BULLETIN OF THE
PET PRACTITIONERS ASSOCIATION OF MUMBAI
(FOR CIRCULATION AMONGST PPAM MEMBERS)
JULY-SEPTEMBER 2024

CONTENTS

Indian Delegates at WSAVA 2024 Suzhou China

Total 10000 deligates, 300 plus Registrations from India

Dr. S. V. Vishwasrao
Ph.D. (Surgery)
Editor, PPAM Bulletin
vishwasraodr@hotmail.com
Mobile : 9322242184

Editorial

Veterinary Doctors Come Forward and Tell Your Story, It will inspire the Budding Veterinarians.

Every individual and every profession have a story waiting to be told. Whether you are a clinician, academician, research worker, in government or private sector, pharma or food industry, dealing with small, large, production or wild animals and working as a veterinarian, please share your experience with others. Your experiences will definitely inspire others. Share your journey, your challenges and your triumphs. Tell our PPAM Bulletin readers what it takes 24 hours in our veterinary profession. Let us be practical when we tell our story, let us not only discuss glamour and success but also tears and disappointments. Let the stories we tell be relatable and relevant.

Let us pen down little moments of success, humour or learning that happens in our life. The true day to day life and professional adventure that makes our life real and relatable to the audience. At times a routine job makes inspiring stories.

Even small mundane tasks can make an impact. Our job could be a small part in large worldly things but yet has the capacity to make a difference. Let us share with others what we have learnt in our journey. Each one of our stories carry the potential to motivate others.

Writing all that we have experienced also helps to release subconscious collections. Our writing down of our experiences will help us in accepting all situations without complaining, as each experience good or bad helps us evolve to be a better professional, only if we learn from our or stories of others.

In the story we tell about our journey let us be honest about our success and failures, and what was the key take away from our failures. If stories connect with our readers, it will have a deep and lasting effect on young and budding veterinarians.

Let's not forget inspiration does not require a thrilling job it comes from a thrilling way of looking at the job.

The story you will tell others can turn an everyday routine job into something extraordinary. So my dear PPAM members lets write down our experiences in our own PPAM Bulletin.

Proud Moment for India and Veterinary Profession

PPAM family congratulates Para Olympic medalist Veterinary student Thulasimathi Murugesan of TANUVAS. Thulasimathi Murugesan is a badminton paralympian from Tamil Nadu. Represented India and participated in the recently concluded Paralympics in Paris. She won a silver medal in the game. She is studying in her third year at Namakkal Veterinary College. She represented India at the 2022 Asian Para Games held at Gangzhou, China. She won three medals in para badminton competitions, SL3-SU5 and SU5 classes. She made history as the first Indian woman shuttler to win a Paralympic silver medal, following a remarkable journey to the final in the SU5 category. Government of Tamil Nadu has given Rs 2.0 crore to Para Olympic medalist Vet student Thulasimathi Murugesan of TANUVAS.

The Vulture Crisis in the Indian Subcontinent: A Review of NSAID Toxicity and Conservation Strategies

Dr. Percy E. Avari, (Vulture Conservationist)
Vice President: The Eye Vet, The Cancer Vet & The Exotics Vet

1. Introduction

The skies of India were once filled with the graceful and majestic flight of the nature's silent guardians, the vultures. These remarkable birds, often called "nature's cleanup crew," play a vital role in maintaining a healthy ecosystem. Their role of efficiently consuming carcasses prevents the spread of diseases, limits the population of other less-efficient scavengers such as feral dogs and rats, and contributes to overall sanitation. A group of 70 vultures can strip off a large ungulate carcass to mere bones within 15 minutes. The tens of millions of vultures in the 1980s, provided an unparalleled carcass disposal service in the Indian sub-continent, having the largest cattle population on the planet. However, in recent decades, this balance has been starkly skewed. Vulture populations in India have experienced catastrophic declines and are now facing total extinction. Long-lived birds like vultures have an estimated annual adult mortality of 5% of the population. However, the decline in the population of vultures in the Indian subcontinent starting in the 1990s has been recorded to be around 50% annually, leading to the decline of the overall population of Gyps vultures by 97 – 99% in half a decade. The white-rumped vulture considered “common” in the year 1996 was declared “critically endangered” in just a matter of four years in the year 2000. It's population declined by a staggering 99.9%! This decline is considered to be faster than the decline of the Dodo.

The severity and speed of the decline baffled the scientific community for a long time and triggered extensive investigation and research to uncover the cause. Research has revealed the main cause behind this crisis to be the veterinary use of non-steroidal anti-inflammatory drug (NSAID), diclofenac, which causes acute toxicity in vultures. Although diclofenac is predominantly a musculo-skeletal drug, it also helps effectively alleviate pain, fever and inflammation in livestock. Diclofenac is however deadly for vultures that consume carcasses of recently treated animals, turning the food of vultures into poison for them.

This revelation presents a conundrum: balancing the need for effective veterinary care for livestock with the urgent imperative to save these ecologically important birds. This article delves into the intricate interplay of factors that make diclofenac so lethal to vultures, focusing on key findings of researchers across the globe including India, who are striving to protect the vultures from extinction.

2. Diclofenac: A Brief Overview

Diclofenac, chemically known as 2-[2-(2,6-dicholorophenyl amino)phenyl]acetic acid, is a phenylacetic acid derivative belonging to the NSAID class. It is used extensively in human medicine to manage osteoarthritis, inflammation, and gout, and when it was off patent in 1992, it was produced very cheaply, and was widely adopted for veterinary use in cattle due to its potent anti-inflammatory and analgesic properties.

3. The Deadly Impact of NSAIDs on Vultures: Pathology and Pathophysiology

The use of NSAIDs in veterinary practice is widespread in India, driven by the need to alleviate suffering in livestock. However, the unintended consequences of this practice on vultures have been devastating.

Restraint of Vulture

Treatment of Vulture

Postmortem of Vulture

White backed vulture on carcass

Photo courtesy
Mridu Paban Phukon

3.1. Diclofenac: The First and Primary Culprit

Diclofenac, widely used to treat pain, fever, and inflammation in cattle in India, emerged as the primary cause of the vulture population decline. Vultures feeding on carcasses of cattle treated with diclofenac shortly before death develop fatal visceral gout within days. This condition is characterized by kidney failure, resulting in the build-up of uric acid in the blood and deposition of uric acid crystals (tophi) on the surfaces of internal organs.

3.2. The Unique Anatomy of the Avian Kidney

To understand the devastating impact of diclofenac on vultures, it is essential to first understand the unique features of the avian kidney. Unlike mammals, who possess only one type of nephron, (the functional unit of the kidney), birds possess two types of nephrons: **Reptilian Nephrons**, like those found in reptiles, which lack a Loop of Henle, a structure crucial for concentrating urine and **Mammalian Nephrons** which possess a Loop of Henle and are responsible for producing concentrated urine.

This dual nephron system is an adaptation to the avian lifestyle, balancing the need for water conservation with the efficient excretion of waste products.

Post-mortem examinations reveal a consistent pattern of pathology:

- **Visceral Gout:** The most prominent finding is extensive visceral gout. A thick, chalky white coating of uric acid crystals covers the surfaces of organs such as the liver, kidneys, heart, and spleen. This visible manifestation of kidney failure underscores the drug's profound impact on renal function.

Presence of visceral gout in vultures

- **Kidney Damage:** Results of microscopic examination of the kidneys reveal severe acute necrosis, primarily in the proximal convoluted tubules of the *mammalian nephrons*. These tubules, responsible for active secretion and reabsorption of various substances, including uric acid, are particularly vulnerable to diclofenac's toxic effects.

The proximal convoluted tubules are often dilated and filled with cellular debris and uric acid crystals, indicating dysfunction and damage. There is minimal inflammation, suggesting rapid and severe damage rather than a chronic condition.

- **Disruption of the Avian Renal Portal System:**

  Birds, including vultures, possess a unique renal portal system, a network of veins carrying blood from the hind limbs to the kidneys. Within this system, a structure called the renal portal valve plays a crucial role in regulating renal blood flow. While its exact function remains debated, the valve is thought to shunt blood away from the kidneys under conditions of stress, potentially diverting the primary nutrient blood supply from the renal cortex.

  - **Diclofenac and the Valve:** Dr. Carol Meteyer and her team proposed that diclofenac might interfere with the renal portal valve by inhibiting the production of prostaglandins, which are involved in modulating vascular tone. This could lead to indiscriminate opening of the valve, reducing blood flow to the renal cortex and causing ischemic necrosis in the proximal convoluted tubules, which is consistent with the observed pathology.
  - **Debate and Further Research:** Subsequent research by Dr. Vinny Naidoo and his team using isolated cranial renal portal veins from chickens, which is a validated model species, found that diclofenac and meloxicam, a vulture-safe NSAID, actually promoted *vasodilation* rather than vasoconstriction, suggesting a different effect on vascular tone. However, the role of prostaglandins in the regulation of the renal portal valve and the potential impact of diclofenac on this system require further investigation.

3.3. A Deep Dive into Diclofenac Toxicity: The Avian Kidney as the Target

Diclofenac's deadly impact on vultures is centered on its effects on the avian kidney. Post-mortem examinations reveal a consistent pattern of pathology:

- **Diclofenac's Effects on the Kidneys:** Gyps vultures appear to metabolize diclofenac very slowly, leading to prolonged exposure to the drug and its metabolites. This metabolic deficiency, potentially linked to variations in cytochrome **P450** enzymes, sets the stage for toxicity. Diclofenac directly targets the proximal convoluted tubules of the mammalian nephrons in the avian kidney, disrupting their critical functions. Research suggests that diclofenac directly or indirectly inhibits organic anion transporters **(OATs)** and multidrug resistance protein **(MRP)**, which are involved in the transport of uric acid from the bloodstream into renal cells and then into the urine, respectively. This interference with uric acid transport, combined with the slow metabolism of diclofenac, exacerbates the build-up of uric acid, leading to hyperuricemia and ultimately to visceral gout. Additionally, diclofenac induces oxidative stress within renal cells, damaging cellular components and leading to apoptosis (cellular death). This culminates in severe acute necrosis of the proximal convoluted tubules. Research suggests that diclofenac might specifically **target mitochondria**, the energy-producing organelles within cells, leading to the generation of reactive oxygen species and **impairing ATP synthesis**, crucial for cellular function.
- **Minimal Inflammation:** There's minimal inflammation in the kidneys, suggesting rapid and severe damage rather than a chronic condition.

The slow metabolism combined with direct damage to the proximal convoluted tubules creates a “perfect storm” of toxicity for vultures, leading to rapid and fatal kidney failure.

3.4. Diclofenac's Reach: Toxicity Beyond Gyps Vultures

While *Gyps* vultures are particularly susceptible to diclofenac poisoning, this drug is not limited to affecting only these species.

- **Red-headed Vulture, Egyptian Vulture, and Steppe Eagle:** Populations of these well-known scavengers have also declined alongside those of *Gyps* species in areas of diclofenac use in livestock. Cases confirming gout and high diclofenac levels have been published for **Cinereous Vulture** and Steppe Eagle.
- **Poultry:** Studies have shown that chickens and other poultry species can also experience diclofenac toxicity, although they are generally less sensitive than vultures.
- **Other Species:** The potential for diclofenac toxicity in other carcass-scavenging bird (or potentially mammal) species remains largely unstudied.

3.5 Exception proves the rule:

In North America, co-evolution has resulted in a separate phylogeny of vultures, including the Turkey vulture which has been experimentally trialed and fed diclofenac. Surprisingly, it proved to be resistant to diclofenac toxicity at 100 times the LD50 for Gyps vultures in Asia and the Old world!

- **Renal Portal Valve Regulation:** The renal portal valve controls blood flow to the kidneys. It's possible that Turkey vultures have a different valve structure or regulatory mechanism that makes them less susceptible to the ischemic effects of reduced prostaglandin levels caused by diclofenac.
- **Glomerular Filtration Rate:** Turkey vultures might have a higher glomerular filtration rate, allowing them to more effectively clear diclofenac and its metabolites, preventing their accumulation in the kidneys.

Slender billed vulture

Long billed vulture

- **Tubular Reabsorption and Secretion:** Differences in tubular transport processes could affect the reabsorption and secretion of diclofenac and uric acid, influencing their excretion and potential for toxicity.

The preliminary research in 2008 on Turkey vulture needs to be further validated and continued to understand the physiological pathways. However, this is an exception and an interesting observation, which proves that diclofenac resistance is a rarity among birds and not the opposite. This is again emphasized by the following paragraph about diclofenac toxicity to other bird species.

3.6 Aceclofenac, Nimesulide, Ketoprofen, Flunixin, and Carprofen: Additional Threats

Since the identification of diclofenac as a vulture toxin, research has shown that other NSAIDs also pose a risk to these birds, and unfortunately, these have been among the drugs replacing diclofenac. Aceclofenac, Nimesulide, ketoprofen, flunixin, and carprofen have all been shown to cause kidney failure and visceral gout in vultures, although their toxicity may vary depending on dosage and specific vulture species.

4. The Price of Silence: Consequences of Vulture Declines

The disappearance of vultures from the skies of India has had far-reaching consequences for the environment and society.

- **Ecosystem Disruptions & Impact on Human Health:** The loss of vultures, which are apex scavenger species, has led to an increase in the populations of less-efficient scavengers such as feral dogs and rats. The increase in feral dog populations has been directly linked to a rise in rabies cases in India. The potential for the spread of other diseases, such as anthrax, also increases when carcasses are not quickly removed by vultures.
- **Economic Losses:** Dr. Frank Eyal's research has provided compelling evidence of the economic impact of vulture decline in India. His findings suggest that districts that were historically highly suitable for vultures experienced an average increase in all-cause human death rates of 4.7% after vulture populations collapsed. Using a conservative estimate, this implies an average of 104,386 additional deaths per year, resulting in an estimated mortality cost of USD 69.4 billion per year and an estimated additional 500,000 human deaths! These staggering numbers underscore the profound economic consequences of losing a keystone species such as the vulture.
- The collapse of vultures has imposed economic costs on various sectors:
  - **Public Health:** The increased burden of rabies cases places a strain on healthcare resources.
  - **Livestock Industry:** Vultures play a role in controlling livestock diseases, and their absence might lead to greater disease prevalence and subsequent economic losses.
  - **Sanitation:** The cost of manual disposal of carcasses or implementation of alternative sanitation measures (such as incinerators) is substantial, to the estimated tune of USD 139,000 or Rs. 83.5 lakhs (in 2014-2015) as presented in a 2016 paper by Ishwar et al.
- **Cultural and Religious Impacts:** The Parsi community, who traditionally rely on vultures for their "sky burials," have been forced to adopt alternative, less-efficient methods such as installing solar concentrators which accelerate the desiccation of the corpse over a long period of time

Table 1: Status of Vulture Species in Indian Subcontinent

Vulture species	Global threat status[1]	Est. population in India / global
White-rumped (aka Oriental white-backed) Vulture (*Gyps bengalensis*)	Critically Endangered	6,000/ 10,000
Indian (aka Long-billed) Vulture (*Gyps indicus*)		15,000/ 15,500
Slender-billed vulture (*Gyps tenuirostris*)		750/ 1,000
Red-headed Vulture (aka King Vulture) (*Sarcogyps calvus*)		no India estimate/ 2500-10,000
Egyptian Vulture (*Neophron percnopterus*)	Endangered	no India estimate/ 50,000
Himalayan Griffon (Himalayan Vulture) (*Gyps himalayensis*)	Near threatened	no India estimate/ 300,000
Cinereous Vulture (*Aegypius monachus*)		no India estimate/ 15,600-21,000
Bearded Vulture (aka Lammergeier) (*Gypaetus barbatus*)		no India estimate/ 1,300-6,700
Eurasian Griffon (*Gyps fulvus*)	Least Concern	no India estimate/ >500,000

compared to a group of vultures which would need a few minutes for disposing of their deceased. In the Hindu religion the brave act of Jatayu sacrificing his life to save the Goddess Sita from the clutches of Ravan is well known. These cultural importances of the vultures are a helpful tool in propagating the idea of conservation with the people and reconnecting the role of vultures in day to day lives.

The consequences of losing vultures highlight the delicate balance that exists within a healthy ecosystem and underscore the importance of protecting species that provide essential services.

