The Scoop on Poop: Management of Acute Small Animal Diarrhea

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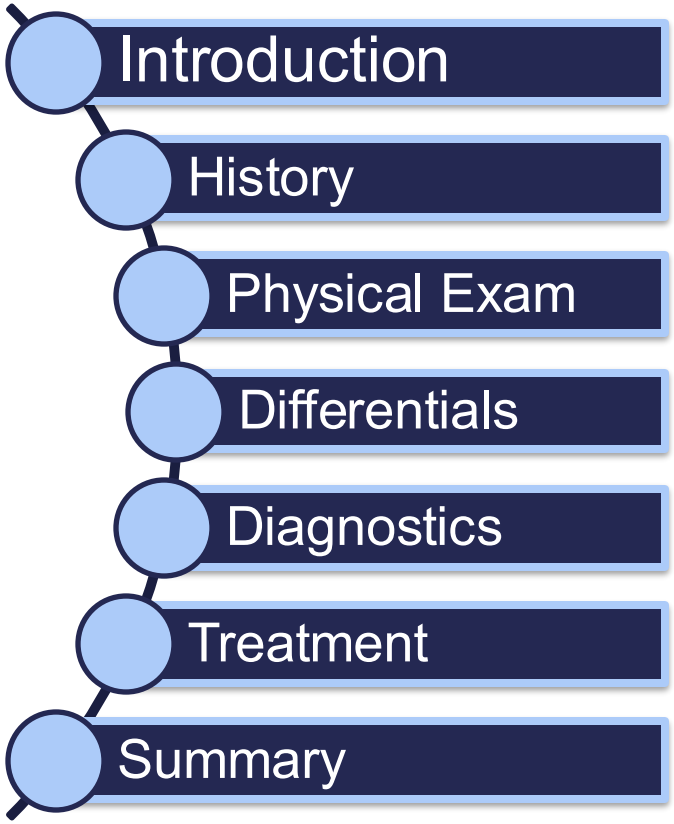
Outline



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Types of Diarrhea

- Acute v. Persistent v. Chronic

Pathophysiology

- Osmotic diarrhea
- Secretory diarrhea
- Increased mucosal permeability
- Deranged motility
- Small bowel diarrhea
- Large bowel diarrhea

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We’ve all been here…

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Acute Diarrhea

- Elimination of >3 stools that are watery in consistency
- >1 loose stool containing hematochezia, +/- vomiting, nausea, fever and abdominal pain
- Considered acute if lasts for less than 14 days
- In this stage, depending on severity, therapy takes precedence over achieving a precise diagnosis

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Persistent Diarrhea v. Chronic Diarrhea

Persistent Diarrhea

- Lasting longer than 14 days but less than 30 days

Chronic Diarrhea

- Considered chronic if lasts more than 30 days
- Not responsive to empirical therapy and requiring more diagnostics and therapies

Therapies and Diagnostics similar, but not covered in this talk

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PATHOPHYSIOLOGY

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Osmotic diarrhea

- Due to a poorly absorbable substance that draws water from plasma into the intestinal lumen
- Hallmark of osmotic diarrhea is that it resolves when the patient stops ingesting the poorly absorbable solute
- Fecal osmotic gap = 290mOsm/kg – [2 * (Fecal Sodium + Fecal Potassium)]
    - Fecal osmotic gap >50 mOsm/kg suggests osmotic diarrhea

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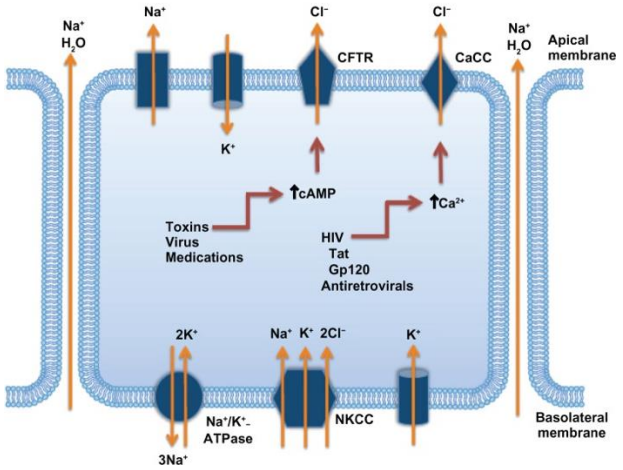
Secretory Diarrhea

- Watery, liquid diarrhea
- Due to disruption of epithelial electrolyte transport
- Distinguishing features of secretory diarrhea
  - Small osmotic gap
  - Diarrhea persists despite fasting
- Examples:
  - *Enteropathic E.coli*
  - IBD
  - *Giardia spp*



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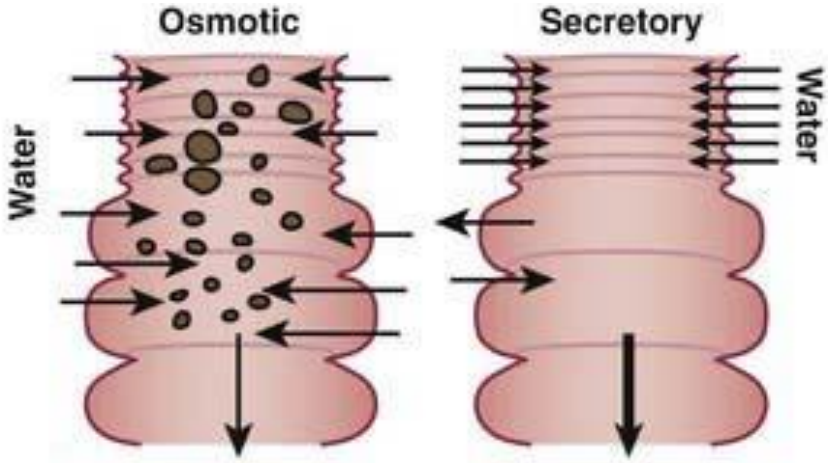
Osmotic vs. Secretory Diarrhea



	Osmotic	Secretory
Stool volume:	Moderately increased	Very large
Response to fasting:	Diarrhea stops	Diarrhea continues
Stool osmolality:	Normal to increased	Normal
Ion gap:	≥ 100 mOsm/kg	< 100 mOsm/kg

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Increased Mucosal Permeability

