1. Enomoto, M. et al., Vet Rec, 2019; 2. Harde EM et al. J. Vet Med Assoc 2002; 220(5):626-632; 3. Godfrey DR. JSAF. 2005 Sep; 46(9): 425-9; 4. Lascelles DD X. BMC Veterinary Research 2012; 8: 10

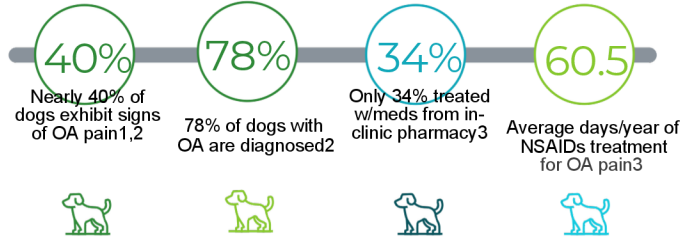
CANINE OA - PREVALENCE

- OA may affect as many as 37% of dogs¹
- It isn't just a disease old age—it affects dogs of all ages, sizes, and breeds^{1,2}
- Main cause is developmental³ (e.g. cruciate ligament disease, hip or elbow dysplasia, OCD, etc.)
- The pain of OA can impact a dog's emotional health^{4,5}.
 - Behavioral changes
 - May be subtle



1. Wright, G. Rimadyl (carprofen) Association of length of administration of carprofen with ability scores in dogs newly diagnosed with osteoarthritis. Zoetis Data on File; 2014; 2. E. Epidemiology of osteoarthritis. Veterinary Focus 2007; 27:18-20; 3. O'Brien AD. Prevalence of radiographic evidence of OA in horses with OA in animal osteoarthritis in dogs. Accessed 05/20/20; 4. Reid, J. et al. Measuring chronic pain in domestic dogs: a novel rating scale with caregivers through 11 impact on health-related quality of life (HRQL). V0772 May 2018; 5. S. Behavioural 5. Assessing for Chronic Pain in Dogs and Cats World Small Animal Veterinary Association World Congress Proceedings, 2015

Osteoarthritis: Common, Underdiagnosed and Undertreated

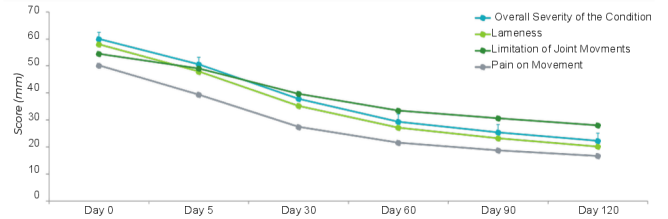


1) Wright A, et al. Identification of canine osteoarthritis using an owner-reported questionnaire and treatment monitoring using functional mobility tests. *Journal of Small Animal Practice* (2022), 1-10 DOI:10.1111/jasp.13501
 2) ZMR: OA Landscape & Chair Pull Study, May 2022, Kymtec
 3) ZMR: PetTrak US Pain Factors National, January 2022
 3) ZMR Kymtec PetTrak Data: GAH-539, Jul 2022

As A Chronic Disease, Osteoarthritis Requires Chronic Treatment to Allow For Progressive Improvement¹⁻⁴



Evolution Over Time of the Four Clinical Parameters Scored by Investigators (Least Square Means) Carprofen Given Once Daily for 120 days



The error bars represent the standard errors for Overall severity of the condition
 1. Jule R, et al. Efficacy and safety of the long-term oral administration of carprofen in the treatment of osteoarthritis in dogs. *Veterinary Record* 2007; 119:1127.
 2. Harms, Stepien et al. Long-term treatment with aspirin of 805 dogs with osteoarthritis. *Veterinary Record* 60.13 (2007): 427-430.
 3. Lipscomb, V. J., et al. "Clinical efficacy and pharmacokinetics of aspirin in the treatment of dogs with osteoarthritis." *Veterinary Record* 150.22 (2002): 654-659.
 Veterinary Record 66.8 (2010): 226-230.

Several Reasons for Low Treatment Rate of OA Pain



Veterinary

- NSAIDs are effective but limited by
 - Low compliance^{1,2}
 - Limited/no response as monotherapy^{3,4}
 - Tolerability⁵
- Label: Lowest effective dose for shortest duration language

Why Dog Owners Discontinue Treatment¹

- Limited effectiveness
- Cost vs. value
- Administration challenges
- Lack of veterinarian proactivity