5. The search for safe alternatives:

The catastrophic declines of vultures led to an extensive hunt for safer alternatives for vultures and two NSAIDs have surfaced for now meloxicam and

Table 2: Annex: Safety of commonly used NSAIDs in veterinary practice in India *

Drug name (& Status in India)	Threat / safety	Known effect
Meloxicam	**Confirmed Safe**	Demonstrated safe for vultures (Swarup D. *et al.* 2007)
Tolfenamic acid	**Confirmed Safe**	Demonstrated safe for vultures (Chandramohan *et al.* 2022)
Carprofen	**Toxic at high doses**	At toxic levels for vultures in cattle tissues around the injection site (Fourie *et al.* 2015)
Flunixin	**Toxic**	Demonstrated toxicity to *Gyps* vultures in Spain & Italy, with dead wild birds showing gout & flunixin in tissues. Not yet fully safety-tested on vultures. (Zorrilla *et al.* 2014, Eleni *et al*. 2019)
Nimesulide **[Recommended for ban by Drugs Technical Advisory Board of India 2024 – ban awaited]**	**Confirmed Toxic**	Widely banned globally due to safety issues in humans but only for under 12s in India. Increasingly popular in India & Nepal. Demonstrated toxicity to vultures. (Galligan *et al.* 2022, Karikalan *et al.* 2023). Also dead wild vultures with gout and nimesulide but no diclofenac (Nambirajan *et al.* 2021)
Aceclofenac **[Banned Aug 2023]**	**Confirmed toxic**	Metabolises into diclofenac in cattle so equivalent effect to diclofenac (Galligan *et al.* 2016, Sharma 2012)
Ketoprofen **[Banned Aug 2023]**	**Confirmed toxic**	Trials carried out on Gyps vultures showed toxicity at concentrations found in treated cattle in India (Naidoo *et al.* 2009). National ban in Bangladesh 2021.
Diclofenac **[Banned 2006]** **[Vial size restriction of human formulations to <3ml 2015]**	**Confirmed toxic**	Confirmed highly toxic in 2003 (Oaks *et al.* 2004), and main cause of recent Asian vulture declines.

Note that the following NSAIDs have not been fully safety-tested but are also licensed and commonly available for veterinary use in India: **paracetamol, phenyl butazone, metamizole, piroxicam, ibuprofen**.

**Replicated with permission from Saving India's Vultures from Extinction: Policy Statement, May 2024.*

tolfenamic acid. These are the only NSAIDs which have been proven safe for vultures by the joint efforts of primarily the Indian Veterinary Research Institute (IVRI), Bombay Natural History Society (BNHS), Ministry of Environment and Forests (MoEF) and Forest Departments of various states.

6. The way forward:

It is proven without a doubt, that diclofenac and other NSAIDs cause toxicity in Gyps species of vultures along with other scavengers and birds of prey. Actions to protect the existing population of vultures and ensure their survival include captive breeding of vultures in multiple centers in the subcontinent, ban on the veterinary use of diclofenac, identification of a safe and effect alternative of veterinary diclofenac for cattle and creating vulture safe zones of a radius of 100 kms to ensure a safe environment for vulture releases. Vultures help support the human, animal and environment health. Veterinary science is an integral part of the "One Health Program" and vulture conservation program is one of the best ways that the veterinarians can support the One Health mission. The whole world is looking at the Indian subcontinent and we have a noble albeit tough and not an impossible task to protect these magnificent birds. The veterinarians working for cattle in India are a part of the larger picture for ensuring nutritional security, relieving poverty, supporting livelihood and last but not the least ensuring the welfare of these wonderful animals and the ecosystem.

The most important steps veterinarians can take (and are not restricted to) are:

1. Ensure the implementation of the ban of vulture toxic drugs.
2. Spread knowledge amongst para-vets and farmers about vulture importance of vulture conservation along with the fact about NSAIDs toxic to vultures. Impart the importance of vultures to veterinary students and inform them about the harmful effects of certain NSAIDs to the vultures.
3. Guide and teach pharmacists to ensure the implementation of ban of vulture toxic drugs.
4. Judicious use of NSAID's for cattle treatment and restricting the use of proven vulture safe NSAIDs for the treatment of cattle is of utmost importance.
5. Support the research to help identify vulture safe NSAIDs for the treatment of cattle.

"If you cannot do great things,
do small things in a great way"

– Napolean Hill

Conservation is not only for conservationists, but also the duty of every human being on the planet. This is a great opportunity for veterinarians to blaze a path in a never seen before conservation effort and continue the noble and selfless service to the animal kingdom.

References: https://save-vultures.org/papers-and-reports/

World Cat Day Program, Nagpur

Dr. Hemant Jain

On the Occasion of World Cat day on 8 August 2024, Dr. Jain clinic, Nagpur organised a special program for Cats. There was a great response For Free Health Check up Camp for Cat from cat owners. Distributuion of free Cat Food samples and clinical examination of all the cats presented was undertaken. Dr. Potbhare Retired Joint Commissioner of Animal Husbandry was the Chief Guest of the Program. Total 26 Cats were examined and treated by Dr. Hemant Jain And Dr. Nikhil Jain .

A) Clinical Pathology: Combined Approach with Haematology, Biochemistry and Cytology

Dr. Sachin M. Kumthekar

Clinical Pathology: Combined Approach with Hematology, Biochemistry and Cytology:

Dr.Sachin M.Kumthekar, BVSc&AH, MVSc (Pathology,MVC)
Ex-faculty St.George's University ,Grenada (W.I)
Consulting Veterinary Pathologist
(E-mail: sachinmanik2000@gmail.com)

- Clinical Pathology is the use of laboratory tests to investigate health or disease status of a LIVE animal
  - **Choose** appropriate samples
  - **Use** reliable laboratory analytical tests
  - **Interpretation** of laboratory results

Clinical pathology is the use of

Clinical pathology deals with different types of specimens and techniques.....

- Hematology (CBC)
- Clinical biochemistry
- Diagnostic cytology
  - Parasitology
  - Serology/Immunology
  - Bacteriology

- Knowledge to use precise tests ("Cost-effectiveness")
- May be using wide test panel to narrow down the disease condition
- Understanding the significance of results (interpretation)

Basic rules of clinical pathology...

- Provide accurate patient data
  - Clinical signs, species, breed, gender, age
- Establish a list of differential diagnosis
  - Fewer tests (less cost to the patient)
- Determine appropriate samples and tests:
  - Whole blood, serum, urine etc.
  - Collect & handle samples with care
  - Ask the lab if you have any doubts
- Interpreting the results
  - Extract & Rank the abnormalities→ Connect with history & signs
- Suggest/think about Further tests (Confirmation)

Results alone are never diagnostic...many factors can influence them

1. Pre-analytical factors
   - Animal factors
   - Collection & sample submission
2. Analytical factors:
   - Equipments, skill & quality control
3. Post-analytical factors
   - Reference ranges, interpretation

Pre-analytical factors affecting the results: Animal related

Fixed: Species, breed, age and gender

Transient:

- Small animals – blood should be collected after fasting
- Large animals – should be rested before collection (esp. horses)
- Drug administration : antibiotics, steroids, fluids
  - Steroids>> lower the lymphocyte counts
  - Ca-borogluconate>> increases blood glucose
  - Fluid therapy>> might alter urine sp. gravity

Pre-analytical factors affecting the results: Clinician related

- Collection technique
- Choice of anticoagulant
- Using suitable sample & analyzing the sample ASAP
- Provision of – accurate signalment, clinical signs & history, tests requested.

Analytical factors affecting results

- Type of equipment
  - Manual vs automated
  - QBC vs Lasercyte
  - Wet biochemistry vs dry biochemistry
  - Analysis : ASAP
- Quality control
- Skill and experience of technician

Post-analytical factors affecting results

- Use of wrong reference ranges
  - Species
  - Different labs
  - Text book reference ranges
- Incorrect transcription of results
- Errors in interpretation

Sample types

- Blood
  - Whole (CBC)
  - Serum (chemistry)
  - Plasma (chemistry)
- Cytology
  - Fluids (effusions, CSF, Joint)
  - Biopsies
  - Needle aspirates/touch imprints
- Urine
  - Free catch (Spot)
  - Cystocentesis
  - Catheterization

Anticoagulants/blood tubes

- **Ethylene Diamine Tetra Acetate (EDTA)**
- Anticoagulant/sample of choice for hematology
  - Preserves cell morphology best
- Should not be used for Coagulation tests
  - Forms an insoluble complex with Ca, and Ca is necessary for clot formation

Anticoagulants/blood tubes

- **Lithium Heparin**
- Anticoagulant/sample of choice for biochemistry
  - Interferes least with chemical assays
- Should not be used for Coagulation tests
  - As heparin inhibits conversion of prothrombin to thrombin
- Not a good choice for glucose estimation, but if the sample is collected in heparin for glucose estimation, plasma should be separated ASAP.
  - As it can not prevent glucose utilization by RBCs

Anticoagulants/blood tubes

- **Fluoride Oxalate blood tube**
- Anticoagulant/sample of choice for glucose estimation.
  - As it prevents RBCs from utilizing glucose.

Anticoagulants/blood tubes

- **Sodium Citrate blood tube**
- Anticoagulant/sample of choice for coagulation tests (PT,PTT).
  - Chelates poorly with calcium
- Plasma should be separated as soon as possible, delayed analysis may alter the results

Handling of blood samples (stability)

- Ideally analysis should take place ASAP !!
- Never freeze the whole blood
- Only plasma/serum can be
- Sample for CBC:
  - Make smears & keep in mailer box
  - Stable for 24 hrs at cool RT
  - Stable for 2/3 days @ 4° C
- Samples for biochemistry
  - Separate plasma/serum from cells
  - Stable for 12-20 hrs @ 4° C
  - Stable for >24 hrs if frozen
  - But analytes like ammonia, bilirubin must be analyzed within 30 mins
  - If Lith Heparainized sample for glucose→ separate plasma ASAP

Hemolysis of blood samples

- Destruction/lysis of RBCs causing free Hb in plasma
  - ~~In vivo (inside body→ mostly pathological)~~
  - In vitro (outside body, during/after sample collection)
- **Causes:**
- Poor collection & handling techniques
  - Presence of water in syringe, re-used needles
  - Excess suction during collection
  - Delay in separation of plasma/serum
  - Excessive spin with centrifuge
- Lipemic plasma (blood collected after feeding)→increases RBC membrane fragility
- Excitement/fear during collection
- Exposure to excess temperatures (too cold/too warm)

Urine: Collection & handling

- **"Free-catch" "Spot collection"**
  - Contain epithelial cells & contaminant bacteria >> may cause false +ve culture results & sediment features
- **Catheterized samples**
  - Contain epithelial cells & bacteria
  - Blood – due to trauma (false positive results)
- **Cystocentesis**
  - Use fine needles
  - No contaminant bacteria & epithelial cells present >> most appropriate for culture
  - May contain trace blood
- Collection method must be recorded to allow interpretation of results !!!

Urine: Collection & handling

- **Containers for Urine Specimen**
  - Tubes must be sterile and free of chemicals
  - May affect culture & chemical assays
- **Examine specimen as soon as possible**
  - Bacterial contamination/overgrowth
  - Lysis of cells & casts
  - Increased crystal formation
  - Cause false positive chemical reactions

Urine: Collection & handling

- **Preservation of Urine Samples** *(if sample can not be analyzed quickly)*
  - ➢Refrigerate immediately upon collection
    - Slows bacterial proliferation
    - May increase crystal formation
  - ➢Preservatives (for 30 ml urine)
    - 1 drop 40 % formaldehyde OR
    - 3ml 10% formal saline OR
    - 0.5g Boric Acid OR
    - Cover surface of urine with layer of Toluene
- Preservatives interfere with chemical tests

Cytology samples: collection and handling

- Variety of samples; different collection techniques
  - Needle aspirate from masses, body fluids, respiratory tract samples (lavages), vaginal cytology etc.
- Proper restraint very essential
  - Physical
  - Sedation
  - Anesthesia
- Use Fine Needles
- Analyze asap

Cytology samples: collection and handling

- **Fine Needle Aspirates (FNA samples)**
  - ➢Adequate restraint
  - – Animal
  - – Mass
    - Lymph nodes
    - Skin masses
    - Internal organs
  - ➢Must use Fine Gauge needles (21-22)
  - ➢Make smears

Cytology samples: collection and handling

- **Touch Imprints (Impression smears)**
  - ➢**Samples**
    - During biopsy
    - At necropsies
  - ➢Touch cut surface of tissue on clean glass slide
  - ➢Air dry and stain with suitable stains
    - Mostly Romanwasky types (Leishman-Giemsa, Diff-quick)
    - Other special stains

Cytology samples: collection and handling

- **Fluids**
  - ➢Body cavity effusions
    - Peritoneal/abdominal
    - Pericardial
  - ➢CSF
  - ➢Joint/Synovial
- Collected in EDTA and Sterile (Sterilin) tubes
- Analyze ASAP
- Effusions can be stable up to 24 hrs if refrigerated

Important points to remember for sample submission

- Standardize collection technique and timing
  - Small animals vs large animals
- EDTA samples
  - Make few smears and refrigerate the rest
  - Stable up to 2 days in fridge (4^0 C)
  - Never freeze
- Clinical biochemistry samples
  - Separate plasma/serum asap
  - If refrigerated (4^0 C) >> stable up to 24 hrs
  - If frozen >> stable up to 3-5 days
  - asap for ammonia, bilirubin, acid base (within 30 mins)
- Fluids
  - Make a few smears and refrigerate rest
  - Stable up to 24 hrs
  - CSF must analyze within 30-60 mins
- Exporting
  - Use same lab, same technicians, same Reference ranges

Result interpretations *(upon obtaining results from the laboratory)*

- Compare results with the reference ranges/intervals (RI) for the species and parameter
  - ➢Use RI from the lab where sample was analyzed.
- Note all values outside the RI (Extract), and rank the changes as mild, moderate and severe (Rank)
  - Usually biggest changes are significant, but it also depends on analytes, species
    - Eg changes in potassium vs liver enzymes, ALKP in dogs vs cats
- Connect marked changes with history & signs to obtain possible diagnosis or differential diagnosis (Connect)
- Suggest/think about Further tests (Confirmation)

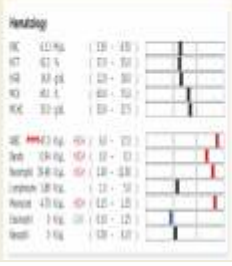
Result interpretations *(upon obtaining results from the laboratory)*

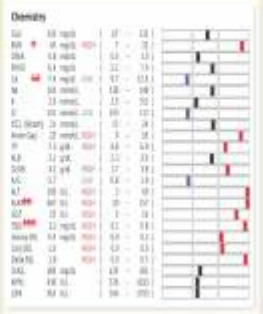
Significance of Ranking abnormalities

- ➢For eg Reference range/interval for Plasma Total Protein (TP) in dogs is 6-8 g/dl
- – Then
- ➢TP 5.9 g/dl >> Mild hypoproteinemia
  - Not significant
- ➢TP 5.6-5.8 >> Mild hypoproteinemia
  - May be significant
- ➢TP 5.2-5.5 >> Moderate hypoproteinemia
  - Significant
- ➢TP < 5.1 g/dl >> Marked hypoproteinemia
  - Very significant
- ❑Automated analyzers : limited ability to rank
  - TP 3.5 g/dl and 5.9 g/dl >> "LOW"

Result interpretations *(upon obtaining results from the laboratory)*

- 10 yr old male GSD dog.
- Anorexia, lethargy, vomiting & abdominal pain





- **Extract abnormal:** — **Rank**
- High WBC – Marked leukocytosis
- High bands – Mild left shift
- High neuts – Marked neutrophilia
- High monos – Marked monocytosis
- Low eosinos – may be mild eosinopenia
- High BUN – Mild azotemia
- Low Ca – Moderate hypocalcemia
- Low chloride – Moderate hypochloremia
- High anion gap – significant acidosis (lactic acid??)
- High TP – Mild hyperproteinemia
- High Glob – Moderate hyperglobulinemia
- High ALT – mild to moderate
- High ALKP – Moderately elevated
- High GGT – Moderate
- High Bilirubin – Marked hyperbilirubinemia

Significant changes due to main cause

Less significant changes

Significant changes secondary to main cause

Main cause ??

Connect:
•Possible inflammatory disease affecting hepatic system (cholestasis??/Bile peritonitis?)
•**Sec differential:** possible pancreatitis ??