- Damage from the mucosal layer that causes leakage
  - Extent of damage is dependent on what leaks out
- Examples:
  - Erosive or ulcerative enteropathies
  - IBD
  - Neoplasia – lymphoma

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Deranged Motility

- Increased motility causes malabsorption of water → increased water loss

Stimulation of giant migrating contractions (GMCs)

Produces ultrarapid transit of intestinal and pancreaticobiliary secretions and undigested food into the colon

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Small Bowel v. Large Bowel

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Small Bowel Diarrhea

FACTOR	SMALL BOWEL
Volume	Normal or increased
Consistency	Watery – semiformed
Blood	Melena
Mucus	Uncommon
Color	Variable
Tenesmus	Absent
Urgency	Normal or slightly increased
Frequency	Normal or slightly increased

- Normal urgency and frequency but passing more stool
- Vomiting, weight loss, flatulence normally present
- Appetite is variable

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Large Bowel Diarrhea

FACTOR	LARGE BOWEL
Volume	Decreased
Consistency	Semi-formed, gelatinous
Blood	Hematochezia
Mucus	Frequent
Color	Normal
Tenesmus	Present
Urgency	Markedly increased
Frequency	Markedly increased

- Increased frequency but smaller amounts passed
- Excessive mucus, hematochezia
- Tenesmus
- Typically do not have weight loss, are not vomiting, and are eating normally

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Factor	Small Bowel	Large Bowel
Volume	Normal or increased	Decreased
Consistency	Watery – semiformed	Semi-formed, gelatinous
Blood	Melena	Hematochezia
Mucus	Uncommon	Frequent
Color	Variable	Normal
Tenesmus	Absent	Present
Urgency	Normal or slightly increased	Markedly increased
Frequency	Normal or slightly increased	Markedly increased

Other Factors	Small Bowel	Large Bowel
Vomiting	✓	uncommon
Flatulence	✓	uncommon
Appetite	Variable	normal
Weight loss	✓	uncommon

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HISTORY TAKING

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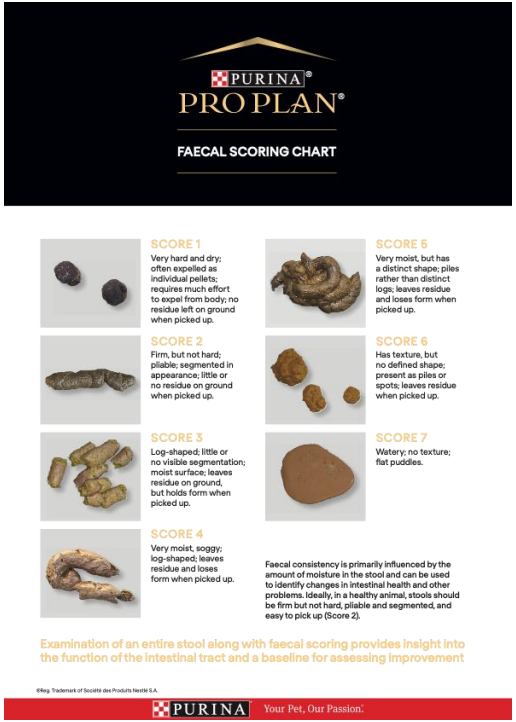
Asking the right questions

- Parasites exposure?
- Infectious agents
- Diet!
  - Raw v. freeze dried raw
  - Chicken and Rice since birth?
- Characterize nature and appearance of feces



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PHYSICAL EXAM

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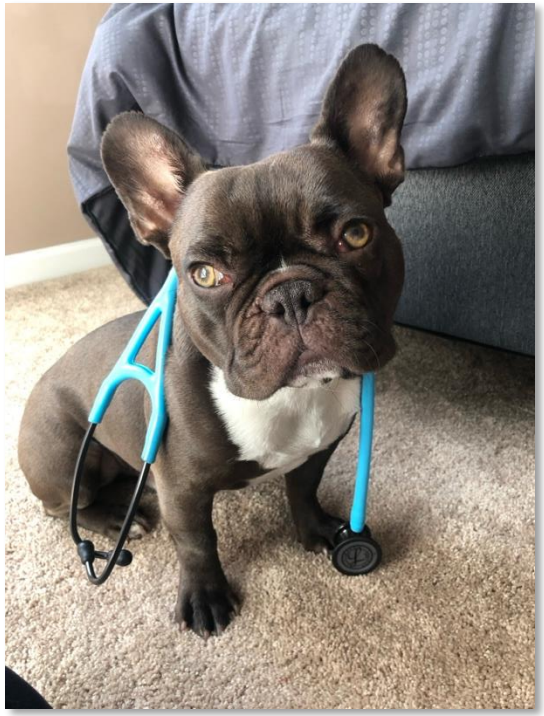
Physical exam

- Signalment – young? Old?
- Rectal
- BCS
- MM/CRT
- HR
- BP
- Temperature
- Abdominal palpation



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Clinical signs

- Abdominal distension, pain
- Increased gut sounds
- Dehydration
- Flatulence
- Melena or hematochezia
- PU/PD
- Tenesmus
- Vomiting
- Weight loss
- Hyporexia or anorexia