1. Osteoarthritis Dog Owner Journey: Market research conducted for Zoetis. Data on file. Zoetis Inc. November 2020. Librela Carine Anti-NOF Market Dynamics and Forecasting Analysis. Market research conducted for Zoetis by Forster Research. Data on file. Zoetis Inc. February 2022.
 2. American Animal Hospital Association (AAHA). "Comparative: Total Quality Care for the Pet Owner." Report of the 2009 AAHA Confidence Follow-Up Study. American Animal Hospital Association, 2009.
 3. Laskaer BDJ, Gunnar JS, Smith ES, et al. Amantadine is a multimodal analgesic regimen for alleviation of refractory osteoarthritis pain in dogs. *J Vet Intern Med*. 2008;22(1):53-59.
 4. Lorenzetti M, Manjari PV, Alvarez J, Torres A, Lacort-Botet J. Zinc-nitric oxide: A novel mechanism for the control of pain in dogs and cats. *Vet Rec*. 2014;194(1):23.
 5. Rychel JK. Diagnosis and treatment of osteoarthritis. *Top Companion Anim Med*. 2010;25(1):20-25.

Every Pet Owner of a Dog >1 Year of Age Should Complete The OA Checklist



Dog Osteoarthritis Pain Checklist

Your dog's name: _____

Sex: _____

Age: _____

Weight: _____

Could your dog have Osteoarthritis?
The number of dogs your veterinarian examines for dogs with osteoarthritis and the number of dogs that report osteoarthritis (OA), a degenerative joint disease that can be painful.

Is your dog showing signs of OA-related pain?
Think about your dog's behavior in the past week. Think of all the signs that you've observed in your dog.

Sign	Yes	No
Limping after exercise	<input type="checkbox"/>	<input type="checkbox"/>
Limping before an activity	<input type="checkbox"/>	<input type="checkbox"/>
Stiff in the morning	<input type="checkbox"/>	<input type="checkbox"/>
Pushing off	<input type="checkbox"/>	<input type="checkbox"/>
Difficulty with stairs	<input type="checkbox"/>	<input type="checkbox"/>

1. Do you think your dog shows signs of pain?
 2. Have you noticed any changes in your dog's behavior?

OA has both physical and emotional aspects.

How about your dog's behavior in the past week. This scale helps measure your dog's pain level and how your dog is feeling. For each statement, circle the number that you think most accurately describes your dog.

Statement	1	2	3	4	5
Energetic & enthusiastic?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Happily & content?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Active & comfortable?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calm & relaxed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sharing additional history can help your veterinarian help your dog.

Question	Yes	No
1. Has your dog ever been injured?	<input type="checkbox"/>	<input type="checkbox"/>
2. Have you ever given your dog medication for pain, with an aspirin?	<input type="checkbox"/>	<input type="checkbox"/>
3. Has your dog gained weight in the past year?	<input type="checkbox"/>	<input type="checkbox"/>

Discomfort can affect dogs of all ages, breeds, and sizes. If left untreated, the pain can become worse over time. This checklist is designed to help with the management of OA pain to help keep your dog happy and active. Your veterinarian will discuss the results of this checklist with you to identify your dog's right treatment plan. This checklist is not a medical diagnostic tool and is not intended to replace discussion with an animal health care professional. Please consult your veterinarian with your veterinarian.

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FELINE OA VALIDATED CHECKLIST STUDY



In a recent study, researchers previously conducted studies, owners of 249 D.D. cats and 500 D.D. cats were asked to assess their cat's ability to do various activities, using a standard set of questions to determine the presence of a series of questions.

Key Findings

Six behaviors correlated with an OA diagnosis with a specificity of 97% when a cat owner responded, "No".

1. Does your cat jump up normally?
2. Does your cat jump down normally?
3. Does your cat climb up stairs or steps normally?
4. Does your cat climb downstairs or steps normally?
5. Does your cat run normally?
6. Does your cat chase moving objects (toys, prey, etc.)?

Education of cat owners about osteoarthritis increased the sensitivity of the checklist from >55% to >97%.

Feline Health-related Quality of Life Study

This study of a quality of life assessment for feline health-related quality of life assessment in cats with osteoarthritis, in cats?

Key Findings

A large initial pool of behaviors were collected through interviews with the owners of sick and healthy cats. These were reduced from 185 to 20 behaviors.

They were then allocated to three domains:

- Vitality
- Comfort
- Emotional Well-Being

Scores in each domain were significantly different between healthy and sick cats.