Some case examples

Case study (For practice)

CBC:

PCV 42 % **(30-50)** Hb 13.5 g/dl **(12-18)** RBC 6.0 x10⁶/ul **(5.5-7.5)**
MCHC 33 g /dl **(30-36)** MCV 70 fl **(60-75)**
Protein 7.0 g/dl **(5-7)**
WBC 18 x10³/ul **(6-16)**
M Neuts 15 x10³/ul **(4-12)**
Im Neuts 0 x10³/ul**(< 1)**
Lymphs 0.6 x10³/ul **(2-4)**
Monos 1.5 x10³/ul **(1 – 1.2)**
Eos 0.5 x10³/ul **(1 – 1.2)**
Platelets 480 x10³/ul **(300-800)**
Blood smear: RBC were normocytic/normochromic, platelets adequate on smear.

Stress Leukogram:
Mild leukocytosis, neutrophilia, lymphopenia. Also mild eosinopenia and mild monocytosis

Biochemistry

ALT; 50 u/l **(20-30)**
AP 1250 u/l **(50-100)**
GGT 14 u/l **(12-36)**
Bile acids 10 Umol/l **(<15)**
TBilirubin 0.3 mg/dl **(0.1-0.6)**

Mildly elevated ALT
Markedly elevated AP

But no evidence of cholestasis or major liver abnormality

Urea; 18 mg/dl **(15-40)** Creat; 1.2 mg/dl **(0.5-1.5)**

Amylase; 1680 u/l **(<2000)** Lipase; 160 u/l **(<200)**

Cholesterol 300 mg/dl **(130-270)**
Triglycer 80 mg/dl (50-110)
Glucose; 150 mg/dl **(80-120)**

Mild hyperglycemia and mild hyperlipidemia

In dogs, major suspects are endocrine prblms.

Total protein 6.8 g/dl **(5-7)** Alb; 3.2 mg/dl **(2-3.5)** Glob; 3.6 mg/dl **(2.5-4)**
In.Phos 4.4 mg/dl **(3-6)** Ca 10.2 mg/dl **(9-11)** Cl 100 mEq/l **(99-110)**
K 4.0 mEq/l **(3.7-5.8)** Na 146 mEq/l **(137-151)**
TCO_2 18 mEq/l **(15-25)** Anion gap 15.3 mmol/L **(12-18)**

Urinalysis:

Color : light yellow,
Turbidity : Clear, no abnormal odor.
SG 1.012
pH; 6.2
Protein: negative
Other chemistries:
(Glucose, bilirubin, ketone): negative
Sediment:
A few RBCs (3 /HPF)
occasional WBCs (2/HPF),
few Squamous & transitional epithelial cells.
Some triple phosphate crystals seen. No casts present.

Dilute urine, hyposthenuric, in the isosthenuric range

Major suspects are: renal failure, nephrogenic diabetes insipidus : caused by hypercalcemia, endocrine abnormalities, medullary washouts etc.

Case study (For practice)

✓Stress leukogram
✓Raised AP
✓Hyperglycemia
✓Hyperlipidemia
✓Dilute urine

Major differentials:
✓Hyperadrenocorticism
Renal failure
Diabetes mellitus
Hypothyroidism
Liver diseases

Most consistent with: Hyperadrenocorticism

Case study (For practice)

Final conclusion: Cushing's /Hyperadrenocorticism

Case 1:
Case history: 6 year old male intact Boxer presenting to you with PU/PD of 3 week's duration. On physical examination, severely enlarged prescapular and popliteal lymph nodes. FNA on lymph nodes performed. Other lab tests carried out.

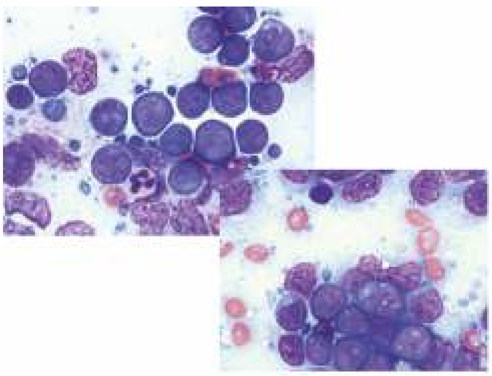
Lab test	Patient results	Reference
PCV	38%	35-55
WBC	17,000	6000-18,000
BUN	30	7-28
CREAT	1.6	0.5-0.8
GLOBULINS	5.2	2.5-4.0
Albumin	2.8	2.5-4.0
In. Phos	2.5	3-12
Calcium	16	9-12.6
iPTH/PTH hormone	1.1	2.0-13.0
PTHrp substance	3.3	0.1-1.0

Pre-renal/Renal

Inflam./antigenic stimulation/g production

Marked hypercalcemia, hypophosphatemia with normal iPTH, but raised PTHrp→ HHM

Urinalysis: Sp.Gravity 1.006, benign sediment, no other findings



Answer:
Mild azotemia – pre-renal/renal
Hyperglobulinemia – inflammation/antigenic stimulation
Marked hypercalcemia – HHM, hyperparathyroidism, ?artifact
Hypophosphatemia – ?diet, ? increased loss.
Urine: Hyposthenuria, but not in isosthenuric range, may be nephrogenic diabetes insipidus related with hypercalcemia (PU/PD).

Discussion:
•Mild azotemia, renal or may be pre-renal, but usually in renal scenarios Sp.gravity is usually in isosthenuric range –hyposthenuric, also no indication of hyperphosphatemia.
•Mildly low iPTH levels rules out hyperparathyroidism (primary or renal) as a cause behind hypercalcemia
•Normal albumin levels rules out artifactual increase in hypercalcemia
•Raised PTHrP diagnostic of/ consistent with malignancy situations → causing humoral hypercalcemia of malignancy.

•Cytology features: consistent with monotonous population of lymphoblast type cells with variable features of malignancy → lymphoma.

Hyperglobulinemia → results of immunoglobulins produced by these lymphocytes → might have a monoclonal gammopathy (if tested further on electrophoresis)
Overall:
Hypercalcemia of malignancy due to lymphoma-lymphosarcoma.

A 12 year-old cairn terrier spayed bitch was presented having had several short 'fits' over the preceding few days. The owner reported that she had been increasingly reluctant to exercise for about 2 months, leading to some weight gain. No clinical abnormality detected on physical examination. The following biochemistry results were obtained. What is the likely cause of the fits and how could that be confirmed?

Test (analytes)	Patient	Reference	Units
Sodium	147	137-151	mEq/l
Potassium	5.0	3.7-5.8	mEq/l
Calcium	10	9-11	mg/dl
Glucose	60	75-110	mg/dl
Urea	25	6-30	mg/dl
Creatinine	0.9	0.5-1.7	mg/dl

- As the major abnormality was with neuroogical signs, Ca, Glucose were evaluated mainly.
- The major abnormality was hypoglycemia (significant).
- Most common causes to be considered in dogs are:
  - Insulinoma
  - Hepatic insufficiency/liver failure
  - Intestinal Malabsorption
  - Septic shock/endotoxemia
  - Hypoadrenocorticism

Final diagnosis: Insulinoma. You will need to do Insulin :Glucose ratio or assay.

Discussion: (Considering hypoglycemia as the major abnormality in this case)

10 year old male (neutered) Scottish Terrier

- Six years ago presented to clinic for recurrent grand mal seizures → diagnoses with epilepsy and started on phenobarbital.
- Phenobarbital decreased initially, couldn't be completely eliminated: ALP, ALT and AST elevations

- Presented for:
  - anorexia, lethargy, panting and dermal lesions involving his feet, progressing to his lips and inguinal region. Tiger was clearly painful and reluctant to walk
- PE revealed
  - abdominal fluid.
  - Coalescing erosions with exudation and thick adherent crusts were present on paw and pads and claw beds of all 4 feet and mucocutaneous junctions of the mouth.
- Abdominal U/S revealed irregular nodular small liver, ascites and no masses or other pathology.

Hypoproteinemia and stress leukogram

CBC:

PCV 32 % (30-50) Hb 13 g/dl (12-18) RBC 6 x10⁶/ul (5.5-7.5)

MCHC 32 g /dl (30-36) MCV 56 fl (60-75) Protein 4 g/dl (5-7)

WBC 18 x10³/u (6-18) M Neuts 15 x10³/ul (4-18) Im Neuts 0.7x10³/ul(< 1)

Lymphs 0.6 x10³/ul (2-4) Mono 2 x10³/ul (1 – 1.2) Eos 0.5 x10³/ul (1 – 1.2)

Platelets 320 x10³/ul (300-800)

Blood smear: RBC were mildly microcytic, but normochromic. Platelets adequate

Elevated liver and cholestatic enzymes. Decreased liver function

Biochemistry

ALT 80 u/l (10-20) AST 60 u/l (10-20) AP 900u/l (50-100)

(Fasting) Bile acids 30 (umol/l) (<15) TBilirubin 0. 6mg/dl (0.1-0.6)

Urea: 10 mg/dl (15-40) Creat: 0.5 mg/dl (0.5-1.5)

Amylase: 1700 u/l (<2000) Lipase: 160 u/l (<200) CK 100 u/l (70-300)

Glucose: 80 mg/dl (80-120) Chole 140 mg/dl (130-270)

Total protein 3.8 g/dl (5-7) Alb: 1.0 mg/dl (2.3-3.5) Glob: 2.8 mg/dl (1.5-3)

In.Phos 6.0 mg/dl (3-6) Calcium 8.2 mg/dl (9-11)

Urinalysis: Source: Free catch

Color: light yellow,

Turbidity: mildly turbid, no abnormal odor

Specific gravity: 1.030 pH: 6

Protein: Trace

Glucose: Negative

Ketones: Negative

Blood (Hemoprotein): Negative

Bilirubin: positive

Sediment: RBC: 1-2 /hpf (Ref. 0-4)

WBC: 1-2/hpf (Ref. 0-2)

Occasional Squamous & transitional epithelial cells seen along with rare hyaline casts

Pure transudate and vacuolar hepatopathy

Abdominal fluid:

Clear, water like or lightly straw colored appearance. Zero turbidity. Nucleated cell count (NCC) of 2 x10³/u and Protein content of 1.0 g/dl. Microscopic examination revealed a few RBCs and occasional rare WBCs. No evidence of inflammation or malignant cells observed.

Liver FNA: Consistent with vacuolar hepatopathy. Presence of WBCs indicate mild inflammatory reaction or possible blood contamination. No evidence of malignant cells seen.

- Liver disease due to chronic phenobarbital use
  - History of giving phenobarbital
  - Stress Leukogram
  - Elevated liver enzymes, decreased liver function
  - Superficial necrolytic dermatitis: skin manifestation of liver disease aka Hepatocutaneous Syndrome
  - Mild hypocalcemia: inability of liver to convert Vit D

- Further Diagnostics:
  - Measure Phenobarbital levels
  - Radiographs
  - Biopsy
  - Continue to monitory liver enzymes and function

B) Clinical Pathology of Endocrine Disorders in Dogs & Cats

Dr. Sachin M. Kumthekar

Major Endocrinopathies

Endocrine Pancreas :
- Diabetes mellitus
- Insulinoma

Hypothalamus-neurohypophysis :
- Diabetes insipidus

Adrenal gland:
- Hyperadrenocorticism
- Hypoadrenocorticism

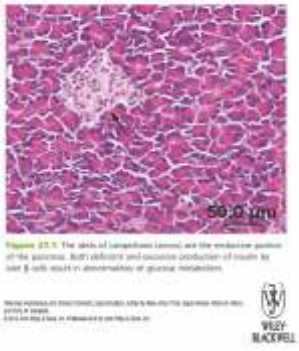
Thyroid gland:
- Hyperthyroidism
- Hypothyroidism

Parathyroid gland :
- Hyperparathyroidism
- Hypoparathyroidism

Diagnostic Approach:

- Clinical Signs & History : Very important
- Primary lab work : Routine CBC & Biochemistry
- Screening Tests : to support primary suspicion
- Specific diagnostic tests : if required, running on multiple occasions

Endocrine Pancreas

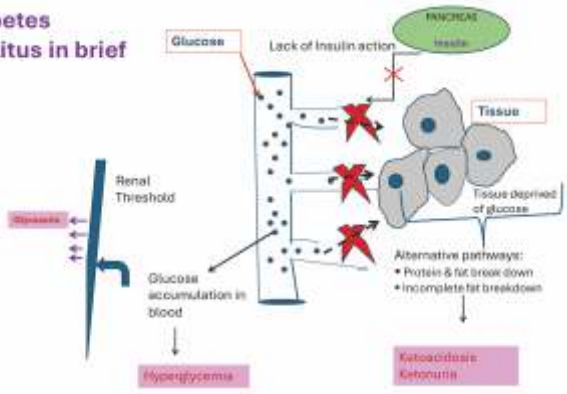


- Diabetes mellitus
- Insulinoma

DIABETES MELLITUS

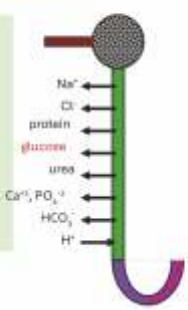
- Type 1 (Insulin Dependent)
  - absolute insulin deficiency
  - Usually all dogs
  - 40% cats
- Type 2 (Non-insulin Dependent)
  - Insulin is present, but ineffective
  - More common in cats

Diabetes mellitus in brief



Evaluating Glucosuria

- Renal threshold for glucose reabsorption
  - Cats, 220–290 mg/dl
  - Dogs 180–220 mg/dl



Diabetes mellitus : Clinical signs

- Polyuria : osmotic diuresis
- Polydipsia: Compensatory
- Polyphagia: inhibition of "hunger centre"
- Weight loss

The severity of these signs is directly related to the severity of hyperglycemia

- May be inappetance
- Dullness
- Emesis

Diabetes mellitus : diagnostic testing

✓Fasting hyperglycemia : preferably use Fluoride Oxalated blood.

✓Glycosuria (Glucosuria)

✓Ketonuria

DM: Other Laboratory findings

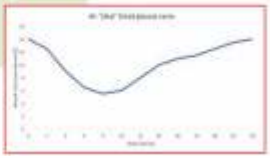
- CBC:
  - Polycythemia & raised plasma proteins (dehydration)
  - Stress and/or inflammatory leukogram
- Hyperlipidemia :
  - raised TGs & Cholesterol
- Ketonemia
- Increased anion gap acidosis :
  - due to ketoacids and +/- Lactic
- Increased hepatic enzymes :
  - due to altered metabolism
- Other :
  - Hypersthenuria (dehydration) / Hyposthenuria (osmotic diuresis)
  - ??Pyuria
  - Electrolyte abnormalities

Establishing the diagnosis:

- "Triad" → Hyperglycemia+Glucosuria+Ketonuria
- Appropriate clinical signs & persistent fasting hyperglycemia and glucosuria.
- Ketonuria → Diabetic ketoacidosis (DKA)
  - Presence of Hyperglycemia differentiates DM from renal glucosuria (hyperglycemia absent) causes
    e.g. Fanconi's syndrome
  - Presence of Glucosuria differentiates DM from other causes of hyperglycemia in which glucosuria is not a feature
    eg. Glucocorticoid stress, ?Hyperadrenocorticism.
  - In cats stress-induced hyperglycemia (glucocorticoid effect) is a common problem, but glucosuria usually absent.

To confirm Latent or equivocal cases of DM

- **Glucose Tolerance Test (GTT) :**
  - Intravenous or oral glucose administration
  - blood samples (FUOx) taken every half hour for 2 hours, and every hour subsequently upto 6 hours.
  - Establish glucose levels & chart a graph
  - In a healthy animal, glucose ~doubles at 2 hrs, then recedes to baseline or below at 5/6 hrs
  - Diabetic / prediabetic patient : the glucose peak is much higher, & remains above baseline at 5-6 hrs (decreased glucose tolerance)
- Limitation:
- Labor and time intensive.



Tests used to monitor treatment for DM

- **Serial blood glucose curve:**
  - Represents patients blood glucose level over the course of the day.
  - Helps to establish insulin dose & dosing intervals.
  - A blood sample is taken, the glucose value determined, and the patient given a dose of insulin. Ideally, blood glucose measurements are then taken every 1.5 to 2 hours for 12 hours.

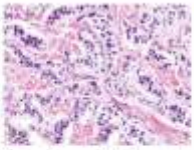
Serum Fructosamine evaluation:

- Glucose binds albumin → fructosamine is formed
- finding of increased fructosamine indicates persistent hyperglycemia.
  - Because the half-life of albumin in dogs and cats is **3 to 4 weeks,** the fructosamine level indicates the average serum glucose level over that period
  - The test is not affected by stress. However, this test cannot evaluate whether the patient had instances of hypoglycemia during the previous few weeks.