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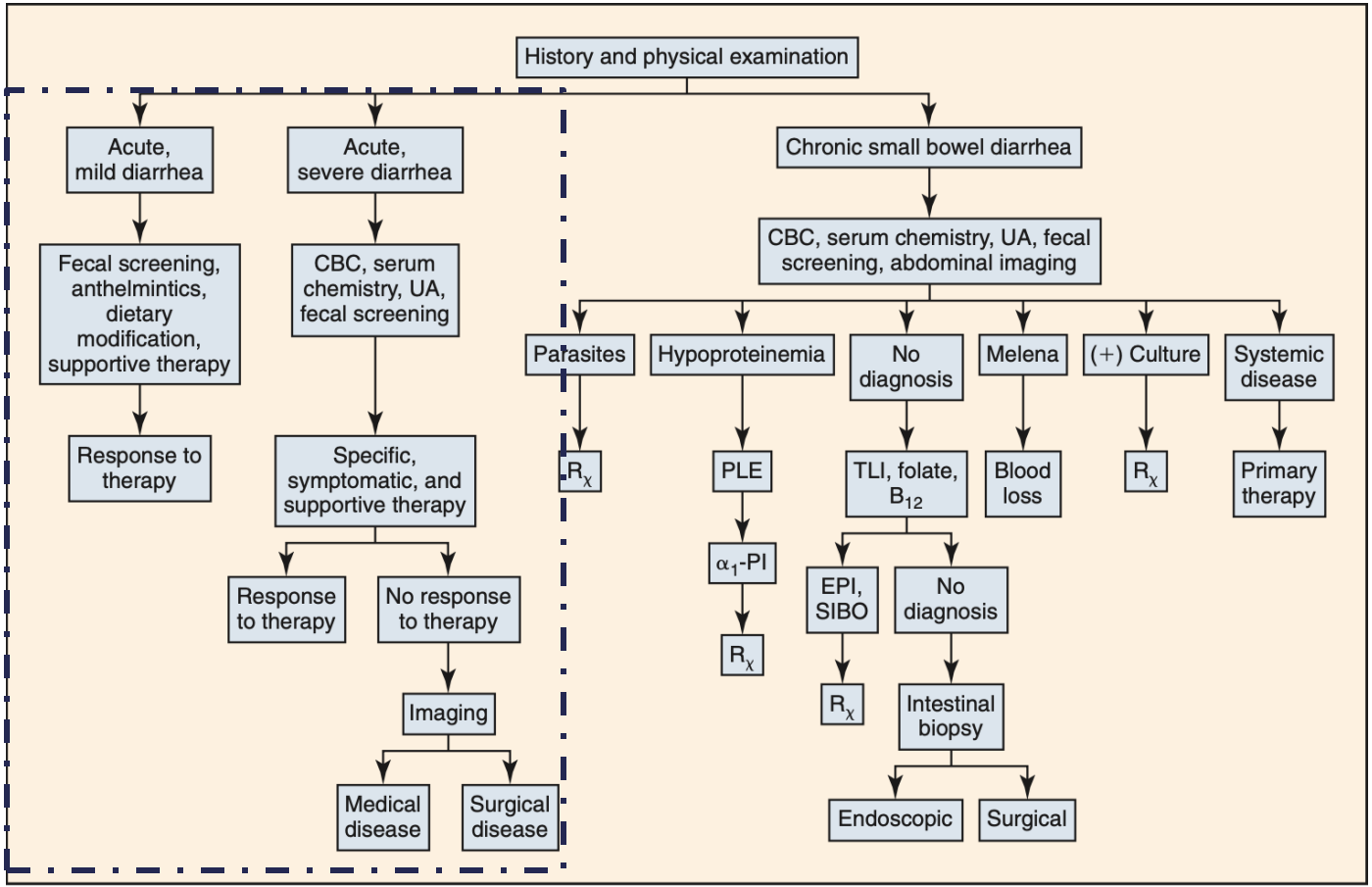

Figure 11-1 Medical workup for dogs and cats with diarrhea primarily of small bowel origin.

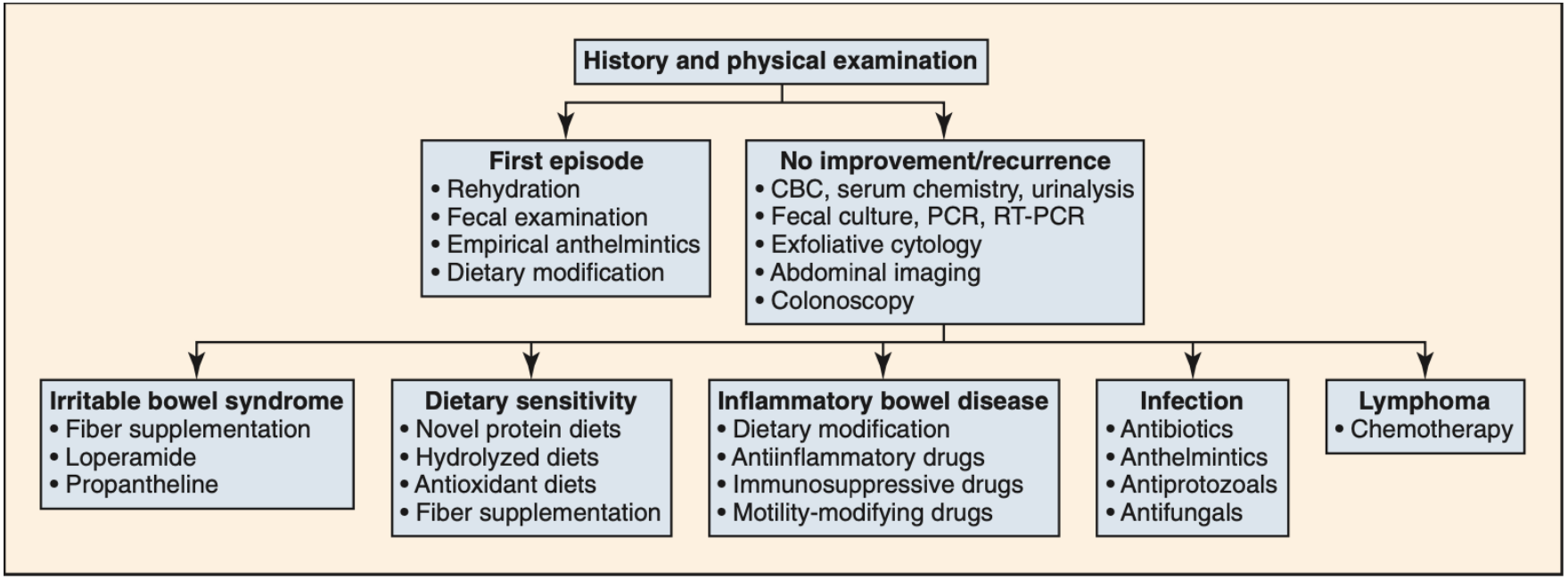

Figure 11-2 Medical workup for dogs and cats with diarrhea primarily of large bowel origin.