1. Based on the Musculoskeletal Pain Screening Checklist (MPSC) © 2019 North Carolina State University.
Noble CL, Wiseman-Orr LM et al. Development, initial validation and reliability testing of a web-based, generic feline health-related quality-of-life instrument. *JMS*. 2018;21(2):84-94



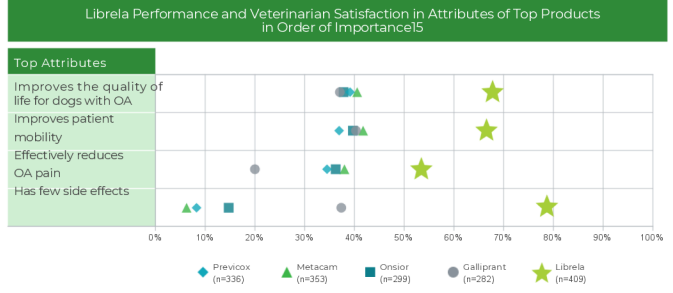
The Librela EU Experience



EMMA

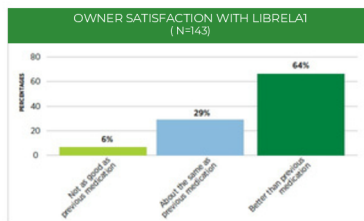


In the EU, Librela Rated Higher in Satisfaction Than Other OA Pain Medications Against the Top 4 Attributes



The Majority of Pet Owners Rated Librela Better than Previous Pain Medications

Owner satisfaction with Librela compared with other pain medications to treat OA (N=143)¹



Librela Canine Anti-NGF Market Dynamics and Forecasting Analysis. Market research conducted for Zoetis by Foster Rosenblatt. Data on file. Zoetis Inc., February 2022.

More Than 11 Million Doses of Librela Have Been Distributed in Europe Since 2021

European Veterinarians Have Used Librela in All Stages of OA and Most Dogs Only Required Librela as a Monotherapy²

Librela has been used to treat a wide range of canine patients with different OA severity levels²

27% Had severe OA pain

37% Had moderate OA pain

36% Had mild OA pain

75% of European veterinarians used Librela as the main OA pain treatment for canine patients, with no other treatment required²

Veterinarians in Europe who are prescribing Librela anticipate that most of their canine patients would not routinely require NSAIDs or other analgesics after initiating Librela³

1. Zoetis Internal Sales Data.
2. Librela awareness and usage patient record real data. FIRM Global Health. Market research conducted for Zoetis. Data on file. Zoetis Inc., December 2021.
3. Data on file. Zoetis Librela Market Research Study. Zoetis Inc. July 2022.

EU Post-Marketing AEs: Uncommon to Very Rare²

Additional Adverse Events After > 2 Years on the Market, and > 4.6 Million Doses Distributed

Uncommonly (1-10 in 1,000 Dogs Treated)	<ul style="list-style-type: none"> • Injection site reactions (injection site swelling/warmth)
Rarely (1-10 in 10,000 Dogs Treated)	<ul style="list-style-type: none"> • PU/PD – is reversible and to date has not been associated with any organ dysfunction • Due to the infrequent nature of these reports, it will take some time to determine cause
Very Rarely (<1 in 10,000 Dogs Treated)	<ul style="list-style-type: none"> • Hyperreactivity reactions, immune mediated anemia or thrombocytopenia • Incidence is similar to these types of AEs reported for Cytopoint

1. Zoetis Data on 96 Pharmacovigilance Report April 2023.
2. Volume 6C: Summary of the Product Characteristics: SPC - Pharmaceuticals 2006

Post-Marketing US Neurological Signs

- Not seen in the target animal safety studies, where Librela was administered at up to 10X the label dose¹ This was a laboratory study in healthy dogs that received either placebo (saline injection) or Librela at 1x, 3x or 10X the label dose for 7 injections. N=8 (4M and 4F)/group.
- Not seen in the clinical field safety and efficacy studies – dog treated up to 9 months^{2,3} (N for Librela treated dogs = 273 in 3-month study, with 89 from the EU study continuing onto through the 9-month study). (Two dogs reported to have paresis but assessed by attending veterinarian as not related to Librela but to underlying causes).
- Post marketing Neurological signs are reported as rare⁴ (>1 but <10/10,000 dogs treated⁵)
 - Average age of dogs with neurological signs is >12, typically large breed with comorbidities and/or concurrent medications⁴
 - Team of experts continue to monitor and assess, to date no association with Librela
- Librela is a large molecule ~150k Daltons and does not pass the intact blood brain barrier⁶
- Use of Librela in acute or chronic neurological disease has not been studied. Use in these patients is case-by-case based on risk/benefit veterinary assessment.

1. Kraußmann M, et al. Laboratory safety evaluation of bedinvetmab, a canine anti-neurotrophin growth factor monoclonal antibody, in dogs. 2021. The Vet journal. <https://doi.org/10.1016/j.vetj.2021.05.005>
2. Carrel, Marie J., et al. "A prospective, open-label, 32-week, placebo-controlled, multiple-dose study of bedinvetmab, a canine monoclonal antibody targeting nerve growth factor, in dogs with osteoarthritis." <https://doi.org/10.1016/j.vetj.2021.05.005>
3. Carrel, Marie J., et al. "A prospective, randomized, double-blind, placebo-controlled multiple-dose study of bedinvetmab, a canine monoclonal antibody, targeting nerve growth factor, in dogs with osteoarthritis." <https://doi.org/10.1016/j.vetj.2021.05.005>
4. Zoetis Ad Hoc Pharmacovigilance Report: Nov 2022. <https://www.zoetis.com/~/media/Products/US/Bedinvetmab/US-SPC-2022-11-01-10-01-2022.pdf>
5. Volume 6C: Summary of the Product Characteristics: SPC - Pharmaceuticals 2006
6. Zoetis Study Number C451W-JS-13-05D. Data on file.