Tests used to monitor treatment for DM

- **Serum Glycosylated Hemoglobin:**
  - Glucose binding to HB
  - the finding of increased glycosylated hemoglobin indicates persistent hyperglycemia.
    - Because the reaction that binds glucose and hemoglobin cannot be reversed, the level of glycosylated hemoglobin is a reflection of the average blood glucose concentration over the life span of an erythrocyte: 3 to 4 months in dogs and 2 to 3 months in cats.
    - but cannot evaluate whether the patient had instances of hypoglycemia during the previous few months

INSULINOMA



Functional Beta cell neoplasia →increased insulin production

- **HISTORY & CLINICAL SIGNS:**
  - Muscular tremors,
  - weakness,
  - exercise intolerance,
  - confusion, convulsions/coma.
- **Lab Findings :**
  - Marked hypoglycemia
  - elevated insulin levels

Diagnostic test : Insulin to Glucose Ratio

Principle: Blood insulin should be low when blood glucose is low. Finding a blood insulin above reference range with low glucose confirms insulinoma

- Collect non-fasting blood, split sample, freeze part, measure glucose on the other.
  - If glucose <60 mg/dl → test insulin on the other sample.
  - If glucose 60-80 mg/dl → remove food & measure glucose every 2 hours until level falls to <60 mg/dl, then measure insulin
- **Result:**
  - Insulin level >25-30μU/ml in hypoglycemic patient indicates hyperinsulinism/insulinoma

DIABETES INSIPIDUS *("Water diabetes")*

Lack of ADH (Antidiuretic hormone) production (Central DI) or unresponsive renal tubules for ADH (Nephrogenic)

- **Normal Pathway:**

DIABETES INSIPIDUS *(Contd.)*

- **Neurogenic/ Central:** Hypothalamus-pituitary based
- **Nephrogenic :**
  1. **Primary** : unknown or familial, rare cause
  2. **Seconadry/acquired**: Most common.
     Hypercalcemia, Hypoadrenocorticism, Hyperadrenocorticism, Canine Pyometra, Diabetes mellitus, Renal medullary washouts etc.

- Psychogenic polydipsia → renal medullary washout → reduced tubular tonicity → lack of ADH effect

Neurogenic (Central) DIABETES INSIPIDUS *(Contd.)*

- **Clinical signs/history:**
  - Marked Pu/Pd
  - Eventual cachexia
- **Laboratory Findings:**
  - Consistently very low specific gravity (1.001 t0 1.006)
  - Other lab values usually normal
- **To Diagnose/Confirm equivocal cases**
  Consider using water deprivation test, as long as the patient is not dehydrated/uremic/vomiting
- To differentiate neurogenic & nephrogenic forms, use water deprivation/vasopressin (ADH) test

Water deprivation-Vasopressin test

- **Indication :**
- Differential diagnosis of Pu/Pd when ADH deficiency /ineffectiveness is suspected
- Not used if patient is dehydrated, uremic or vomiting
- **Procedure:**
- Measure urine SG & body weight.
- Remove water, measure body wt & urine SG hourly; end test if body weight drops by 5% OR after 6 hrs OR when urine SG >1.020
- After 6 hours, SG still <1.020 indicates D.I.
- Then consider ***vasopressin test*** to differentiate DI forms (neurogenic vs nephrogenic)

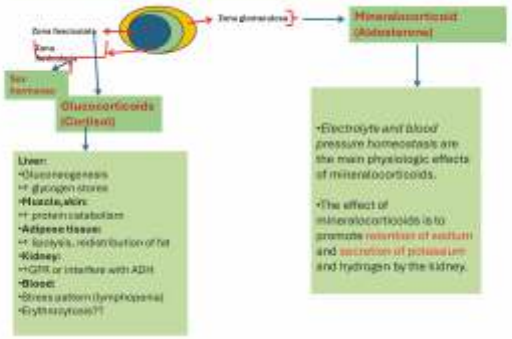
Water deprivation-Vasopressin test (Contd.)

- ***Vasopressin (ADH) test***
- Once the diagnosis of D.I is established with water deprivation test, it can be continued as Water-deprivation-Vasopressin test
- Vasopressin (ADH) is administered and urine SG is measured
- If SG now >1.020, it is the neurogenic form
  If SG still <1.020, it is the nephrogenic form or Psychogenic Pu/Pd
  - May need to "prime" tubules to ADH if chronically Pd

ADRENAL GLAND

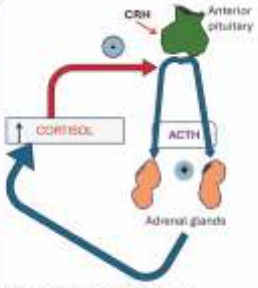
- **Hyperadrenocorticism**
- **Hypoadrenocorticism**

Adrenal gland:



The pituitary-adrenal axis:

- Corticotropin Releasing Hormone (CRH) stimulates the production and secretion of ACTH from the pituitary gland.
- ACTH stimulates the production and release of Cortisol and Aldosterone from the adrenal gland.
- In the negative feedback system increasing the cortisol inhibits the secretion of CRH and ACTH.



Regulation of Cortisol in Normal animals

Hyperadrenocorticism *(Cushing's disease)*

- **Hyperadrenocorticism (Cushing Syndrome)**
  - Primarily a disease of middle-aged to older dogs (7-12 years).
  - Rare in cats, when present, is usually pituitary in origin.
  - Other species: Horses, Ferrets
- May be caused by:
  - **Pituitary dependent hyperadrenocorticism (PBH) (85%). Tends to affect small-breed dogs**
  - **Functional adreno-cortical tumors (15%)Tends to affect large-breed dogs (AT /ABH)**

HAC : Clinical signs & history

- Dermatologic disease
  - Bilateral Symetrical alopecia, thin skin, Hyperpigmentation, comedones etc.
- Heat intolerance / Panting
- Abdominal enlargement or "Pot Belly"
- Obesity
- PU/PD
- Polyphagia
- Recurrent urinary tract infections

HAC: *Common Clinical Pathology Findings*

- **CBC**
  - **Stress Leukogram** (mature neutrophilia, monocytosis, lymphopenia & eosinopenia), with mild Hemoconcentration
- **Serum Chemistry**
  - **Markedly Increased ALP** – (glucocorticoid induced isoenzyme),
  - Mildly raised ALT.
  - Hyperglycemia
    (secondary to insulin antagonism by cortisol and due to gluconeogenesis by cortisol)
    ** *but glucosuria is rare or usually absent*
  - Raised cholesterol : due to increased lipolysis
  - Increased blood cortisol : but not diagnostic
- **Urinalysis**
  - Bacteruria without pyuria
  - Proteinuria secondary to glomerulosclerosis
  - Urine specific gravity often decreased (hyposthenuria/dilute)

HAC: *establishing a diagnosis*

- The diagnosis should be based upon suggestive clinical signs in conjunction with supporting minimum database abnormalities (Stress leukogram,, increased ALP,high serum cholesterol, hyperglycemia) and confirmed via an appropriate screening test & specific tests.
  - **Note:** If screening/specific test results are inconclusive, test the patient again 3-6 months later, rather than subject the patient to treatment without a definitive diagnosis.

HAC: *Screening tests 1*

- **Urine Cortisol:CreatinineRatio (UCCR)**
  - **Dogs with HAC will have high UCCR**
  - **But dogs with moderate to severe non-adrenal illness and stress also exhibit increased ratios (False positives).**
  - **If UCCR is normal in suspected dogs: will rule out HAC**
  - An elevated ratio should always be confirmed with an ACTH Stimulation or LDDS test.
    - Should be performed on urine sample collected by the owner at home, since stress/excitement during vet visit can create a FP result. First urine of the day is the best sample to use.

HAC: *Screening tests 2*

- **Alkaline phosphatase (AP) isoenzyme heat resistance test:**
  - Usually markedly high (10x) AP in cushingoid dogs, which is a heat resistant isoenzyme

  Test:
  - Heat plasma @ 60°C for 3 min & measure AP
  - AP value unchanged or near base value → suggests Cushings
  - AP value below base value → suggests liver disease
- But stress may cause false positives results

HAC : *Diagnostic tests 1*

- **Principle** of suppression of the pituitary-adrenal axis.

Low Dose Dexamethasone Suppression Test (LDDS):

- Dexamethasone is administered at a low dose to cause negative feedback to the pituitary gland.
  - In health, this negative feedback produces decrease in endogenous ACTH secretion and a resultant decrease in circulating cortisol concentration.
  - In hyperadrenocorticism (PBH and ABH), this negative feedback is lost.
- Dexamethasone is the ONLY synthetic corticosteroid that does not cross-react with the cortisole assay.

HAC : *Diagnostic tests 1*

- **Low Dose Dexamethasone Suppression Test (LDDS)**
  - Very good sensitivity, fairly good specificity
  - Obtain basal cortisol levels
  - Give 0.01 mg/kg Dexamethasone I/M
  - Analyse cortisol levels @ 4 hr & 8 hr
- **Interpret:**
  - Normal dog: cortisol value <40 nmol/l at 4-8 hrs
  - Hyperadrenocorticoid dog : basal cortisol high & remains > 40 nmol/l at 4 hr and 8 hr

HAC : *Diagnostic tests 2*

- **The ACTH Stimulation**
  - Used to:
    - "Screen" for/ diagnose spontaneous hyperadrenocorticism. Adrenal glands that are enlarged because of chronic pituitary stimulation by ACTH, or that are neoplastic, will show an exaggerated response to exogenous ACTH.
- Other uses:
- Identify iatrogenic hyperadrenocorticism (due to prednisone treatment)
- Monitor Mitotane (lysodren) and Trilostane treatment.
- Diagnosing Addison's disease (Hypoadrenocorticism)

HAC : *Diagnostic tests 2*

- **The ACTH Stimulation:**
  - Fairly good sensitivity, very good specificity
  - Obtain basal cortisol levels
  - Give 250 ug Synacthen I/v
  - Analyse cortisol levels @ 1 hr.
- **Interpret:**
  - Normal dogs : post stimulation cortisol may double basal level (but remain <400nmol/L)
  - HAC : post stimulation cortisol may be 3-5 times more than basal value (>500nmol/L)

HAC : *tests to differentiate PBH vs ABH*

1. High Dose Dexamethasone Suppression (HDDS)

- Differentiation Test
- Works on the principle that :
- ACTH secretion has already been suppressed maximally in dogs with **functioning adrenal tumors (ABH/AT)**
- Thus, high dose dexamethasone will not suppress the serum cortisol concentration.
- However, in dogs with **PBH, high doses of dexamethasone suppress ACTH and therefore cortisol secretion.**

➢ Note: Dogs with pituitary macroadenomas (25-30% of dogs with pituitary-dependent disease) fail to suppress.

HAC : *tests to differentiate PBH vs ABH*

1. High Dose Dexamethasone Suppression (HDDS)

- Obtain basal cortisol levels
- Give 0.1 mg/kg Dexamethasone I/M
- Analyse cortisol levels @ 4 hr & 8 hr
- **Interpret:**
  - Hyperadrenocorticoid dogs :
    - PBH: cortisol value <40 nmol/l at 4-8 hrs (Suppressed)
    - AT (ABH): Cortsol value high, stays high (not suppressed)

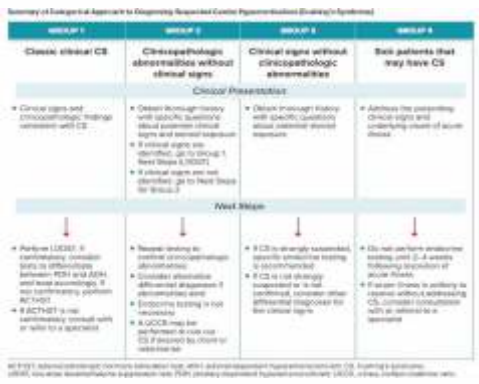
HAC : *tests to differentiate PBH vs ABH*

2. Endogeneous Plasma ACTH Concentration (e ACTH)

- **Most reliable way of discriminating between PBH and ABH.**
  - Dogs with ABH/iatrogenic Cushings have low to undetectable ACTH concentrations.
  - Dogs with PBH exhibit increased ACTH concentrations.

HAC : *tests to differentiate PBH vs ABH*

- **Other "non-clin path" tests:**
  - Ultra sound, CT, MRI:
  - Useful along with clinical signs & lab data
  - But still has limitations in classifying or identifying the exact nature of the adrenal lesions



Source: 2023 AAHA Selected Endocrinopathies of Dogs and Cats Guidelines, Andrew Bugbee et al, *J Am Anim Hosp Assoc* 2023 59:3 May/Jun 2023.

Hyperadrenocorticism in Cats

- infrequent diagnosis of cats.
- usually have pituitary-dependent HAC.
- Rarely negatively affected by chronic use of exogenous glucocorticoids → the incidence of iatrogenic Cushing's syndrome in cats is much less frequent compared with dogs.
- middle-aged to older cats, with the majority having concurrent diabetes mellitus.
- Hyperglycemia, hypercholesterol, may be stress leukogram.
- LDDS test may be useful – but need to use 0.1 mg/kg dose.

HAC in other species *(FYI only)*

- **Ferrets:**
- Very common
- Hyperplasia/neoplasia of adrenals
  - Mainly adrenal based, but sex hormones are major reason for the disease condition (esp. estradial or estradial precursors)
- Similar clinical signs (esp. baldness)
- Measurement of serum estradial/estradial prescursors

Source:

HAC in other species *(FYI only)*

- Equine Cushing's like syndrome (Pitutary pars intermedia dysfunction/PPID):
  - Aged horses
  - Hirsutism, laminitis, abnormal fat distribuition, hyperhidrosis (i.e.enhanced sweating), intermittant infections/fever
- **Tests:**
  - LDDS, ACTH stimulation
  - eACTH measurement
  - TRH response test

*TRH = Thyrotropin releasing hormone

HYPOADRENOCORTICISM

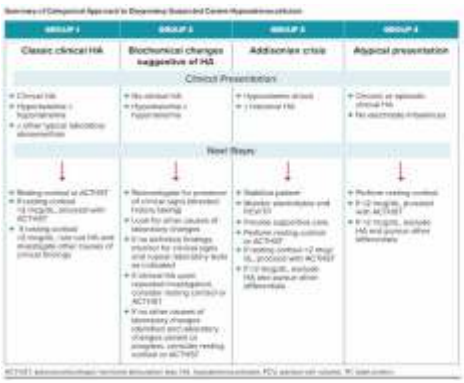
- **Primary hypoadrenocorticism (Addison's Disease)**
  - Deficiency of both Glucocorticoid and Mineralocorticoid secretion from the adrenal cortices (primary adrenocortical failure).
- **Secondary hypoadrenocorticism**
  - Pituitary ACTH deficiency, causing Decreased Glucocorticoid secretion.
- **Atypical Addison's Disease :**
  - Failure of the adrenal glands to produce Glucocorticoids, but mineralocorticoids are produced.

HYPOADRENOCORTICISM

- **The disease:**
  - Most commonly diagnosed in young female dogs and often has an immune-mediated cause.
  - Certain breeds such as Leonbergers, Standard Poodles, and Portuguese Water Dogs are at increased risk.
  - **Clinical findings:**
    - Chronic form : Bradycardia, intermittent vomiting, diarrhea, weight loss, lethargy, anorexia and weakness.
    - Acute : bradycardia, sudden collapse, shock, acute dehydration ("Addisonian Crisis")
  - A "waxing-and-waning" course of disease is often present.

HYPOADRENOCORTICISM: Routine Clinical Pathology findings

- **Chemistry:**
  - Severe **Hyponatremia, Hypochloremia, Hyperkalemia**
  - **Na:K ratio less than 23:1 is suggestive, <15:1 is semidiagnostic**
  - Prerenal azotemia secondary to hypovolemia
  - Low urine Sp. Gr. (*Medullary washout due to* Na depletion)
    - ***Caution:*** Dilute urine in the face of azotemia and hyperkalemia may be easily mistaken for acute renal failure.
    - Rechecking after electrolyte and fluid therapy may be useful
    - Hormonal assays are required to differentiate between adrenal disease and renal failure
  - Low blood cortisol levels
  - May be hypoglycemia
- **CBC :**
  - Lymphocytosis and eosinophilia or normal lymphocyte and eosinophil counts in the face of severe metabolic stress (Absence of "Stress" pattern)
  - Hemoconcentration



Source: 2023 AAHA Selected Endocrinopathies of Dogs and Cats Guidelines, Andrew Bugbee et al, *J Am Anim Hosp Assoc* 2023 59:3 May/Jun 2023.