DIFFERENTIAL DIAGNOSES

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INFECTIOUS

VIRAL

- PARVO
- DISTEMPER*
- CORONAVIRUS*
- CIRCOVIRUS*
- ADENOVIRUS-1*
- ROTAVIRUS

BACTERIAL

- *CLOSTRIDIUM*
- *CAMPYLOBACTER*
- *SALMONELLA*
- *E.COLI*

PARASITIC

- GIARDIA
- TRICHURIS VULPIS

*will not be covered in this talk

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PARVO

- CPV-2
- Attacks rapidly dividing cells
  - Lymphoid tissue, intestinal epithelium, and bone marrow
  - Less commonly, can cause a myocarditis
- Most commonly affects puppies less then 6 months of age
  - *But all dogs of all ages are susceptible to parvo virus!*
- Puppies are most susceptible to disease as maternal antibodies decrease
- Predisposed breeds
  - Rottweilers, Doberman pinschers, Bully breeds, GSD, English Springer Spaniels
- Dogs are 3x more likely contract parvovirus during July-September

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PARVO

- Fecal – oronasal exposure
- Virus disseminates into oral lymphoid tissue and tonsils
  - Thymic atrophy, lymphoid depletion, leukopenia, and generalized immunosuppression occurs
- Fecal shedding occurs on day 3-14
  - Earliest detection on SNAP is day 4
- Unvaccinated puppies are 12.7x more likely to contract parvovirus
- Subclinical infections can occur in older, immunocompron animals
- Very stable within environments and resistant to heat and pH changes
- Treatment to be discussed later on!

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ROTAVIRUS

Feline Leukemia Virus (FeLV)

- Spread through most bodily fluids via oronasal route or through bite wounds
  - Horizontal spread infected queens to kittens
- Primary viremia and secondary viremia
- Directly infect intestinal epithelial cells as well as gut-associated lymphoid tissue
- 4% prevalence in US and Canada (2020 AAFP Feline Retrovirus Testing and Management Guidelines)

Feline Immunodeficiency Virus

- Spread through bite wounds
- Primary stage associated with fever, lymphadenopathy and lymphopenia
- FIV can cause a severe, purulent colitis
- 5% prevalence in US and Canada (2020 AAFP Feline Retrovirus Testing and Management Guidelines)

Prognosis is poor, supportive/palliative therapy

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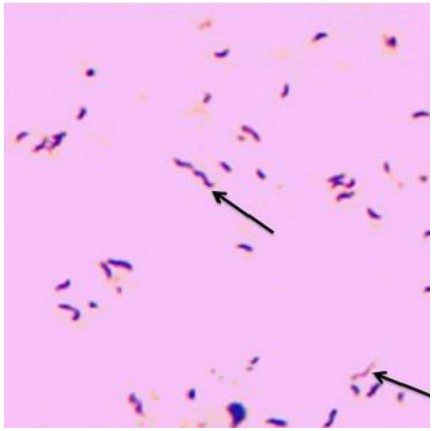
BACTERIAL

- *Campylobacter jejuni & Campylobacter upsaliensis*
  - Can be found in intestinal tract of healthy cats and dogs
- Typically found in animals <6mo living in crowded conditions or as a nosocomial infection
- Only treat if symptomatic and fits clinical picture!
  - Mucoid diarrhea +/- hematochezia
  - Anorexia
  - Fever
- Tends to be self limiting, but may contribute to chronic diarrhea
- Can be diagnosed on a fecal smear
  - S-shaped or seagull shaped appearance
  - PCR is more sensitive and specific for pathogenicity
- Zoonotic potential dependent on strains



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BACTERIAL

- Salmonella
- Being fed raw food diets is clinically related to an increased in chronic and amplified shedding of Salmonella in dog feces
  - Be sure to ask about treats!
- Blood cultures, fecal PCR
- Treatment depends on severity
- Zoonotic – isolate and keep away from young, old and immunocompromised people
  - Isolate until asymptomatic
    - 4-6 negative blood cultures or 3 negative fecal PCRs
- Reportable!

Primal pooch

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BACTERIAL

- E.coli
- 7 pathotypes:
  1. *Enteropathogenic E.coli (EPEC)*
  2. *Enterotoxigenic E.coli (ETEC)*
  3. *Enterohemorrhagic E.coli (EHEC)*
  4. *Necrotoxigenic E.coli (NTEC)*
  5. *Enteroinvasive E.coli (EIEC)*
  6. *Enteroaggregarative E.coli (EAEC)*
  7. *Adherent-invasive E.coli (AIEC) (Boxer Colitis)*

- Many strains have been isolated from dogs with/without diarrhea
- Evidence that AIEC occurs in susceptible breeds like Boxers, Frenchies, and Border Collies

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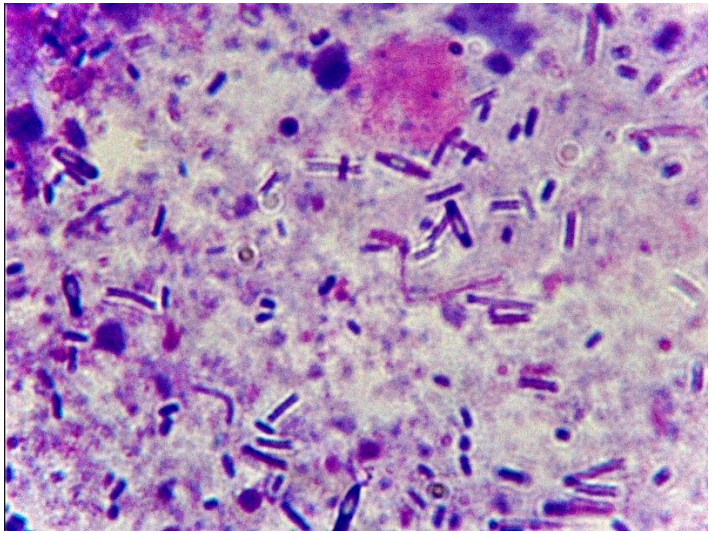
BACTERIAL

Clostridium perfringens and *Clostridium difficile*

- Clostridium can be found in clinically normal dogs, normal inhabitant of feces
- *Clostridium perfringens* enterotoxin (CPE) is a well characterized virulence factor that contributes to acute diarrhea
- No best way to confirm diagnosis, many papers recommend ELISA followed by PCR testing of feces for enterotoxigenic strains



Finding spore-forming bacteria on a fecal smear is <u>not diagnostic for pathogenic clostridium</u>, and does not always warrant antimicrobial therapy