Librela Patient Selection: Key to Success

Cases to Consider Librela	Cases Not Appropriate for Librela
<ul style="list-style-type: none"> • Confirm that the dog has OA pain, and this reason for treating with Librela <ul style="list-style-type: none"> ◦ Ensure that the dog does not have an undiagnosed condition • Option as first-line treatment for dogs over 12 months with OA • Dogs that do not tolerate NSAIDs • Dogs that are not easy to pill • Dogs with chronic, stable diseases <ul style="list-style-type: none"> ◦ Dogs with chronic, stable diseases were included in the clinical studies ◦ Librela can be considered on a case-by-case basis after a risk/benefit assessment 	<ul style="list-style-type: none"> • Not a substitute for surgical procedures such as cruciate ligament rupture • Dogs that are pregnant, lactating or breeding • Dogs with a known hypersensitivity to bedinvetmab
	Cases Where We Did Not Study Librela
	<ul style="list-style-type: none"> • Dogs with acute diseases and dogs with neurological diseases <ul style="list-style-type: none"> ◦ Excluded from clinical studies, therefore not studied ◦ Case-by-case basis after risk/benefit assessment

Bella Before and After Videos



IMPORTANT SAFETY INFORMATION

For use in dogs only. Women who are pregnant, trying to conceive or breastfeeding should take extreme care to avoid self-injection. Hypersensitivity reactions, including anaphylaxis, could potentially occur with self-injection. LIBRELA should not be used in breeding, pregnant or lactating dogs. LIBRELA should not be administered to dogs with known hypersensitivity to bedinvetmab. The most common adverse events reported in a clinical study were urinary tract infections, bacterial skin infections and dermatitis. See Full Prescribing Information at LibrelaPI.com.

Important Safety Information

For use in cats only. Women who are pregnant, trying to conceive or breastfeeding should take extreme care to avoid self-injection. Hypersensitivity reactions, including anaphylaxis, could potentially occur with self-injection. Solensia should not be used in breeding cats or in pregnant or lactating queens. Solensia should not be administered to cats with known hypersensitivity to frunevetmab. The most common adverse events reported in a clinical study were vomiting and injection site pain. See full Prescribing Information at www.SolensiaPI.com



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Introduction

What is massage?

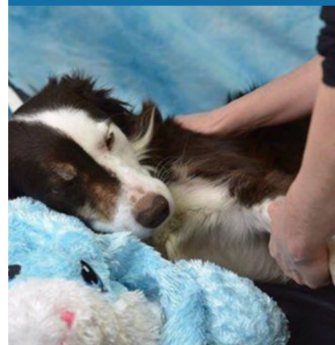
- Massage can be defined as gentle manipulation of the body's soft tissues.
- The word 'massage' originally comes from the Arabic word 'massa' meaning to touch, to feel.
- Archaeological evidence for the practice of massage dates back to over 2000 B.C. in many ancient civilizations such as in Asia, Egypt, Greece, and the Roman Empire.
- The first record of animal massage was done on war dogs and horses in ancient China and the Roman Empire.



Introduction

How does massage the canine patient?

- Enhances flexibility and range of motion
- Improves muscle tone & circulation
- Relieves pain
- Improves gait and balance
- Producing a calming effect or on the contrary, an energizing effect
- Builds trust in dogs with behavior issues
- Increases your knowledge about your patient – know what is normal vs. abnormal
- Aids in detecting early signs of injury or disease



Introduction

Who benefits from massage?

Whether the dog is an athlete or a couch potato dealing with muscle pain, compromised range of motion, circulatory problems, or behavioral issues – massage is a valid therapeutic tool



Massage Techniques



1. Vibration

(myofascial release)

A light stroking of the skin, in a parallel direction to the spine and to the long bones of the limbs.

What is it used for?

To loosen the skin from deeper tissues and break up adhesions.

The body responds to pain by contracting the muscles (spasm), leading to reduced circulation and possible formation of adhesions.

2. Wringing

(myofascial release)

This technique is applied using both hands. One hand brings the tissue towards you, while the other hand moves it away. Each wring is held for 2-5 seconds before slowly releasing.

What is it used for?