HYPOADRENOCORTICISM : *Definitive diagnosis*

- **ACTH stimulation test:**
  - Obtain basal cortisol levels
  - Give 250 ug Synacthen I/v
  - Analyse cortisol levels @ 1 hr
- **Interpret:**
  - Normal dogs : post stimulation cortisol may double basal level
  - Hypoadrenaocorticoids :
    - Basal value is likely to be low
    - Post stimulation blood cortisol value is low as well

Feline Hyperaldosteronism

- The adrenal gland is the primary producer of the hormone aldosterone → which is responsible in part for sodium and potassium homeostasis.
- Feline primary hyperaldosteronism (PHA):
  - most commonly caused by a unilateral adrenocortical adenoma, with malignant adenocarcinomas reported less commonly.

Feline Hyperaldosteronism

- Middle-aged to older cats.
  - signs are typical of increased potassium loss/hypokalemia and retained sodium.
  - Hypokalemia, usually less than 3 mEq/L, will lead to progressive muscle weakness.
  - The owner may notice reluctance to jump, abnormal gait, lethargy, or cervical ventroflexion.
  - Sudden blindness due to retinal detachment is a consequence of persistent systemic hypertension (SHT).
  - Chronic kidney disease (CKD) is a frequent comorbidity

Feline Hyperaldosteronism

Presentation

- Hypokalemia, frequently under 3 mEq/L, which may not respond well to supplementation.
- Systemic hypertension that may be difficult to control.
- Serum sodium concentrations are usually normal.
- Plasma aldosterone levels are elevated.
- Abdominal ultrasound or other imaging may show adrenal mass.

Diagnostic Red Flags for Hyperaldosteronism

- Hypokalemia with no obvious cause, which may not respond well to supplementation.
- Hypophosphatemia +/- metabolic alkalosis despite azotemia.
- Hypertension that is difficult to control with standard doses of medications.
- Hypertension without concurrent cardiac or thyroid disease.

THYROID GLAND

HYPOTHYROIDISM
HYPERTHYROIDISM

Thyroid Physiology

- T4 is a prohormone that is converted to T3 or reverse T3 within cells
- Greater than 90% of T4 is protein-bound in blood and serves as a storage pool
- Free T4 refers to non-protein bound T4 and is the form that moves into cells where it is converted to T3 or reverse T3
- Within cells T3 binds to receptors and stimulates actions of thyroid hormone in the cell (increased metabolic rate, O_2 consumption, increased heart rate, etc.)

Canine Hypothyroidism

- Deficiency of circulating thyroid hormone caused by destruction of thyroid glands.
  - Lymphocytic thyroiditis(50%)
  - Idiopathic atrophy (50%)
- Hypothyroidism in **cats is almost always an iatrogenic disease that follows treatment for hyperthyroidism**

Canine Hypothyroidism

- Most dogs are between 4-10 years of age
- Clinical signs:
  - Lethargy, weight gain without appetite increase
  - Hair loss on trunk and tail (Rat Tail)
  - Dry skin
  - Cold intolerance
  - Slow heart rate
- Chronic ear and skin infections (bacterial)

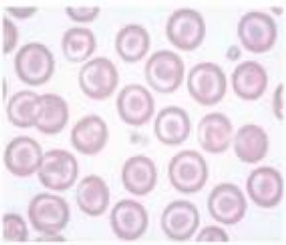
Canine Hypothyroidism

Clinical Pathology abnormalities:

- Fasting hyperlipidemia (approx. 75% of dogs)
  - Cholesterol: 350 to >1500 mg/dl
  - Triglycerides: 150 to >2000 mg/dl

Hematology:

- Non-regenerative anemia (approx. 35% of dogs) : PCV between 25% to 35%
- Increased leptocytes



Canine Hypothyroidism

- **Diagnosis of canine hypothyroidism**
  - **Total T4 measurements (tT4):** low levels
    - But, as a sole test →Often inadequate for diagnosis (as non-thyroidal illness can lower T4 value)
    - **If the serum tT4 concentration is WRI** Hypothyroidism can be excluded. (Good specificity)
    - (except in approximately 5% of dogs where anti-T4 antibodies exist and lead to a falsely elevated T4 value.)
  - An **increased serum TSH concentration** adds specificity to the diagnosis
  - **A decreased [fT_4]$_{ed\ (equilibrium\ dialysis)}$ is highly specific for hypothyroidism**

Canine Hypothyroidism

❖**Diagnostic criteria/ approach:**

- Appropriate clinical signs & history
- Routine lab: Hyperlipidemia±Mild anemia
- Diagnostic tests:
  a. Baseline serum total T4 →**Low**
  b. Serum free T4 by dialysis →**Low**
  c. Serum TSH →**High**
  d. Thyroglobulin antibody (TgAA) →Positive (If autoimmune) Or Negative (if idiopathic)

Caution: Many dogs are inappropriately diagnosed as having hypothyroidism solely on the basis of a low Total T4 *test*

Interpretation of Thyroid profile results in dogs

(tT4)	(fT4)ed	(TSH)	TgAA	Interpretation
WRI	———	———	———	Rules out Hypothyroidism, **unless (tT4) falsely raised due to TgAA
↓	↓	↑	Positive	Hypothyroidism – Lymphocytic thyroiditis
↓	↓	↑	Negative	Hypothyroidism – Thyroid atrophy
↓	↓	WRI	Negative	Euthyroid sickness – non-thyroid illness (MOST usual pattern)
↓	WRI-↓	WRI-↑	Negative	Euthyroid sickness – non-thyroid illness (Unusual pattern)

Sick Euthyroid syndrome:

•Decreased T4 levels due to various diseases other than hypothyroidism.

•If total T4 is the only test available and if it shows low value → then hypothyroidism and sick euthyroid scenario should be considered.

•Examples : Severe pyoderma, diabetes mellitus, Chronic renal failure, liver diseases

Summary of Categorical Approach to Diagnosing Suspected Canine Hypothyroidism

GROUP 1	GROUP 2	GROUP 3
Classic clinical HT	No HT signs with low TT4	Possible HT with normal TT4
Clinical Presentation		
• Clinical HT • Low TT4	• No clinical HT • Low TT4	• Clinical HT • Normal TT4
Next Steps:		
↓ • Measure fT4 and TSH to confirm diagnosis • Treat with supplementation • Monitor levels 4 weeks after starting medication or dose adjustments until controlled, and then every 6 to 12 months	↓ • Review history & medications • Evaluate for NTD • Monitor for clinical signs, retest as indicated	↓ • Evaluate for NTD • Perform fT4ed, TSH, +/- anti-T4 autoABs • Treat with supplementation if indicated • Monitor levels 4 weeks after starting medication or dose adjustments until controlled, and then every 6 to 12 months

Anti-T4 autoABs, anti-thyroxine auto-antibodies; fT4, free thyroxine level; fT4ed, free thyroxine level by equilibrium dialysis; HT, hypothyroidism; NTD, nonthyroidal disease; TSH, thyroid-stimulating hormone level; TT4, total serum thyroxine level.

Source: 2023 AAHA Selected Endocrinopathies of Dogs and Cats Guidelines, Andrea Bugbee et al, J Am Anim Hosp Assoc 2023 59:3 May/Jun 2023.

Feline Hypothyroidism

- Mostly Iatrogenic.
- Naturally occurs rarely.
- Diagnostic testing like canine but need to rule out most of the non-thyroidal illnesses.
- Many lab findings are similar, azotemia might be additional feature.

Congenital Disease
- Slow growth rate
- Short limbs
- Broad head
- Lethargy
- Constipation
- Mental dullness
- Retained deciduous teeth
- Gingival overgrowth
- Retained kitten hair coat

Iatrogenic or Adult-Onset Disease
- Lethargy
- Weight gain, obesity
- Seborrhea, poor haircoat
- Poor regrowth of hair
- Inappetence
- Bradycardia

THYROID GLAND

Feline HYPERTHYROIDISM

Feline Hyperthyroidism

- Most common endocrinopathy in cats.
- Results from the excessive and autonomous secretion of thyroid hormone from the thyroid gland
- **Histologic findings include:**
  - Adenomatous hyperplasia →Common
  - Thyroid adenoma
  - Thyroid carcinoma → less than 5%, but very aggressive

Feline Hyperthyroidism

- **Thyroid lobe involvement is variable**
  - Single thyroid lobe (30%)
  - Both lobes, asymmetric in size (60%)
  - Both lobes, symmetric in size (10%)
  - Multiple masses (<2%)
- Less than 5% of cases involve ectopic thyroid tissue most often found in the thoracic cavity

Feline Hyperthyroidism

- Mean age: 12 years (range 4 to 20 years)
- **History**: Polyphagia and weight loss, hyperactivity and aggression
- **Findings on physical examination include**:
  - Palpable thyroid nodule
  - Hyperactive patient
  - Hair loss, patchy alopecia, matted hair
  - Tachycardia
  - Thin or cachectic (not dehydrated)

Feline Hyperthyroidism

- **Routine laboratory findings:**
  - **Erythocytosis/polycythemia** : approx. 50% of cases. (May be due to thyroid hormone bone marrow stimulation, or increased EPO production.)
  - **Leukocytosis, lymphocytosis** : Excitement response
  - **ALT and ALP- mild increases**: approx. 75% cases (May be due to malnutrition, congestive heart failure, hepatotoxic effects of thyroid hormone, or hepatic hypoxia)
    - **Raised Urea and Creatinine** : coincidental findings, age related CRF

Feline Hyperthyroidism

- **Establishing diagnosis:**
  - Appropriate clinical signs, may be routine lab changes.
  - Palpation of a thyroid nodule
  - Documenting an increased serum T4 concentration
- **Diagnosis:**
- **Basal tT4 :**
  - high value (>4.0 µg/dl)is diagnostic in a cat with typical features.

Feline Hyperthyroidism

(Diagnosing equivocal cases)

❖**T3 suppression test:**

Principle: Normally T3 initiates a negative feedback upon T4 release, thereby suppressing levels.

Protocol:
- Measure basal T4 levels from blood, pre-T3 administration
- Give synthetic T3 (sodium liothyronine) orally for 3 days
- Measure basal T4 from blood, post-T3 administration

Interpret:
- **Normal cat**: 50% suppression in basal T4 post-admin.
- **Hyperthyroid cat**: pre and post levels of basal T4 both high (fail to suppress)

Summary of Categorical Approach to Diagnosing Suspected Feline Hyperthyroidism

GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5	GROUP 6
Classic clinical disease	Possible FHT with probable NTD	Enlarged thyroid without clinical FHT	Subclinical FHT	Clinical FHT with confirmed NTD	Clinically normal
Clinical Presentation					
• Clinical FHT • Elevated T4	• Clinical FHT • Normal T4	• No clinical FHT • Normal T4 • Enlarged thyroid gland	• No overt clinical FHT but some PE findings suggestive of FHT • Elevated T4	• Clinical FHT • Elevated T4 • One or more concurrent diseases	• No clinical FHT • No palpable nodule • Elevated T4
Next Steps:					
↓ • Consider and recommend treatment options for FHT	↓ • T4 with fT4ed assays 2–4 weeks after initial exam • Evaluate for NTD • Consider T3 suppression or thyroid scintigraphy	↓ • Monitor clinical signs • Repeat T4 assay in 6 months	↓ • Repeat T4 assay in 2 weeks • If elevated, treat for FHT • If T4 is normal, reevaluate in 6 months	↓ • Treat for FHT • Institute appropriate management of concurrent diseases	↓ • Confirm T4 • If normal, monitor clinical signs and repeat T4 in 6 months • If elevated, treat for FHT

FHT, feline hyperthyroidism; fT4ed, free thyroxine measured by equilibrium dialysis; NTD, nonthyroidal disease; PE, physical examination; T3, triiodothyronine; T4, total serum thyroxine concentration.

Source: 2023 AAHA Selected Endocrinopathies of Dogs and Cats Guidelines, Andrea Bugbee et al, J Am Anim Hosp Assoc 2023 59:3 May/Jun 2023.

•PARATHYROID GLAND
•Hypoparathyroidism
•Hyperparathyroidism

Parathyroid Glands *(FYI only)*

- **Parathormone (PTH)**
  - Produced by the parathyroid gland in response to hypocalcemia.
  - Although serum phosphorous has no direct effect on PTH secretion, hyperphosphatemia may cause a reciprocal decrease in serum calcium and thus, indirectly stimulate PTH release.
- The net effect of PTH is increased serum calcium, decreased serum phosphorus (by increasing renal excretion of phosphorus).

Parathyroid Glands *(FYI only)*

- **PTH promotes the following:**
  - Calcium release from bone
  - Accelerated formation of the active form of vitamin D
  - Calcium absorption from the intestine
  - Calcium re-absorption by the renal tubules
  - Phosphorus excretion by the kidney

Hypoparathyroidism

- Absolute or relative deficiency in PTH secretion leading to hypocalcemia
- **Primary hypoparathyroidism:** Rare
  - **Dogs** - idiopathic immune-mediated parathyroiditis, rarely neoplasm and amyloid infiltration.
  - **Cats** -Most commonly iatrogenic secondary to damaged or removed parathyroid glands during thyroidectomy for hyperthyroidism

Hypoparathyroidism

- **Signs: (Dogs & Cats)**
  - Seizures,
  - muscle trembling, twitching and fasciculation,
  - tense splinted abdomen
  - ataxia/stiff gait
- **Lab findings:**
  - Hypocalcemia (<6.5mg/dl)
  - Hyperphosphatemia
- **Diagnosis:**
  - Low serum PTH concentrations
  - Frozen serum sample
  - Patients with other processes causing hypocalcemia(renal failure) have normal to high PTH concentrations

Functional Hypoparathyroidism

- **Cow, Sheep :** very common & important
  - milk fever
  - Parturient paresis
- **Bitch, mare :** less common
  - Eclampsia
- **Diagnosis:**
- Very low blood Calcium
- Often, mildly low Phosphorus or Magnesium

Pathophysiology:

- In cows (fed with adequate Ca^{++} prior calving)

↓

Quiescent parathyroid

↓

Inability to respond a sudden demand for Ca^{++} after calving

↓

Hypocalcemia (Milk fever)

Hyperparathyroidism

- A pathologic, sustained high circulating concentration of parathyroid hormone (PTH) : due to hyperplasia/hypertrophy
- **Primary hyperparathyroidism:** very rare
  - In older dogs : adenoma of the parathyroid gland(s) causing autonomous and unregulated PTH secretion
- **Secondary Renal hyperparathyroidism :** Most Common
  - Inability to excrete PO_4, renal calcium loss and reduced GI absorption of calcium due to deficiency in calcitriol production by renal tubular cells
    - → stimulates parathyroid → hyperplastic
    - → ↑ PTH → bone demineralization → osteodystrophia fibrosa
- **Second. Nutritional Hyperparathyroid:** Uncommon
  - Excess PO4 or deficient Ca → parathyroid hyperplasia

Primary Hyperparathyroidism

- **Routine Lab findings:**
  - High serum calcium concentration
  - low or low normal serum phosphorus concentration
- **Diagnosis:**
- High Serum PTH levels
  - Immediately separate blood
  - Freeze the serum (Frozen transport)

With secondary hyperparathyroidism (Renal failure)

- **Lab findings:**
  - High Phos., WRI-low calcium
  - Other findings of renal failure (azotemia, isosthenuria)
  - Serum PTH levels increased

Pseudo hyperparathyroidism (Humoral Hypercalcemia of malignancy/HHM)

Parathyroid hormone related protein (PTHrP):

- Anal sac adenocarcinoma
- Some lymphomas
- A few carcinomas

PTHrP has same effect as normal PTH

Lab. Changes:

Hypercalcemia

May be decreased Phos.