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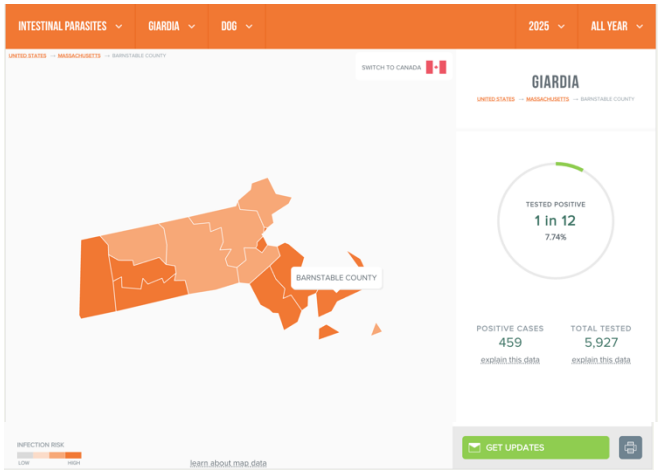
PARASITIC

Giardia

- The most common intestinal parasite in dogs in the US (CAPC)
- Transmission occurs via ingestion of cysts shed by animals or humans
- Trophozoites attach to enterocytes, causing functional changes and blunting of the villi
- Zoonoses?
  - Strains are mainly species specific
  - Dog to human transmission is rare but can occur



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PARASITIC

Giardia

- Difficult to diagnose due to intermittent shedding of cysts
- Companion Animal Parasite Council (CAPC) recommends testing symptomatic dogs with a variety of diagnostics
- Patients may be asymptomatic
  - Consider factors when thinking about treatment
- Treatment is varied
  - Patients who are symptomatic but do not have a zoonotic strain, a high fiber diet with probiotics may be sufficient
  - Metronidazole 10-25 mg/kg q12 for 5-8 days
  - Fenbendazole 50mg/kg q24 for 3 days – experimental evidence states more effective than metro
  - Drontal plus – dosed based off weight for three days
  - Control environment re-exposure
- Follow up testing?

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PARASITIC

Trichuris vulpis

- Affects canines only
- Hosts are infected via ingestion of embryonated eggs from soil
- Very long PPP (up to 3 months!)
- Causes hemorrhagic diarrhea
  - Severe infections cause weight loss, dehydration, anemia, and possibly death
- Adult worms live in the cecum
- Feeding habits of the worms result in clinical disease
- Due to the long PPP, diagnosis can be challenging
  - PCR can identify infection prior to eggs being shed
  - Best practice is to combine PCR + fecal float
- Treatment
  - Drontal Plus – single dose based on weight
  - Fenbendazole 50mg/kg PO q24 for 3d
  - Can repeat treatment once monthly for three months

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INFLAMMATORY

- AHDS
- DIETARY INDESCRETION
- DYSBIOSIS

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INFLAMMATORY

Acute Hemorrhagic Diarrhea Syndrome (AHDS)

- Formerly known as Hemorrhagic Gastroenteritis (HGE)

- Large volumes of hemorrhagic diarrhea with significant losses of fluid and necrosis of the intestinal lining
- Commonly seen in middle aged, small breed dogs
- Some require hospitalization to treat hypovolemic shock and severe dehydration
- Enterotoxigenic *Clostridium perfringens* thought to be in the pathogenesis of AHDS
- *Clostridium perfringens* NetE & NetF toxin role?

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AHDS

- Often previously healthy dogs, no pertinent medical history
- Bloody, explosive diarrhea, along with anorexia, vomiting, and extreme lethargy
- PCV >60% with low/normal TP
  - Elevated PCV is due to hemoconcentration and or splenic contraction
  - GI loss of proteins or redistribution of body water into vascular space
- Treatment is aimed at fluid therapy

It is not recommended to use antibiotics with AHDS unless there is a growing concern for sepsis or SIRS

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AHDS

- Not specific for sepsis/SIRS, but *suspicious*
- Difficult to initially distinguish between SIRS and dehydration!
  - The most relevant finding in before and after rehydration was **tachycardia** (Dupont et al JVIM 2021)
- If two or more signs persist despite aggressive supportive care there should be an increased level of concern

SEPSIS/SIRS

CRITERIA	DOGS 2 criteria required	CATS 3 criteria required
Temperature *F	<100.6 or >102.6	<100 or >103.5
HR (beats/min)	>120	<140 or >225
RR (breaths/min)	>20	>40
WBC (x10^3)	<6 or >6	<5 or >19.5
Band cells (%)	>3	>5

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DIETARY INDESCRETION

- Garbage gut
- Diagnosed through PE and thorough history taking
- Treatment is supportive care
  - SQ fluids (25-30 ml/kg), probiotics, diet
- Should resolve in 24-72h

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DIETARY INDESCRETION

- Foreign body v. garbage gut
- Diagnosed through PE, abdominal imaging, and history taking
- Depending on type (partially obstructive v. obstructive v. linear), treatment depends
    - If partially obstructive, IVF and frequent walks may help it pass!
- Watch for severe ileus, which may confuse with gastric foreign bodies or small intestinal FB

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DIETARY INDESCRETION

Dysbiosis

- Secondary to use of antimicrobials causing a riff in GI microbiome
- This study looked at the changes of the microbiome associated with the administration of metronidazole in healthy dogs for 14d
    - The microbiome composition was significantly altered for at least 4 weeks, and the dysbiosis continued afterwards, indicating a long-term dysbiosis of the microenvironment

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STANDARD ARTICLE

Journal of Veterinary Internal Medicine Open Access ACVIM American College of Veterinary Internal Medicine

Effects of metronidazole on the fecal microbiome and metabolome in healthy dogs

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METABOLIC

- HYPOADRENOCORTICISM
- LIVER*
- RENAL*
- PANCREATITIS
- HYPERTHYROIDISIM

*not covered in this talk

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HYPOADRENOCORTICISM

- Young – middle aged dogs (avg 4y)
- Predisposed breeds: Portuguese Water Dogs, Great Danes, Westies, Poodles, Wheaton Terrier, Rotties
    - Most common breeds are actually mixed breeds!
- Animals diagnosed older will typically have atypical Addison's (glucocorticoid deficiency only)
- Suspected to be caused by immune mediated destruction of the adrenal cortices