- To restore mobility between tissue layers
- To aid in tissue fluid mobility
- To increase mobility and length of fibrous tissue
- To increase the extensibility and strength of connective tissue

3. Stroking

Place your entire hand in contact with the skin. While maintaining a firm but gentle pressure, move your hand from the top of the area you are working on towards the bottom. For arthritic dogs, make sure not to apply too much pressure over the joints such as elbows, hips, and knees (stifles).

What is it used for?

- To improve circulation in combination with EFFLEURAGE (more later)
- To relax the dog
- To introduce touch
- To sedate by slow strikes
- To stimulate by brisk strokes

4. Effleurage

Effleurage is the opposite of stroking. Instead of stroking from top to bottom, you will be stroking from bottom to top. Remember to use a firm but gentle pressure and maintain the same depth of pressure throughout the stroke. Again, be careful moving over arthritic areas such as the elbows, hips, and knees.

What is it used for?

- To increase venous and lymphatic return
- To aid in the removal of chemical irritants
- To improve mobility between tissue layers
- To stretch muscle fibers

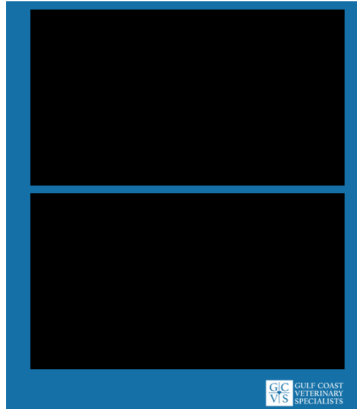
5. Skin Rolling

(myofascial release)

Like vibration and wringing, these are all methods of myofascial release (more on next slide). Skin rolling helps breakup abnormal cross-links or adhesions between the skin and the underlying issues.

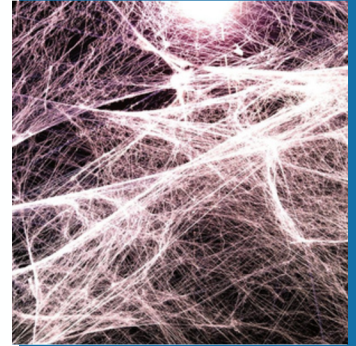
What is it used for?

- To decrease pain
- To improve lymphatic flow
- To improve mobility and range of motion

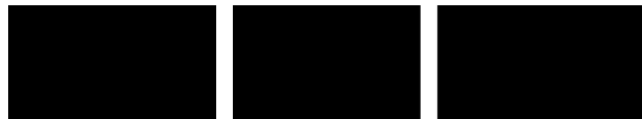


Myofascial Release

- It is a type of physical therapy to treat **myofascial pain syndrome**, a chronic pain disorder caused by sensitivity and tightness in myofascial tissues (thin, strong, fibrous connective tissues that support and protect muscles, bones, and other structures)
- The pain usually originates from specific "trigger points" within the myofascial tissues, leading to areas that feel stiff and tight
- Myofascial release eases tension and tightness, thereby reducing pain
- Usually, a broader area is treated rather than a single point to aid in relieving pain



Massage Techniques



6. Passive Range of Motion

This is done after massage, when the muscles are warmed and relaxed. Just like the massage, passive range of motion techniques are done in sequence. Each joint is flexed and extended within its limits.

What is it used for?

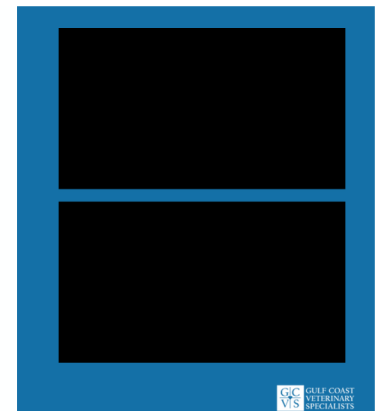
To work each joint through its normal range of motion, which will increase flexibility and function.

7. Stretching

Extending the joint to its maximum (straightened) extended position.

What is it used for?

To increase mobility in the muscles and around the joints.



Applying the Techniques

Spine

- **Vibration massage** on the spine from the top of the head to the tail. Use a very light pressure. Repeat 10 times.
- **Wringing massage** on the spine from the neck to the base of the tail. Repeat 10 times.



Applying the Techniques

Front Limb:

- **Vibration massage:** on the front limb. Use a very light pressure. Repeat 10 times.
- **Stroking and effleurage massage:** with your hand flat and firm, massage from the top of the shoulder down to the toes and then back to the shoulder. Use medium pressure. Repeat 10 times.
- **Skin rolling (triangle massage):** Gently pinch the skin between your fingers and pull the skin away from the underlying tissues in the shoulder area. Repeat 10 times.

Passive Range of Motion/Stretching:

- Gently move the shoulder through its normal range of motion. Repeat 10 times.
- Then gently and slowly extend the shoulder to its maximum flexed (bent) and extended (straightened) position and slowly release. Repeat 10 times.