Normal PTH

Raised PTHrP

Anal sac adenocarcinoma (dogs) is one of the malignant neoplasms commonly associated with "hypercalcemia of malignancy"

Guidelines for evaluation of Ca and Phos together

Ca and Phos ions usually evaluated together due to physiologic relationship

Both can be increased in young animals with active bone remodeling

With many disease processes, the changes in Calcium are most consistent, phosphorus may or may not fit the pattern

Approach Hypocalcemia (Dogs and Cats)

- If hypocalemic
  - Check albumin concentration and acid/base status
    - If hypoalbuminemic, either correct for albumin or, better yet, check ionized calcium
  - If not hypoalbuminemic,
    - ✓Acute pancreatitis OR
    - ✓Consider primary renal
    - ✓or GI (malabsorptive) disease
    - ✓Primary hypoparathyroidism is rare

Approach Hypercalcemia (Dogs and Cats)

- For significant hypercalcemia (presenting signs)
  - ✓Consider malignancy
  - ✓Hyperparathyroidism
- For mild to moderate hypercalcemia
  - Rule out acidosis
  - Consider rule outs above...but also ?renal disease (if Ionized Ca used for analysis, can occur in 10% cases)
  - Addisons (hypoadrenocorticism)
  - Toxins, Vitamin D toxicosis etc

Additional consideration for Ca & P interpretations (FYI)

- The product of these two analytes is predictive of soft tissue mineralization.
- A product of Ca X P >70 indicates likely possibility of soft tissue mineralization.
- A product of Ca X P > 90 indicates mineralization is occurring.
- Use total serum calcium in the product formula
- Typical locations for mineralization: blood vessels, kidneys, stomach, lung, heart, intercostals and intestinal sub mucosa.

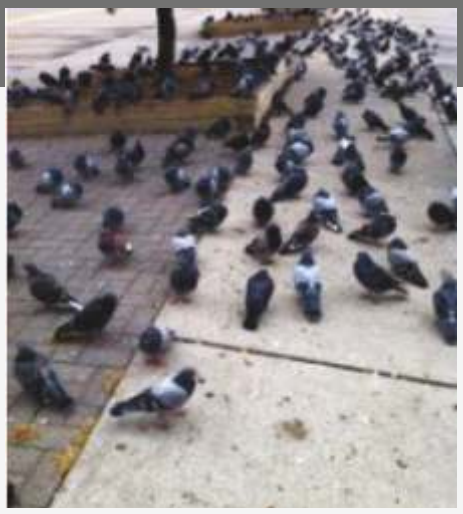
Differential Diagnosis for Hypercalcemia (expected hormone & mineral patterns):

Disease	tCa^{2+}	Phos	iPTH	PTHrp	Vit.D
Primary hyperparathyroidism	Increased	low	WRI-increased	WRI	WRI
HH malignancy	Increased	low	Low	Increased	WRI
Excess VitD	Increased	increased	WRI-low	WRI	Increased
Renal Fail (horse)	Increased	WRI-low	Low	WRI	n/a
Hypoadrenocorticism	Increased	WRI-increas	WRI-low	WRI	WRI

Differential Diagnosis for Hypocalcemia (expected hormone & mineral patterns):

Disease	tCa^{2+}	Phos	iPTH	PTHrp	Vit.D
Renal fail. (Dogs,cats)	WRI-low	Increased	Increased	WRI	WRI-low
Hypoalbuminemia	Low	WRI	WRI	WRI	WRI
Primary Hypoparathyroidism	Low	WRI-increased	WRI-Low	WRI	WRI
Milk Fever	Low	Low	WRI-increase	WRI	WRI-increase

Prolonged Close Proximity to Pigeons can cause Lung Disease in Humans.



We as veterinarians must be aware and make people aware.

The increasing population of Pigeons in cities in India has to be looked into very seriously. There has been as per respiratory physicians' observations a steady rise in lung diseases including Bird breeders' disease also called as Hypersensitive pneumonia. It is commonest form of interstitial lung disease. Typical symptoms in humans are cough and breathlessness on exertion. The common causes are exposure to pigeon droppings in areas where pigeon feeding is done, other factors contributing to this condition are overcrowding, construction work and damp walls at home.

Hypersensitive pneumonia is an immune disorder caused by inhaled allergens. Pigeon dropping and dust that arises when droppings are swept of surface is the most common allergen that causes this condition. The droppings contain fungi like aspergillus which when enters the human lung through inhalation causes Histoplasmosis which leads to Bird breeders' disease. Prevention is possible by putting bird nets, avoiding spending time near pigeon feeding or breeding area or cages of pigeon birds. If bird cages are to be cleaned then its better to wash them with water instead of dusting them or vacuum cleaning them.

Scaling up to New Challenges!!

Dr. Nishit Gokarn

Veterinary dentistry, though still in its early stages in India, is steadily and rapidly evolving. As more complex dental cases arise, veterinarians must be ready to embrace new challenges and techniques. This case report highlights a recent case of root pulp exposure of the Maxillary and mandibular canine in a working Belgian Malinois, treated with a root canal and a crown placement. The successful outcome allowed the dog to return to its full working capacity, demonstrating how modern veterinary dentistry can have a transformative impact on working animals.

A 3-year-old working Belgian Malinois, trained for protection and law enforcement work, presented with a fracture in the right maxillary (104) and left Mandibular (304) canine tooth. The fracture exposed the pulp, causing significant pain and posing a high risk for infection. As this was a working dog that relied heavily on its bite strength, extraction was not a viable option. Preserving the tooth was crucial for the dog's continued effectiveness in discharging its duties.

Given the nature of the injury and the dog's role in high-intensity bite work, we opted for a root canal followed by the placement of a protective crown. The root canal involves removing the damaged pulp, disinfecting the canal, and sealing it to prevent further infection. The procedure was carefully guided by dental X-rays to ensure precision and to ensure we reach the apex of the tooth.

Once the root canal was completed, the next challenge was to restore the tooth's strength and functionality. A metal crown was chosen for its durability and ability to withstand the stress of bite work. The crown needed to be custom-fitted to ensure proper alignment and comfort for the dog.

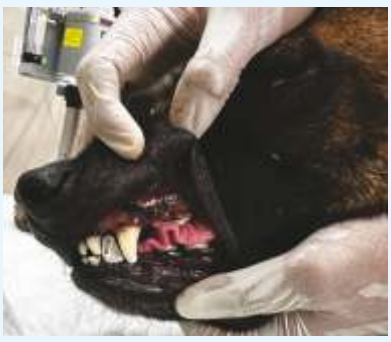
Here, we must extend our deepest gratitude to our human dental colleagues, who generously guided us through the crown placement process. Their expertise in dental impressions and crown fittings was invaluable, and with their assistance, we were able to create a perfect crown that restored the dog's full dental function.

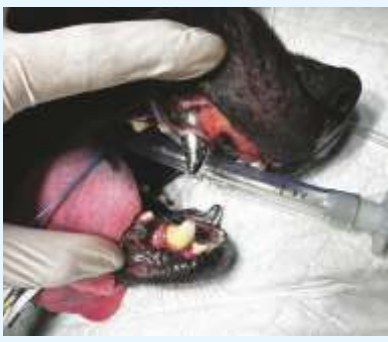
The Belgian Malinois had an uneventful recovery and was able to return to its duties within a four weeks. The crown held up well under the demands of bite work, and regular follow-up checks confirmed the tooth was functioning normally. There was one incident of the crown falling off but it was replaced with a better fitting one within a week. The success of this case underscores the importance of advanced dental care in preserving not only a pet's health but also its professional capabilities.

This case highlights the growing role of veterinary dentistry in modern animal care. In the past, such cases may have resulted in the extraction of the tooth, leading to compromised performance for working animals. However, with advances in dental techniques and the help of skilled colleagues, we can now offer solutions that maintain the health and abilities of these animals.

Veterinary dentistry is still an emerging field, and many practices have yet to explore its full potential. However, this case demonstrates how important it is for veterinarians to embrace these new challenges and techniques. The ability to perform complex procedures such as root canals and crown placements can significantly improve the outcomes for working animals and pets alike.

We would like to express our heartfelt thanks to our human dental colleagues, whose guidance was





essential to the success of this case. Their expertise in creating a high-quality impression for the crown ensured the best possible outcome for our patients. This collaboration between veterinary and human dentistry was key to restoring the Belgian Malinois to full working condition, and we look forward to more such partnerships in the future.

Veterinary dentistry holds great promise for improving animal welfare and functionality. This case of root pulp exposure in a working Belgian Malinois serves as a reminder of the potential that advanced dental procedures offer. Veterinarians must stay open to learning and integrating these techniques into their practices to provide the best possible care for their patients.

The journey of veterinary dentistry is just beginning, and by scaling up to meet these challenges, we can ensure a brighter, healthier future for all our patients.

Ablation of Submandibular Cystic Adenoma in Indian Rock Python (Python Molurus)

Dr. Pradnya Pethe and Dr. Vinaya Jangle

An Indian Rock Python (Python molurus) was rescued by SGNP Wild Animal Rescue team from Aarey Colony Goregaon. The said python was initially examined by Dr. Vinaya Jangle, Veterinary Officer SGNP. On preliminary examination of the python, it was observed that the growth was obstructing the complete opening of the buccal cavity thereby preventing the python from its natural mechanism of ingesting of prey. So, the python was fed mixture of raw egg and water, through feeding tube.

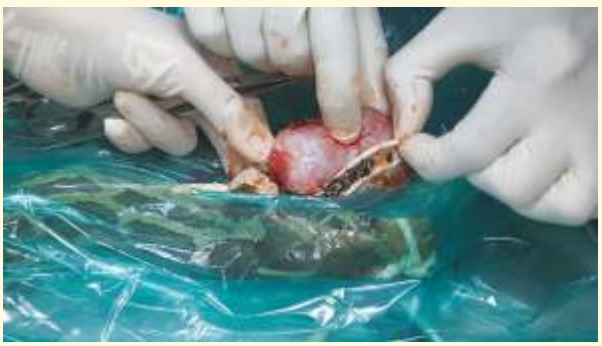
The case was further referred to Dr. Pradnya Pethe for further surgical intervention.

A radiograph of the skull was taken to ascertain the extent of the growth. The python was alert and aggressive. Entire biometrics of the snake with length, weight, shedding history was taken as part of preanesthetic assessment.

The python was given induction GA with Tiletamine & Zolazepam (Zoletil) combination @ 2.5 mg/kg body weight intramuscularly. Inj Meloxicam was given @ 0.2mg/kg IM. Thereafter the non-cuffed ET tube was passed in the wind pipe of the python. Initially the python was well ventilated with oxygen flow rate of 2 lit./min. Isoflurane gas was given @ 3% through non rebreathing system until the righting reflex had ceased. During entire surgery the python was provided assisted ventilaton at the rate of 4-6 breaths / min. The entire growth weighing approx. 140 gms was excised surgically. The wound was sutured with Vicryl No.3-0. The excised growth was sent for histopath analysis.

Post operatively, the python was kept under warm condition till normal recovery. Injectable antibiotics and wound dressing were done on alternate days to avoid handling stress. The wounds healed normally in 10 days. After complete healing, the python was offered live chicken weighing approx 800 gms for consumption which it gulped normally. After one more natural feeding after 10 days, the python was released in the natural habitat.

The histopathology reports were suggestive of cystic adenoma (salivary origin).



drools VETERINARY HEALTH

drools®
Feed Real. Feed Clean.

L-PantoCar

Keeping Hearts Strong, Keeping Pet's Happy

Contents - L-Carnitine + D Panthenol

Conditions - Boosts Energy , Improves Metabolism , Corrects Fatugue Strengthens the heart

Recommended Dosage - 1ml Per 10Kg Body weight for Dogs and Cats. If more than 5ml Dose should be divided.

ClindaGuard

The Trusted Guard Against Infections

Contents - Clindamycin Hydrochloride 150mg/ 300mg/ 600mg

Conditions - Toxoplasmosis, Dental infections, Osteomyelitis, Abcesses and Deep Wounds

Recommended Dosage - As directed by your Veterinarian.

DROOLS ARTICLE

Therapeutic Effects of L-Carnitine Supplementation in Dogs with Dilated Cardiomyopathy

Dr. Pooja Chitteni
M.V.Sc (Veterinary Biochemistry)
Veterinary Product Specialist, Drools Pet Food Pvt. Ltd.

Introduction

Dilated Cardiomyopathy (DCM) is a serious and prevalent cardiac condition in dogs, characterized by progressive ventricular dilation and impaired myocardial contractility. This progressive disorder frequently leads to heart failure, especially in large dog breeds such as Doberman Pinschers, Boxers, and Great Danes. Standard treatments typically include ACE inhibitors, diuretics, and beta-blockers, which help manage symptoms but do not address the underlying metabolic disturbances contributing to DCM. Among the emerging therapeutic options, L-carnitine, a naturally occurring compound vital for fatty acid metabolism in the heart has shown potential in enhancing cardiac function and possibly altering the progression of heart disease. This article reviews the potential benefits of L-carnitine supplementation in dogs with DCM, based on clinical studies and observational data.

Key Points: Dogs, Dilated Cardiomyopathy, Fatty acid metabolism, L-Carnitine

L-Carnitine and Cardiac Function

L-carnitine (β-hydroxy-γ-trimethylaminobutyric acid) is a small, water-soluble molecule with a molecular weight of 160. In dogs, L-carnitine is obtained either from dietary protein or synthesized in the liver using the amino acids lysine and methionine, along with essential cofactors like iron, vitamin C, and vitamin B6 (1). Despite being an amino acid derivative, L-carnitine is not utilized for protein synthesis (2). In the body, it is present as free carnitine, short-chain acylcarnitine, or long-chain acylcarnitine, with 95%-98% stored in the cardiac and skeletal muscles (Rebouche, C. J., & Engel, A. G. (3). The heart cannot synthesize L-carnitine and depends on circulating L-carnitine, which is concentrated up to 100 times in cardiac muscle through active transport. Only the L-form of carnitine is biologically active, as the D-form competes with and inhibits L-carnitine's activity and cannot be converted to the L-form.

L-carnitine plays a crucial role in transporting long-chain fatty acids across the mitochondrial membrane, where they undergo oxidation to produce ATP, the primary energy source for myocardial cells (4). The heart derives approximately 60% of its energy from the oxidation of long-chain fatty acids (5). To facilitate this process, a 'carnitine shuttle' is necessary to transport fatty acids into the mitochondria for beta-oxidation (Fig 1). In dogs with dilated cardiomyopathy (DCM), an L-carnitine deficiency hinders the heart's ATP production, leading to weakened myocardial contractility and potential heart failure. Certain breeds may be more prone to DCM due to this deficiency (6). Supplementing with L-carnitine can enhance energy metabolism in myocardial cells, improving cardiac contractility and potentially reversing some of the functional impairments associated with DCM. This supplementation may improve myocardial energy efficiency, boost cardiac output, and alleviate heart failure symptoms, offering therapeutic benefits for affected dogs.

Additionally, L-carnitine helps maintain the intramitochondrial acyl-CoA ratio, preventing the accumulation of acyl-CoA derivatives that could disrupt oxidative metabolism (7). L-carnitine also aids in the removal of excess short- and medium-chain organic acids, supporting mitochondrial detoxification.

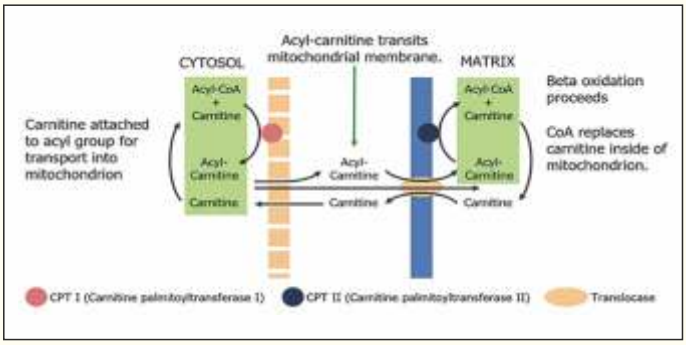


Fig. 1 *Carnitine Shuttle*

Carnitine deficiency in dogs can be categorized into three main types

1. **Plasma Carnitine Deficiency:** This type is characterized by low levels of free carnitine in the plasma. Although not extensively documented, it

is frequently observed in veterinary practice because plasma carnitine is commonly measured, even when tissue carnitine levels are not assessed.

2. **Systemic Carnitine Deficiency:** This type involves low concentrations of free carnitine in both plasma and tissue, indicating a more widespread deficiency throughout the body.
3. **Myopathic Carnitine Deficiency:** Characterized by low carnitine levels specifically in the heart muscle, this type can occur even when plasma carnitine levels are normal or elevated. It's estimated that this form affects 17% to 60% of dogs with Dilated Cardiomyopathy (DCM).

Clinical Evidence Supporting L-Carnitine Supplementation in dogs with DCM

In dogs, the association between myocardial L-carnitine deficiency and Dilated Cardiomyopathy was first identified in a Boxer that exhibited significant clinical, echocardiographic, and functional recovery after receiving L-carnitine supplementation (8). This supplementation successfully restored the dog's myocardial L-carnitine levels. Initially, the dog showed severe symptoms such as exercise intolerance and respiratory distress, but within two months of treatment, it was able to return to normal activity, demonstrating L-carnitine's potential as a therapeutic aid.