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HYPOADRENOCORTICISM

- Clinical findings
  - Decrease in Na:K ratio (28:1)
  - Inappropriately low USG
  - Anemic
  - Lack of a stress leukogram when clinically ill
  - Azotemic
  - Hyperphosphatemic
  - Hypoglycemia
  - Hypotension
  - Abdominal ultrasound – bilaterally small adrenal glands
- Diagnosed with ACTH Stim
  - Cosyntropin IV 1-5 mcg/kg

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HYPERTHYROIDISM

- Feline hyperthyroidism
  - Most common endocrine disease in cats
- Thyroid hormones control body's metabolic rate → increased thyroid → hypermetabolic state
- Thyrotoxicosis changes SI muscular contractions, increases intestinal motility, and decreases mouth-cecum transit times
- Diagnosed with T4 levels

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PANCREATITIS

- Acute pancreatitis is a fully reversible inflammation of the pancreas with the histologic presence of edema, neutrophilic infiltrate, and necrosis
- Disease can remain local or cause SIRS/MODS in severe cases
- Predisposing factors
  - Breed – Mini Schnauzers, Yorkies, DSH
  - **Dietary indiscretion**
  - Infections – *Babesiosis*
  - Drug reactions – ELSPAR, azathioprine, potentiated sulfonamides, phenobarbital, potassium bromide
  - Endocrine disases – Diabetes Mellitus, hyperadrenocorticism, hypothyroidism, DKA
  - Hypertriglyceridemia and obesity
    - Triglyceride levels >862 mg/dL are 4.5x more likely to develop panc

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PANCREATITIS

- Key Factors initiating pancreatic inflammation is thought to be the activation of trypsin within the acinar cells, based on three scenarios:
  1. Blockage of the acinar cell apex in the pancreatic duct, leading to co-localization and fusion of zymogen and lysosomal granules
  2. Oxidative stress
  3. Hypotension
- Intracellular pancreatic secretory trypsin is the neutralizing factor to trypsin, but it is overwhelmed when more than 10% of intracellular trypsin is activated
- Causes local inflammation → neutrophil migration → reactive oxygen species and nitric oxide → overwhelming inflammation
- Treatment depends on severity

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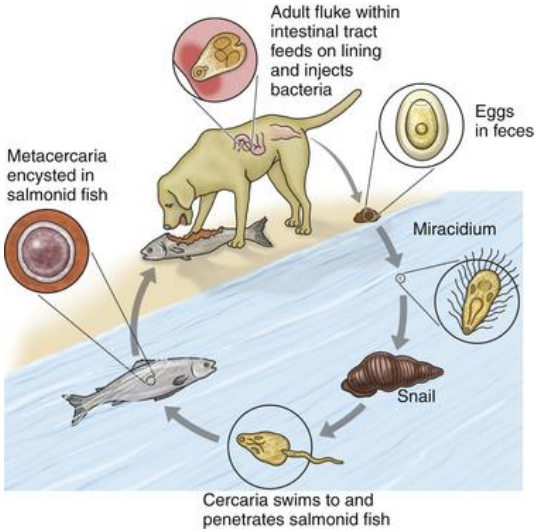
SALMON POISONING

- *Neorickettsia heminthoeca*
- Found primarily in the northwest, occurs when a dog ingests a raw fish (typically salmon) that is infected with a fluke (*Nanophytetus salmincola)*
- Clinical signs
  - Start with a fever, that normalizes
  - Anorexia, weight loss and small bowel diarrhea occurs
- Diagnosed through FNA of lymph nodes with rickettsia
- Treated with tetracyclines, IVF, and GI support
- If left untreated, poor prognosis



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FUNGAL

- HISTOPLASMOSIS - *Histoplasma capsulatum*
- Primarily found from Mississippi to Ohio
- Can affect GI (most severe), respiratory, reticuloendothelial, skeletal, and ocular
- The colon is most commonly affected
  - Diffuse, severe, granulomatous, ulcerative mucosal disease occurs
  - hematochezia
  - Weight loss
  - Intermittent fever
- Diagnosed through colonic mucosal scraping and viewing yeast on cytology
- Urine ELISA not validated in dogs, but appears to be helpful
- Prognosis is better if caught early, but if progresses to multiple organs the prognosis is poor

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OTHERS

Toxins

- Heavy Metals
- Organophosphates
- Nsaids
- Steroids
- Chemotherapy
- Chocolate

Renal/hepatic

- AKI
- Acute Hepatotoxin

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DIAGNOSTICS

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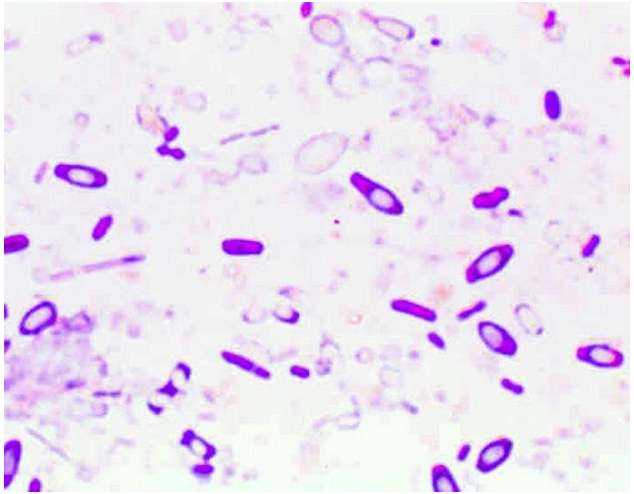
FECAL

- Float
- Fecal Smears?
  - Possibly helpful, but identifying clostridial overgrowth in a diarrheic patient is not sensitive to identifying pathogenic clostridium
- PCR
  - Antech KeyScreen Fecal PCR
  - Idexx Feline/Canine Diarrhea panel