Applying the Techniques

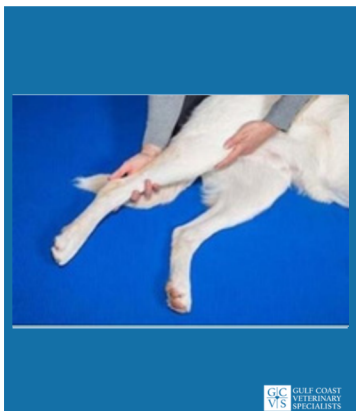
Hind Limb:

- **Vibration massage:** on the hind limb. Use a very light pressure. Repeat 10 times.
- **Stroking and effleurage massage:** With your hand flat and firm, massage from the top of the hip down to the toes and then back to the hip. Use medium pressure. Repeat 10 times.
- **Skin rolling:** Pinch the skin between your fingers and pull the skin away from the underlying tissues in the hip area. Repeat 10 times.

Passive Range of Motion/Stretching:

- **Tarsus/Knee:** Gently perform 10 forward bicycle movements and 10 backward bicycle movements.
- **Hip:** Gently move the hip through its normal range of motion and repeat 10 times. Then gently and slowly flex and extend the hip to its maximum position and slowly release. Repeat 3 times.

*Have the dog lay on the other side and repeat the steps above.



Acknowledgement

Thank you to "Prix" and "Mungo" for their help and patience during the video production of this presentation.



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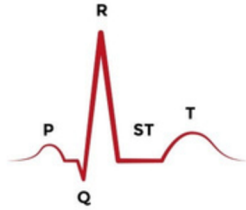


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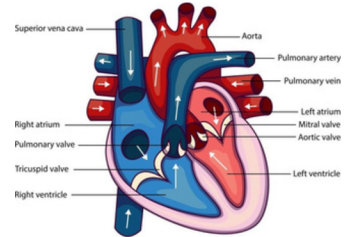
P, Q, R, S, & T: The Basics of an ECG

April Whatley, LVT
GCVS Cardiology Lead
Technician



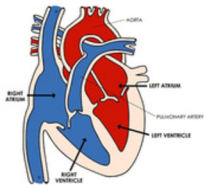
Cardiac Anatomy

- Blue – Deoxygenated blood
- Red – Oxygenated blood

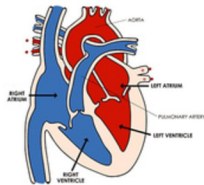


Blood Flow Through the Heart

Deoxygenated blood traveling through right heart into the lungs.

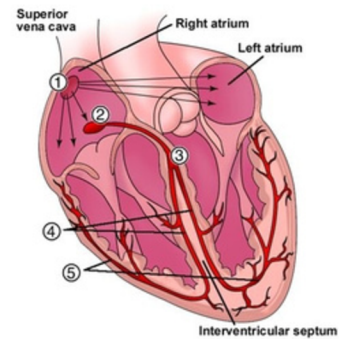


Oxygenated blood traveling through left heart to periphery.



Electrical Conduction

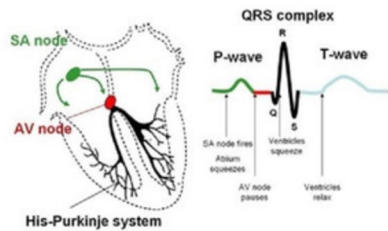
- 1 Sinatrial node
- The pacemaker
- 2 Atrioventricular node
- 3 Left and Right bundle branches
- 4 Purkinje fibers



5

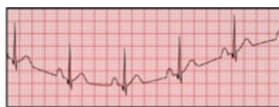
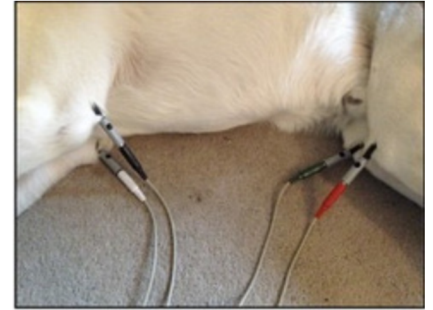
Conduction Through the Heart

- P wave: atrial depolarization
- PR interval: conduction through the AV node
- Q wave: initial depolarization of the interventricular septum
- R wave: ventricular depolarization
- S wave: basilar ventricular depolarization
- T wave: repolarization of the ventricle
- Contraction – depolarization
- Relaxation – repolarization

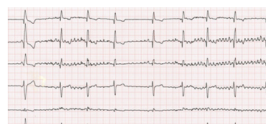


Patient Positioning and Lead Placement

- Right lateral recumbency
- White – right forelimb
- Black – left forelimb
- Green – right rear limb
- Red – left rear limb