Studies have consistently found that dogs from families prone to DCM typically exhibit reduced myocardial L-carnitine levels compared to healthy counterparts. Supplementing these dogs with high doses of L-carnitine led to substantial improvements in their health and heart function. Although L-carnitine treatment did not completely restore myocardial function in all cases, it greatly enhanced the quality of life for these dogs, extending it by several months or years (9).

L-Carnitine's Impact on DCM

1. **Enhancing Myocardial Function:** Studies show that L-carnitine supplementation can improve left ventricular function in dogs with DCM by restoring fatty acid metabolism and boosting cardiac energy production. This improvement leads to better cardiac output and alleviation of heart failure symptoms. Similar results have been observed in cardiomyopathic Syrian hamsters, where high-dose L-carnitine supplementation significantly enhanced heart function (10).
2. **Alleviation of Clinical Symptoms:** DCM in dogs often results in symptoms such as exercise intolerance, coughing, and respiratory distress. Dogs receiving L-carnitine showed significant improvements in exercise tolerance and overall vitality within weeks of treatment. These improvements persisted over several months, indicating that L-carnitine has a lasting effect in managing DCM (11).
3. **Potential for Extended Survival:** While L-carnitine does not cure DCM, its supplementation has been linked to increased survival rates in affected dogs. A study involving 18 Doberman Pinschers with DCM found that those with myocardial L-carnitine deficiency lived considerably longer when given L-carnitine supplements compared to those with normal myocardial L-carnitine levels. This suggests that L-carnitine supplementation may be particularly effective in cases where there is a deficiency (12).

L-carnitine has been shown to improve heart rate, lipid profiles, and exercise tolerance, as well as provide protection against cardiac necrosis, all of which are crucial for restoring normal cardiac function in affected dogs.

Underlying Factors

Despite promising results, the precise mechanisms by which L-carnitine supplementation benefits dogs with DCM remain unclear. Preliminary evidence suggests that many dogs with myocardial L-carnitine deficiency may suffer from a membrane transport defect. This defect may hinder the effective uptake of L-carnitine into myocardial cells, even when plasma levels are normal or elevated (13, 14)

The hypothesis of a transport defect is supported by findings that dogs with myocardial L-carnitine deficiency often have plasma levels comparable to or higher than those in healthy dogs (15, 16).This suggests that the issue may not be a simple deficiency in plasma L-carnitine but rather an impaired ability to transport L-carnitine into the myocardium.

Conclusion

L-Carnitine offers a promising therapeutic approach for managing dilated cardiomyopathy in dogs. By improving myocardial energy production, it can enhance cardiac function, alleviate symptoms, and potentially extend survival. While more research is needed to refine its use, current evidence supports incorporating L-carnitine into treatment plans for DCM, especially in breeds prone to myocardial L-carnitine deficiency.

References

1. Bremer, J. (1983). Carnitine--metabolism and functions. *Physiological reviews, 63*(4), 1420-1480.
2. Leibowitz BE. Carnitine. Adv Res Press 1987;2:1–13.
3. Rebouche, C. J., & Engel, A. G. (1983). Kinetic compartmental analysis of carnitine metabolism in the dog. *Archives of Biochemistry and Biophysics, 220*(1), 60-70.

4. Wang, Z. Y., Liu, Y. Y., Liu, G. H., Lu, H. B., & Mao, C. Y. (2018). l-Carnitine and heart disease. *Life sciences, 194*, 88-97.
5. Neely, J. R., & Morgan, H. E. (1974). Relationship between carbohydrate and lipid metabolism and the energy balance of heart muscle. *Annual review of physiology, 36*(1), 413-459.
6. Calvert, C. A. (1986). Dilated congestive cardiomyopathy in Doberman pinschers.
7. Stumpf, D. A., Parker Jr, W. D., & Angelini, C. (1985). Carnitine deficiency, organic acidemias, and Reye's syndrome. *Neurology, 35*(7), 1041-1041.
8. Costa, N. D., & Labuc, R. H. (1994). Case Report: Efficacy of oral carnitine therapy for dilated cardiomyopathy in boxer dogs. *The Journal of nutrition, 124*, 2687S-2692S.
9. Kittleson, M. D. (2000). Taurine-and carnitine-responsive dilated cardiomyopathy in American Cocker Spaniel.
10. Whitmer, J.T. (1987). L-carnitine treatment improves cardiac performance and restores high energy phosphate pools in cardiomyopathic Syrian hamsters. Circulation Research, 61, 396-408.
11. Keene, B. W. (1991). l-Carnitine supplementation in the therapy of canine dilated cardiomyopathy. *Veterinary Clinics of North America: Small Animal Practice, 21*(5), 1005-1009.
12. Freeman, L. M., Rush, J. E., & DeFrancesco, T. C. (2022). Effect of L-carnitine on survival and cardiac function in dogs with dilated cardiomyopathy. Journal of Veterinary Cardiology, 24(3), 215-223.
13. Sanderson, S. L. (2006). Taurine and carnitine in canine cardiomyopathy. *Veterinary Clinics: Small Animal Practice, 36*(6), 1325-1343.
14. Fathi, E. Z. Z. A. T. O. L. L. A. H., & Farahzadi, R. A. H. E. L. E. H. (2014). Application of L-carnitine as nutritional supplement in veterinary medicine.
15. Dove, R. S. (2001). Nutritional therapy in the treatment of heart disease in dogs.(Heart Disease in Dogs). *Alternative Medicine Review*, S-38.
16. Keene, B. W., Panciera, D. P., Atkins, C. E., Regitz, V., Schmidt, M. J., & Shug, A. L. (1991). Myocardial L-carnitine deficiency in a family of dogs with dilated cardiomyopathy. *Journal of the American Veterinary Medical Association, 198*(4), 647-650.

PPAM Allana-Bowlers CE on Lameness in Pets

PPAM in Association with Bowlers and Allana organised a Continuing Education Program on Lameness in Pets on Sunday 07 July 2024 at Hotel Trident, Bandra Kurla Complex, Bandra East Mumbai. The Key speaker was Dr. Amrita Deb, B.V.Sc & A.H, MSc, MRCVS. Large number of PPAM members attended the talk.

Highlights of PPAM AGM held on 18.08.2024

PPAM AGM was held on Sunday 18th August 2024
at the Club, Colonial hall, D. N. Nagar, Andheri West, Mumbai 400 053.

Dr. Sachin Kumthekar Lecture during AGM on 18.08.2024

Dr. Sachin Kumthekar M.V.Sc (Pathology) delivered talk on the following topics.
1. Combined Approach-Haematology, Biochemistry and Cytology.
2. Clinical Pathology of Endocrine disorders in Dogs and Cats.
3. Case based studies from clinical pathology Perception.
Sponsors of this presentation was Bowlers, Allana. The event was held on Sunday 18 August 2024 at the Club, Andheri West, Mumbai 400 053.

Proud Moment for PPAM Members

Dr. Kasturi Bhadsavle and Dr. Noopur Desai

On the occasion of 90th anniversary of Bank of Maharashtra , Dr. Kasturi Bhadsavle (The Eye Vet) and Dr. Noopur Desai (The Cancer Vet) were felicitated on Thursday 19th Sept. in Pune for work in advancing veterinary specialization and contributing to India's growth by Honorable Union Finance Minister Nirmala Sitharaman, Shri M. Nagaraju, Secretary of the Department of Financial Services, and Shri Nidhu Saxena, MD and CEO of Bank of Maharashtra.

Dr. Deepashree Desai

Professor, Department of Poultry Science, recipient of CLFMA award 2024.

Dr. Deepashree Desai received the most prestigious national CLFMA Award 2024 (Compound Livestock Feed Manufacturers Association Award) at the hands of Mr. Rajiv Ranjan Singh, Hon. Minister of Animal Husbandry and Dairying, GOI in 65 th National Symposium of CLFMA at Goa on 20.09.2024

Dr. Sangeeta Vengsarkar Shah

Dr. Sangeeta Vengsarkar Shah received the lifetime achievement award for her contribution to the field of Veterinary Cardiology from Veterinary Cardiovascular Society at the first exclusive Cardiology conference in India held at Hyderabad on 13.07.2024.

Avnish Gala and Ishaan Acharya

Indian Students at IVSA Global Congress, Lima, Peru.

Two students from BVC, Avnish Gala (final year) and Ishaan Acharya (4th year) represented Indian Veterinary students as members of IVSA India at the IVSA Global Congress in Lima, Peru in August 2024. They were the only delegates from India and were both IVSA Officials. It was an 11 day event, and included general assemblies where they voiced the opinions of Indian veterinary students. It also included lectures and workshops on topics like cardiology, exotic animal medicine, ultrasound and animal welfare, as well as social events like cultural night and formal dinner.

Dr. G. S. Khandekar *et.al.*

Poster presentation at WSAVA conference.

Dr. G. S. Khandekar, Dr. Harshal Patil, Dr. S. D. Tripathi, Dr. S. V. Gaikwad, Dr. R. R. Rohi, Dr. Dishant Saini and Dr. Rujuta Sawant presented a poster paper at WSAVA 2024, Suzhou China.

Dr. Makarand Chousalkar, Dr. Madhura S. Vishwasrao & Dr. Sanjana Karve

Speakers at the Back-to-Basics Seminar in Vasai.

Dr. Madhura Vishwasrao delivered a talk on Suturing techniques and pattern.

Dr. Sanjana Karve also addressed the group of veterinarians.

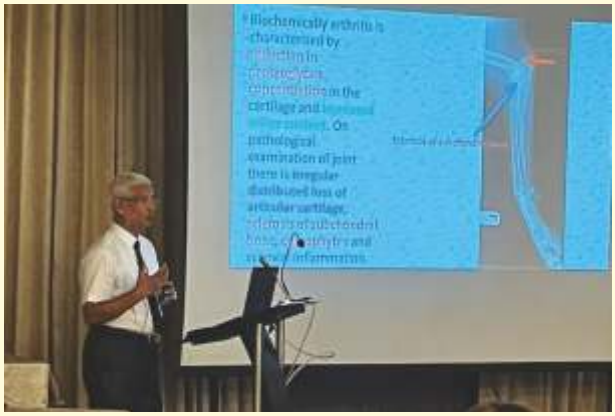
Dr. Makarand Chousalkar delivered a talk on 'Stabilisation of Emergency Patients'.

Dr. Makarand Chavan

Dr. Makarand Chavan spoke in Delhi on Shaping the future of Pet food Industry on 20.09.2024.

Dr. Shriniwas V. Vishwasrao

Dr. Shriniwas V. Vishwasrao delivered a talk CE program in Kolkata on 14.09.2024.



Highlights of PPAM-PDAP Event Lonavala on 29.09.2024

Pet Practitioner Association of Mumbai and Pet Doctors Association of Pune jointly organised a CE program on Small Animal Anesthesia and Surgery. The speakers were Dr. Vinay Bhagat and Dr. Sanjana Karve. The sponcers were Pet Care by Rossari. A large number of Pet Practitioners from Mumbai and Pune attended the CE program. Dr. Vinay Bhagat spoke on Anesthesia and Analgesia in Dogs and cats, Dr. Sanjana Karve spoke on Suture material and Techniques.

Appeal to PPAM Members to Renew Membership

1. Renewal of Annual Membership	Rs. 1500.00 + GST (Rs. 270.00) = Total Rs. 1770.00
2. New Membership	Rs. 1750.00 + GST (Rs. 315.00) = Rs. 2065.00
3. Life Membership	Rs. 17500.00 (No GST)

Bank Details :
Indian Bank;
A/c name - Pet practioners association,
Branch- Santacruz (w)
A/c no. 744946564 ,

(As soon as payment transfer is made
please send a message to
Hon. Treasurer Dr. Hitesh Swali on 98211 20058 &
Hon. Joint Treasurer Dr. Nihar Jayakar on 98207 20246.
Please also mention your complete name,
date of payment and transaction id.)

Scan For Payment

World Food India 2024 (WFI2024)

Dr. Makarand Chavan

The Ministry of Food Processing Industries, Govt of India (MOFPI) organized the Global Summit-World Food India 2024 from 19th to 22nd September 2024.

There were 1200 stalls from across the Globe and India with state of the art exhibition of various food products and food technology and knowledge exchange though interaction. For the first time, the World Food India 2024, organized by MOFPI, included pet food as a core agenda item. This significant step aims to foster a comprehensive ecosystem for the pet food processing industry. The session, titled "Shaping the Future of the Pet Food Industry," took place at the Bharat Mandapam in Pragati Maidan, bringing together key stakeholders to discuss future growth, challenges, and innovations in India's rapidly evolving pet food sector.

The expert panel featured leaders from both domestic and international companies, including

Dr. Umesh Kallahalli (Senior Veterinarian, Mars Petcare), Mr. Satinder Singh (General Manager, Royal Canin), Dr. Makarand Chavan (General Secretary, FSAPAI & PPAM), Ms. Pallavi Anand (Business Head, Nestlé Purina Petcare, Mr. Varun Sadana (Co-Founder, Supertails), and Ms. Geeta Seshamani (CEO, Friendicoes SECA).

Neetu Bansal (Senior Client Director, IPSOS) moderated the discussion. These industry pioneers provided valuable insights as the Indian pet food market which is projected to reach $800 million by the end of 2024. Mr. Govind Suryawanshi, Corporate Affairs Director, Royal Canin took a great initiative in coordination of this event.

The panelists emphasized the sector's rapid growth, noting the shift of pets from functional animals to beloved family members. Key discussion points included the necessity of government regulations to ensure quality and safety, as well as the role of technology in personalized nutrition. Market trends highlighted during the session included the demand for human-grade ingredients, vegan options, and innovations in pet diagnostics. Additionally, discussions on animal welfare, supply chain enhancements, and infrastructure improvements underscored the importance of collaboration and innovation for the industry's future.

The panel discussion reinforced the importance of industry collaboration, government support, and innovation to advance the Indian pet food market and align with global standards. Emphasis was placed on developing regulatory frameworks that prioritize safety and quality, utilizing technology for nutrition, and fostering partnerships to create a sustainable pet food ecosystem. By aligning with global best practices and driving innovation through collaboration, India has the potential to emerge as a significant hub for pet food manufacturing and exports.

Dr. Makarand Chavan shared the thoughts on the importance of dietary management in both – healthy and sick pets. He spoke about raising awareness among pet parents about the important role of commercial diet - Wellness and Prescription Diet. He also explained that currently there is great improvement in diagnostic services and surgical facilities for companion pets in clinics across India.

It was a very well attended session and all the minutes of the meeting were shared with the Animal Husbandry Dept , Govt of India. as well.

DROOLS ARTICLE

The Critical Role of Nutrition in Managing Canine and Feline Gastrointestinal Disorders

Dr. Jadhav Aditya Sudhir, MVSc (Animal Nutrition)
Product Executive, Drools Pet Food Pvt. Ltd.

Perhaps no other organ system is so directly and immediately affected by nutrition than the gastrointestinal tract. Timing and frequency of feeding, route of feeding, and macronutrient and micronutrient compositions of the diet have profound influences on oral and intestinal health. In addition to the direct effect of diet on the body, there is a considerable indirect effect through dietary influences on the intestinal microflora.

Key Dietary Variables

Protein

Dietary protein interacts with the gastrointestinal tract in several ways. It is a source of essential amino acids for the gastrointestinal tract, a source of dispensable amino acids for oxidation by the gastrointestinal tract, a source of energy and amino acids for the luminal flora, and a source of foreign antigens (Ames *et al.* 1999; Brandtzaeg 2002; Bounous and Kongshavn 1985). Proteins (and amino acids) are also a key stimulus for the release of trophic hormones such as insulin, insulin like growth factor-1 (IGF-1) and glucagon-like peptide-2 (GLP-2). Dietary protein affects motility in two main ways. First, the presence of protein in the stomach stimulates the release of gastrin, which promotes gastric, ileal, and colonic motility at the same time as ileocolic valve relaxation, as well as stimulating gastric secretion and having a trophic effect on the gastric and intestinal mucosa (Bueno and Fiormonti 1994; Hall et al. 1989; Lloyd 1994) The presence of dietary protein in the duodenum is also an effective stimulus for the release of cholecystokinin (CCK) from the proximal duodenum.