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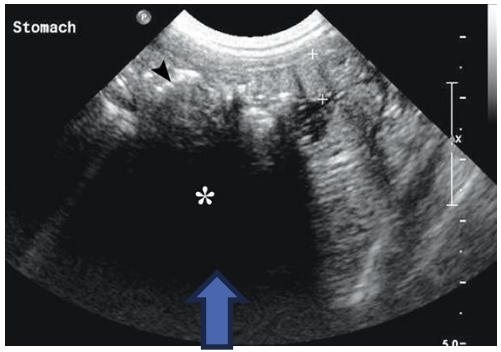
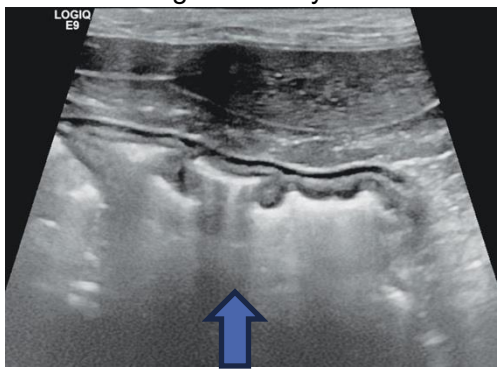
ABDOMINAL IMAGING

Abdominal radiographs v. ultrasound

- Both are warranted in most workups
- Abdominal radiographs are important for obvious, large causes
  - i.e. gastric or radiopaque foreign bodies, large masses, stones, etc
- Abdominal ultrasound is more sensitive when looking for foreign bodies, intussusceptions, extra-GI causes of diarrhea
  - POCUS!



Shadowing secondary to FB



Shadowing secondary to gas

BLOODWORK

- CBC
  - Neutropenia – parvovirus needs to be ruled out (even in old dogs) v. sepsis
  - Eosinophilia – endoparasitism, eosinophilic enteritis, hypoadrenocorticism, or mast cell neoplasia
  - Anemia – enteric blood loss or depressed erythropoiesis from systemic disease, chronic inflammation, or malnutrition
  - Left shift with toxic neutrophils – needs aggressive workup for underlying causes
  - Lymphopenia – common in dogs with lymphangiectasia

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BLOODWORK

- Chemistry panel
  - Panhypoproteinemia (ALB, GLOB) – PLE
  - Hypocholesterolemia – PLE, lympangiectasia
  - Electrolyte disorders
  - Other electrolytes not commonly thought about
    - Magnesium – if low, reduced GI motility and ileus
  - Elevated liver values

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BLOODWORK

- 4Dx
  - Anaplasmosis can cause GI signs
  - May need to send out PCR to confirm
- FeLV/FIV
  - Should be performed based on housing/habitat/clinical presentation
- T4
  - Warranted in any cat >8y, independent of concurrent signs like polyphagia and weight loss

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TREATMENT

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GOALS OF THERAPY

- Restore and maintain electrolyte balance and dietary modification
- Administration of broad spectrum anti-helminthics (if indicated)
- Judicious use of antimicrobials
- When inpatient therapy is warranted:
  - Severe dehydration
  - Hypovolemic Shock
  - Uncontrollable outs – nonstop liquid diarrhea or vomiting
- Fasting to “let the bowel rest”?

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INPATIENT THERAPY

- Determined by history, PE, results of lab findings, and underlying disease process
- Common errors in interpretation of hydration on PE:
  - Animals that have lost a considerable amount of weight have reduced skin turgor, prolonged skin retraction, and ocular recession even if euhydrated
  - Elevated HR – consider other factors besides shock/dehydration
    - i.e. pain, anxiety
  - Nausea – hypersalivation causes mm to have more moisture
  - Panting dog – more tacky mm
- CRT
  - Quick CRT – vasodilation – think shock!
  - Delayed CRT – marked sympathetic stimulation and constriction of peripheral vascu[illegible]s

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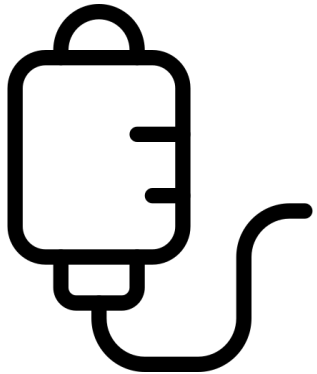
FLUID THERAPY

Goals of fluid therapy include

- Restoration and maintenance of circulating volume for tissue perfusion
  - Crystalloid and colloidal fluids
- Correction of abnormalities of electrolytes, glucose
  - Crystalloid, electrolyte, and glucose supplements
- Provision of oncotic support
  - Synthetic and natural colloids
- Restoration of oxygen carrying capacity
  - Whole blood v. pRBCs
- Provision of nutritional support
  - Enteral and parental nutritional solutions (when indicated)



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DIETARY THERAPY

- Highly digestible, moderately fat-restricted, low-residue intestinal formula or an elimination diet consistent of a novel, select protein source
- Increased fat content delays gastric emptying
- Malabsorbed fats are hydroxylated by intestinal and colonic bacteria → stimulate colonic water secretion → increasing fluid loss and exacerbating diarrhea

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FIBER

- Non-digestible carbohydrates
- Plays an important role nutritionally - not just in the GI tract
- Important physiochemical properties of fiber include fermentability, solubility, and viscosity
    - Fermentability – decreases GI transit time, increased short chain fatty acid production, increase fecal bulk
    - Solubility – soluble v. insoluble fiber
    - Viscosity – ability for fiber to thicken and form gel like solution

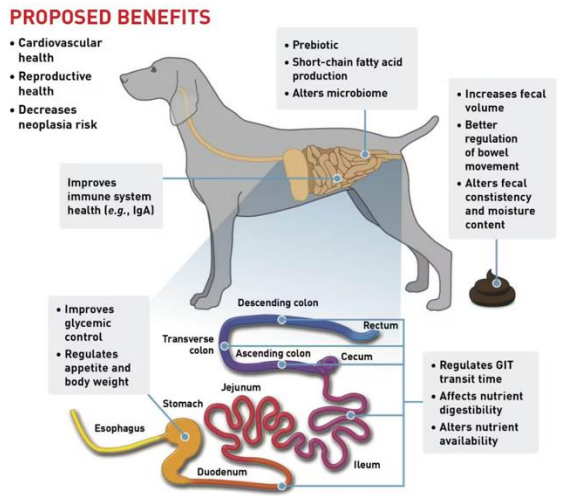

Figure 1. Dietary fiber has widespread effects within the gastrointestinal tract and systemically. The primary effects documented in dogs and cats are highlighted in this figure. © Adam J. Rudinsky

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FIBER

Insoluble Fiber

- Draws water out of the colon and absorbs it, creating increased fecal bulk

Soluble Fiber

- Draws water into the lumen
- May have pre/probiotic effects from being fermented by microbes