Motion/Breathing
Aka wandering baseline



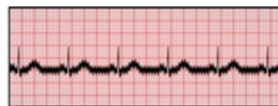
Trembling

Common Artifact



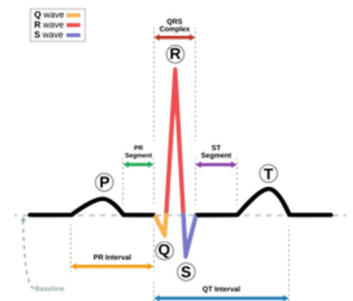
leads I & III are mirror images
"far-field" signal

Incorrect lead placement



Electrical interference

Normal Complex



Evaluating Rate

- 50mm/s
 - 5 large boxes = 0.5 second
 - 30 boxes = 3 seconds
 - Count the complexes in 3 seconds, multiply by 20.
- 25mm/s
 - 5 large boxes = 1.0 second
 - 30 boxes = 6 seconds
 - Count complexes in 6 seconds, multiply by 10.
- Bic pen method
- 6-inch ruler



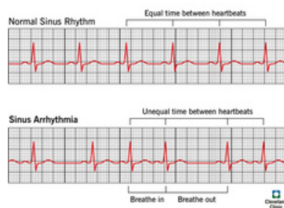
50mm/sec
3 second strip
What's the rate?

Evaluating the Rhythm

- Ask yourself the following:
 - Is there a P wave for every QRS complex?
 - What is the rate? Fast? Slow?
 - Is it regular?
 - Are the complexes consistent?

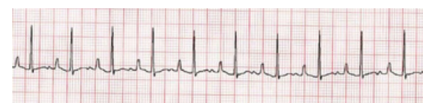
Common Abnormalities

- Sinus arrhythmia or respiratory arrhythmia
- "Regularly irregular"
- Gradual increase and decrease in heart rate, most commonly associated with breathing.



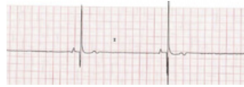
Common Abnormalities

- Sinus tachycardia
 - Dogs HR 180 and above
 - Cats HR 240 and above



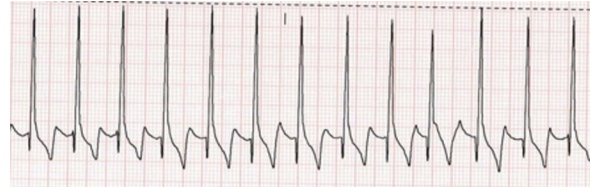
Common Abnormalities

- Sinus bradycardia
 - Dogs HR 60 and below
 - Cats HR 160 and below



Supraventricular Arrhythmias

Supraventricular Tachycardia – SVT



Supraventricular Arrhythmias

Atrial Premature Complex



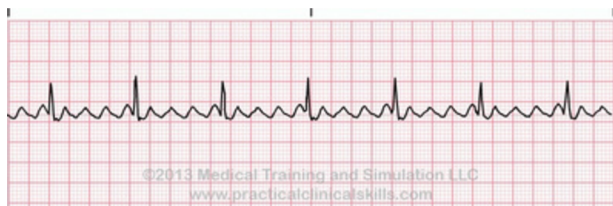
Supraventricular Arrhythmias

Atrial Fibrillation



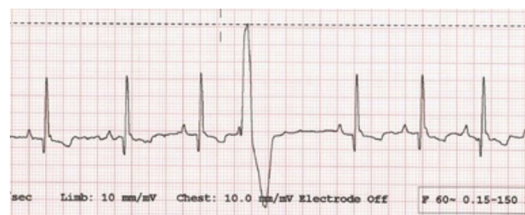
Supraventricular Arrhythmias

Atrial Flutter



Ventricular Arrhythmias

Ventricular Premature Complex - Single



Ventricular Arrhythmias

Ventricular Premature Complex - Bigeminy



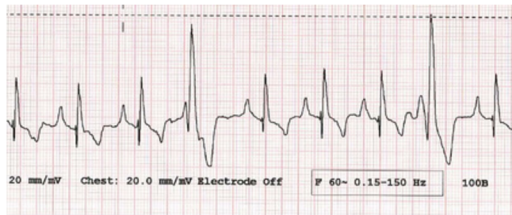
Ventricular Arrhythmias

Ventricular Premature Complex - Trigeminy



Ventricular Arrhythmias

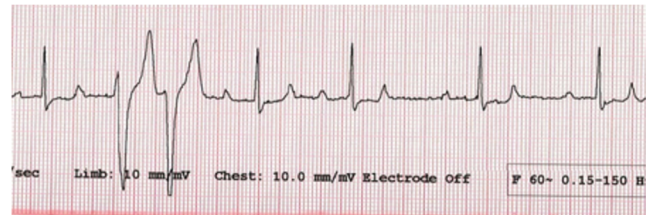
Ventricular Premature Complex - Quadrageminy