Glutamine

Glutamine is a conditionally essential amino acid, and is utilized as a significant fuel source by mucosal leukocytes, in particular lymphocytes, and by small intestinal epithelial cells (Newsholme *et al.* 1987; Ziegler *et al.* 2003). In addition, it serves as the dominant nitrogen source for purine synthesis, the requirement for which is relatively large given the mitotic rate within the normal mucosa, and at an even greater rate during periods of mucosal repair. Many animal studies have demonstrated that enteral glutamine supplementation enhances gut mucosal growth and repair, decreases bacterial translocation and inflammation, and improves nitrogen balance in animal models of intestinal atrophy, injury, and adaptation (Ziegler *et al.* 2003). Surprisingly perhaps, glutamine may be a more effective nutrient when incorporated into highly digestible proteins or small polypeptides than when administered as a free amino acid in solution (Boza, Maire *et al.* 2000; Boza, Moennoz *et al.* 2000). This could be due to differences in utilization of glutamine by enterocytes or leukocytes, or it could be due to differences in the intestinal hormone-dependent trophic response to whole proteins rather than elemental diets.

Fat

Dietary fat is an important source of energy and is the macronutrient variable that determines the dry matter energy density of a diet. Animals with chronic intestinal disease are frequently malnourished from inappetance, maldigestion, and malabsorption, and thus may benefit greatly from higher energy dense diets. In addition, the absorption of dietary fat is required for the concurrent optimal absorption of the fat-soluble vitamins A, D, E, and K, as well as other fat-soluble nutrients (e.g., carotenoids, flavonoids). The presence of fat in the duodenum generates feedback signals to both the central nervous system (CNS) and to the myenteric plexus. Mediators of these signals include cholecystokinin (CCK), glucagon-like peptide-1 (GLP-1), and peptide YY (NPYY). In the intestine, CCK-secreting cells, known as "I-cells," are located within the epithelium with their apical surfaces exposed to the lumen and are concentrated in the duodenum and proximal jejunum (Liddle 1997). CCK release from I-cells stimulates gall bladder contraction, pancreatic secretion, intestinal peristalsis, and inhibits gastric emptying and gastric acid production. In the cat, like dogs and humans, secretion of CCK by I-cells occurs in response to the luminal presence of long-chain triacylglycerides, proteins, and some amino acids (Backus, Rosenquist *et al.* 1995). The slowing of gastric emptying by small intestinal nutrients is associated with a reduction in proximal gastric tone, suppression of antral contractions, and stimulation of tonic and phasic pyloric contractions (Feinle, Rades *et al.* 2001). The increase in phasic pyloric contractions is associated with cessation of transpyloric flow.

In both dogs and cats, fat is a potent secretogogue for neuropeptides such as CCK. However, pharmacological inhibition of pancreatic lipase attenuates the effects of duodenal fat on reducing gastric emptying, on appetite, and CCK and GLP-1 secretion (Feinle, O'Donovan *et al.* 2003). Thus, fat maldigestion such as occurs in exocrine pancreatic insufficiency may contribute to maldigestion of other nutrients, independent of pancreatic function.

Fibre

The systemic health of animals and maintenance of gastrointestinal tract (GIT) homeostasis relies heavily on influences from dietary fiber, which consists of a diverse assortment of non-digestible carbohydrates. Dietary fiber can be classified according to physical or chemical characteristics, according to its effects on bowel microflora, or its effects on specific variables in the whole animal. In regard to its effects on gastrointestinal physiology and pathophysiology, the most important characteristics are viscosity, and fermentability.

Some types of soluble dietary fiber increase the viscosity of water when in solution and have the capacity to retain water within the viscous gel ("water-holding capacity"). This effect increases fecal water content and mass. Psyllium hydrocolloid has a greater waterholding effect than pea, oat, or sugar beet fiber (McBurney 1991). The formation of viscous gels slows gastric emptying, increases small intestinal transit times, slows the absorption, and reduces the digestibility of some nutrients. Different fiber molecules can participate in hydrophilic and hydrophobic interactions. The diversity of structure and fermentability, and the chemical and structural changes that occur within the intestine alter binding capacities. Attempts to characterize the suitability of fibers for binding on the basis of simple physicochemical classifications are inadequate, and binding capacity for molecules of interest are best studied directly.

Fiber	Chemistry	Source
Lignin	Complex phenolic	Cell walls of woody plants and seeds
Cellulose	Linear, insoluble glucose polymer with β-1,4 glycosidic bonds	The main component of all higher plant cell walls
Hemicelluloses	Diverse group of polysaccharides containing hexoses and pentoses forming random amorphous structures	Found in almost all plant cell walls
Beta-glucans	Glucose polymers with a mixture of β-1,4 glycosidic bonds and β-1,3 glycosidic bonds	Oats and barley are rich sources
Pectins	Mostly a linear chain of α-1,4-linked D-galacturonic acid	Intercellular component of nonwoody plants, especially citrus fruits, apples, and some berries
Gums	A complex of viscous polysaccharides of varying types, and some glycoproteins	Seeds
Inulin and oligofructose (fructans)	Inulin is a mixture of fructose chains, oligofructose is a mixture of shorter fructose chains that may terminate in glucose or fructose	Energy storage compound of some plants, e.g., rhizomes
Resistant starch	Starch that is sequestered in plant cell walls or highly dehydrated and therefore, inaccessible to digestive enzymes	Bananas, legumes, raw potatoes. Can be formed during food processing by cooling and reheating.

Fiber	Crude Fiber % DM	Total Dietary Fiber % DM	Soluble Fiber % DM	Insoluble Fiber % DM
Apple pectin	0 %	85 %	78 %	7 %
Citrus pectin	1 %	82 %	82 %	0 %
Beet pectin	0 %	76 %	76 %	0 %
Guar gum	2 %	92 %	83 %	10 %
Carrageen refined	0 %	50 %	44 %	6 %
Cellulose (Wheat)	63 %	72 %	0 %	69 %

(Kienzle; Schrag *et al*. 2001.)

Effect of Fiber on Intestinal Flora: Prebiosis

Certain fibers, such as the β-2 fructans (e.g., inulin, fructooligosaccharides), stimulate the growth and/or activity of intestinal bacteria such as Lactobacillus and Bifidobacterium species (Gibson, Beatty et al. 1995; Kaplan and Hutkins 2000). It has been proposed that increasing the numbers of these nonpathogenic species may have several direct effects including: (1) competition with pathogens for substrate; (2) interference with pathogen binding with, and competition for, epithelial binding sites; and (3) direct interaction with mucosal immune system.

Nutritional strategies for managing Inflammatory Bowel Disease (IBD) in dogs and cats.

1. Pre- and Probiotics:

Prebiotics: Fermentable fibers like resistant starch, fructooligosaccharides (FOS), and inulin can promote beneficial gut bacteria, potentially reducing inflammation in IBD. However, specific recommendations on type and quantity are still unclear.

Probiotics: Probiotics can alter intestinal microflora and offer health benefits, but the quality of commercial veterinary probiotics varies. It's crucial to select high-quality options and understand that more research is needed to determine optimal strains and dosages.

2. Glutamine:

It has been proposed that gut mucosal turnover and barrier function is compromised during IBD due, in part, to a relative glutamine deficiency. Glutamine is important for gut mucosal health and to reduce the inflammation in IBD. This is supported by experimental studies that have demonstrated a reduction in mucosal inflammation and lipid peroxidation products following luminal glutamine supplementation in models of mucosal inflammation.

3. Arginine and Nitric Oxide (NO):

Arginine supplementation could modulate NO production, which plays a significant role in counteracting the inflammation in the mucosa of the intestine. But prolonged chronic inflammation in the submucosal layers leads to accelerated production of NO that causes harmful effects on the cellular system of the intestine of IBD cases.

4. Antioxidants:

Oxidative stress is a feature of IBD, and antioxidants like vitamins A, E, C, zinc, manganese, and copper may help mitigate this. Although their role in canine and feline IBD isn't fully understood, supplementing these nutrients is considered beneficial.

5. Dietary Fat:

Dogs: Fat-restricted diets are crucial for managing gastrointestinal diseases in dogs, particularly when lymphangiectasia accompanies IBD. Fat malabsorption can worsen diarrhea and fluid loss. Low-fat diets (less than 15% fat) are recommended in severe cases, although they are not widely available commercially.

Cats: Fat malabsorption is less significant in cats. A study found no difference in the improvement of diarrhea between cats on high-fat and low-fat diets, suggesting fat restriction is less critical for feline IBD management.

6. Polyunsaturated n-3 Fatty Acids (PUFAs):

PUFAs, especially n-3 fatty acids like EPA and DHA, can modulate immune responses and reduce inflammation. The balance of n-6 to n-3 PUFAs in the diet is essential, but the optimal ratio and amount for managing IBD in pets remain undetermined. Fish oil supplementation may help, but the results are inconsistent, and antioxidant supplementation might be necessary to counteract potential side effects.

Recommended management following diagnosis is as follows:

1. Assess the nutritional status of the patient. This will include physical parameters such as body condition, lean body mass, history of recent weight loss, current appetite, hydration, presence of edema, and coat condition. Clinicopathological indices include serum albumin concentration, serum electrolyte concentrations, erythrocyte and leukocyte indicators of malnutrition, evidence of protein-losing gastroenteritis (PLGE) (panhypoproteinemia, hypocholesterolemia, lymphopenia), serum PIVKA measurement (proteins invoked by vitamin K antagonism) or coagulation panel to assess vitamin K status, serum vitamin B12 concentration, and folate.
2. Address specific concerns regarding malnutrition. This may include vitamin B12, folate, or vitamin K1 supplementation.
3. Address anorexia through pharmacological means (i.e., specific therapy for IBD) and consider supplemental or supportive nutrition in severely malnourished individuals. Indicators for the need for supportive nutrition would include persistent anorexia, recent weight loss of >10% body weight, anemia, hypoalbuminemia, and a body condition score of 3 or less on a 9-point scale with poor appetite.
4. Select a highly digestible, novel protein or hydrolyzed protein diet and feed exclusively until immunosuppressive therapy can be discontinued.

5. Consider fat restriction in severe cases, or where there is histological evidence of lymphangiectasia.
6. If dietary fat is not limiting, then consider enrichment of the diet with n-3 PUFAs using fish oil to achieve a crude ratio of <2 : 1, n-6 : n-3.

References:

Ames, J.M., A. Wynne, A. Hofmann et al. 1999. "The effect of a model melanoidin mixture on faecal bacterial populations in *vitro.*" *British Journal of Nutrition* 82(6): 489–495.

Backus, R.C., G.L. Rosenquist, Q.R. Rogers et al. 1995. "Elevation of plasma cholecystokinin (CCK) immunoreactivity by fat, protein, and amino acids in the cat, a carnivore." *Regulatory Peptides* 57(2): 123–131.

Bounous, G., and P.A. Kongshavn. 1985. "Differential effect of dietary protein type on the B-cell and T-cell immune responses in mice." *J Nutr* 115: 1403–1408.

Boza, J.J., D. Moennoz, J. Vuichoud et al. 2000. "Protein hydrolysate vs free amino acid-based diets on the nutritional recovery of the starved rat." *European Journal of Nutrition* 39(6): 237–243.

Boza, J.J., J.-C. Maire, L. Bovetto et al. 2000. "Plasma glutamine response to enteral administration of glutamine in human volunteers (free glutamine versus protein-bound glutamine)." *Nutrition* 16(11–12): 1037–1042.

Brandtzaeg, P. 2002. "Current understanding of gastrointestinal immunoregulation and its relation to food allergy." *Ann NY Acad Sci* 964: 13–45.

Bueno, L., and J. Fioramonti. 1994. "Neurohormonal control of intestinal transit." *Reproduction, Nutrition, Development*34 (6): 513–525.

Feinle, C., D. O'Donovan, S. Doran et al. 2003. "Effects of fat digestion on appetite, APD motility, and gut hormones in response to duodenal fat infusion in humans." *Am J Physiol Gastrointest Liver Physiol* 284: G798–G807.

Feinle, C., T. Rades, B. Otto et al. 2001. "Fat digestion modulates gastrointestinal sensations induced by gastric distention and duodenal lipid in humans." *Gastroenterology* 120(5): 1100–1107.

Gibson, G.R., E.R. Beatty, X. Wang et al. 1995. "Selective stimulation of bifidobacteria in the human colon byoligofructose and inulin." *Gastroenterology* 108(4): 975–982.

Hall, J.A., D.C. Twedt, C.R. Curtis. 1989. "Relationship of plasma gastrin immunoreactivity and gastroesophageal sphincter pressure in clinically normal dogs and in dogs with previous gastric dilatation-volvulus." *American Journal of Veterinary Research* 50(8): 1228–1232.

Kaplan, H., and R.W. Hutkins. 2000. "Fermentation of fructooligosaccharides by lactic acid bacteria and bifidobacteria." *Applied and Environmental Microbiology* 66(6): 2682–2684.

Kienzle, E., I. Schrag, R. Butterwick et al. 2001. "Calculation of gross energy in pet foods: New data on heat combustion and fiber analysis in a selection of foods for dogs and cats." *J Anim Physiol Anim Nutr (Berl)* 85(5–6): 148–157.

Liddle, R.A. 1997. "Cholecystokinin cells." *Annual Review of Physiology* 59: 221–242.

Lloyd, K.C. 1994. "Gut hormones in gastric function." B*aillieres Clinical Endocrinology and Metabolism* 8(1): 111–136.

McBurney, M.I. 1991. "Potential water-holding capacity and short-chain fatty acid production from purified fiber sources in a fecal incubation system." *Nutrition* 7(6): 421–424.

Newsholme, P., S. Gordon, and E.A. Newsholme. 1987. "Rates of utilization and fates of glucose, glutamine, pyruvate, fatty acids and ketone bodies by mouse macrophages." *Biochemical Journal* 242(3): 631–636.

Ziegler, T.R., M.E. Evans, C. Fernandez-Estivariz et al. 2003. "Trophic and cytoprotective nutrition for intestinal adaptation, mucosal repair, and barrier function." *Annual Review of Nutrition* 23: 229–261.

Camel Population in Rajasthan has Reduced Significantly

In 2014 camel was declared a state animal by Rajasthan which accounts for 84% of India's camel population. Camel population has fallen by over 50% since 2007. Today grazing lands for camels is a big hurdle. The solution according to experts is legally protect camel grazing areas, and build a value chain for camel products. Camel milk has low fat content and high medicinal value. Camel milk has been used in treatment of diabetes and autism while camel blood is rich in immunoglobulins is used in vaccine development. A study is also in progress to examine the potential benefit of camel milk for patients with tuberculosis and dengue. Camel milk is believed to have medicinal properties and acts as natural insulin. Efforts must be made by all so that ship of the desert remains afloat.

VET-PRO®

Specially Formulated by Experienced Veterinarians
& Animal Experts In the US

drools
Feed Real. Feed Clean.

- **BEET PULP & FOS - HEALTHY DIGESTION**
- **SOLUBLE & INSOLUBLE FIBRE - MODIFIES BOWEL TRANSIT TIME**
- **OMEGA 3&6 - HEALTHY SKIN & COAT**
- **QUINOA SEED EXTRACT/FLAX SEEDS - REDUCES INFLAMMATION & SUPPORTS DIGESTION**

SCAN TO KNOW MORE

Glue and Clasp Hooks used to bring together Cracked Shell in an Indian Flapshell Turtle

(Inputs from Dr. Abijit Pawde)

Experts at Indian Veterinary Research Institute at Bareilly used Fevikwik and blouse clasp hooks to reconstruct the shattered shell of an Indian Flapshell turtle that was run over by a car. Dr. Abijit Pawde and Dr. Kamlesh Kumar and their colleagues performed this procedure as reported by TOI dated 10.07.2024. This turtle had seven eggs in the womb. The procedure was performed by fixing the blouse clasps on either side of the cracked shell and fastened with orthopaedic wire to bring together the cracked pieces of the shell.

Biovet Biocan Novel Vaccine Launched in Mumbai on 27.09.2024

Vetina launched Bioveta Biocan Noval vaccine at a function held in Mumbai at Hotel Peninsula Grand on 27.09.2024.The speaker was Dr. Paukner Karel MVDr from Czech Republic.

Official Add : Shop No 1, Bramhandev CHS, Padmabai Thakkar Road, Shivaji Park, Mahim, Mumbai 400 016.
Printed at TRIKKON S. K., N. M. Joshi Marg, Mumbai 400 013. Tel.: 98704 29093