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Ventricular Arrhythmias

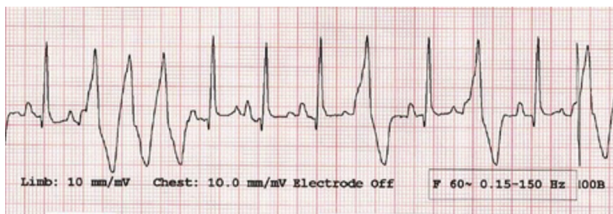
Ventricular Premature Complex - Couplet



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Ventricular Arrhythmias

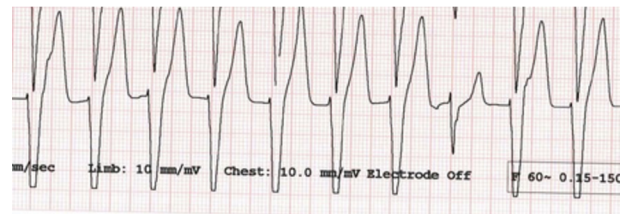
Ventricular Premature Complex - Triplet



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Ventricular Arrhythmias

Ventricular Premature Complex - Ventricular Tachycardia



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Ventricular Arrhythmias

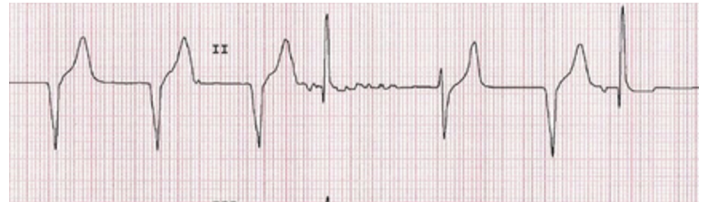
Ventricular Premature Complex – Ventricular Ectopy



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Ventricular Arrhythmias

Accelerated Idioventricular Rhythm



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Ventricular Arrhythmias

Ventricular Fibrillation

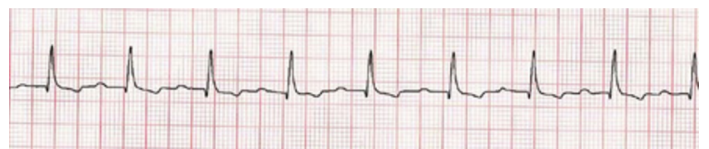
Ventricular Fibrillation (VF)



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Atrioventricular Block

1st Degree
Prolonged PR interval



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Atrioventricular Block

2nd Degree - Type 1

PR interval increases then blocks.



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Atrioventricular Block

Second Degree- Type 2



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Atrioventricular Block

Third Degree



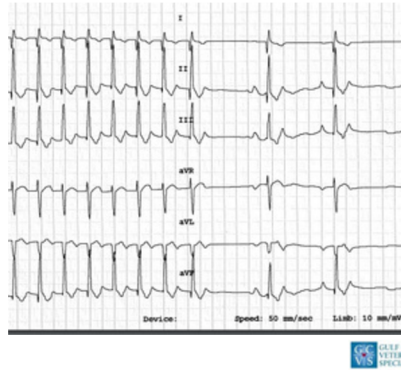
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Examples

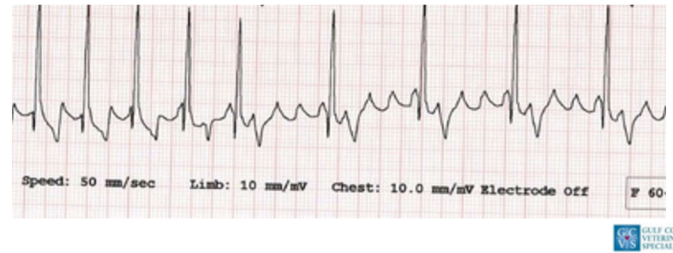


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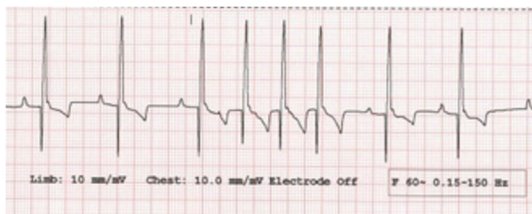
Examples



Examples



Examples



Examples



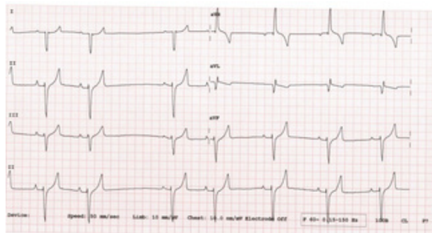
Examples



Examples



Examples



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