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FIBER

- Diets specific for fiber-responsive diarrhea contain higher total dietary fiber (TDF) compared to other easily digestible diets (i.e. hydrolyzed, Hills i/d)
  - TDF dogs – 4.5-6g/100kcal
  - TDF cats – 2.6-2.9g/100kcal
- *C. perfringens* respond well to fiber-supplemented diets
- Multiple studies have found feeding a **high fiber, high protein, low fat diet alone is superior to doing a bland diet with metronidazole**
  - Faster recovery time 5 days, compared to 8.5 days with bland diet and metronidazole (Rudinsky et al 2022)
  - Less likely to have reoccurrence of diarrhea with high fiber diet

JAVMA AVMA

Randomized controlled trial demonstrates nutritional management is superior to metronidazole for treatment of acute colitis in dogs

Adam J. Rudinsky, DVM, MS, DACVIM[1,2]*; Valerie J. Parker, DVM, DACVIM[1,2]; Jenessa Winston, DVM, PhD, DACVIM[1,2]; Edward Cooper, DVM, MS, DACVECC[1]; Tamra Mathie, RVT[3]; James P. Howard, DVM, MS, DACVS[1,2]; C. A. Bremer, BS[4]; Page Yaxley, DVM, DACVECC[1]; Antionette Marsh, JD, MS, PhD[4]; Jeremy Laxalde, PhD[5]; Jan Suchodolski, MedVet, DrVetMed, PhD, AGAF, DACVM[6]; Sally Perea, DVM, MS, DACVIM[5]

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STANDARD ARTICLE
Journal of Veterinary Internal Medicine Open Access ACVIM American College of Veterinary Internal Medicine

Efficacy of feeding a diet containing a high concentration of mixed fiber sources for management of acute large bowel diarrhea in dogs in shelters

Michael R. Lappin[1] | Amy Zug[1] | Claire Hovenga[1] | Jason Gagne[2] | Emily Cross[2]

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FIBER

- Are cats with fiber-responsive diarrhea just like small dogs?
  - Limited data, but essentially yes
- Increased dietary fiber in acute colitis kittens in a shelter had a fewer day resolution of clinical signs compared to a traditional diet
- Hairball management
  - Increasing dietary fiber increases fecal hair excretion in longhair cats

JAVMA AVMA

Dietary fiber aids in the management of canine and feline gastrointestinal disease

Adam A. Moreno, DVM[1,2]; Valerie J. Parker, DVM, DACVIM (SAIM and Nutrition)[1,2]; Jenessa A. Winston, DVM, PhD, DACVIM (SAIM)[1,2]; Adam J. Rudinsky, DVM, MS, DACVIM (SAIM)[1,2*]

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doi.org/10.2460/javma.22.08.0351

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FIBER

Fiber Source	Amount	Total Fiber ~20 grams
Psyllium husk	2 tbsp	
Canned pumpkin	3 cups	
Green beans	8 cups	

Figure 4—Relative fiber contributions totaling 20 g of fiber from various commonly used fiber sources in clinical practice.

Animal size	TBSP psyllium husk per day
Toy breeds/cats	0.5 tbsp / day
Small dogs	1 tbsp / day
Medium dogs	2 tbsp / day
Large dogs	3 tbsp / day

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PROBIOTICS

- Living organisms with low-no pathogenicity that exert beneficial effects (i.e. stimulation of innate and acquired immunity) on the health of the host
- Protective effect on normal microflora on the human gut by their antimicrobial activities directed toward intestinal pathogens
    - They also can provide enhanced immune response, upregulation of metabolites, or production of antimicrobials substances
- Several studies show improvement in acute diarrhea and faster resolution when given probiotics as part of treatment plans

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PROBIOTICS

- *Enterococcus faecium*
  - Safely colonized in canine GI tract
  - Increases fecal immunoglobulin A content and circulating mature B cells in puppies
  - May be useful in preventing or treating canine GI disease
  - Down sides – may enhance Campylobacter jejuni adhesion and colonization in canine intestines
- *Lactobacilli* - Gram positive commensal lactic acid bacteria
  - Enhanced lymphocyte proliferation, innate and acquired immunity, and anti-inflammatory cytokine production
  - L. rhamnosus GG – bacterium used in yogurt – effective in treating and preventing diarrhea, recurrent clostridium difficile infection, primary rotavirus infections (FIV/FELV) and atopic dermatitis in humans

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PROBIOTICS

- 60 dogs enrolled in the study, given either a probiotic, metronidazole, or a placebo (sucralose)
- Treated on outpatient basis
- Time to resolution (avg)
  - Probiotic administration – 3.5 days
  - Metronidazole administration – 4.6 days
  - Placebo administration – 4.8 days
- Mean time to resolution was 1.3 days shorter in dogs who received probiotics v. placebo

frontiers in Veterinary Science

CLINICAL TRIAL
published: 04 June 2019
doi: 10.3389/fvets.2019.00163

A Randomized Double Blinded Placebo-Controlled Clinical Trial of a Probiotic or Metronidazole for Acute Canine Diarrhea

Justin Shmalberg[1], Christina Montalbano[1], Giada Morelli[2] and Gareth J. Buckley[3]*

[1] Department of Comparative, Diagnostic, and Population Medicine, College of Veterinary Medicine, University of Florida, Gainesville, FL, United States, [2] Department of Animal Medicine, Production and Health, University of Padua, Padova, Italy, [3] Department of Small Animal Clinical Sciences, College of Veterinary Medicine, University of Florida, Gainesville, FL, United States

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PROBIOTICS

- Evaluated whether probiotic treatment had an impact on the clinical course of dogs with an abundance of *C. perfringens* and toxigenic *C. perfringens* with AHDS
- 84 dogs originally in study
  - 59 dogs excluded
  - 25 dogs with AHDS included
    - 13 received probiotics, 12 placebo
- Additional therapy standardized with IVF, cerenia (1 mg/kg) and rescue buprenorphine PRN (0.01mg/kg q6-8h), fed RC GILF for 21 days (included outpatient care)
- Tested feces daily for 8 days for fecal microbiota PCR
- Significantly lower abundance of *C. perfringens* in dogs treated with probiotics compared to placebo on day 7 of treatment
- Significant improvement in clinical signs on Day 3 of probiotic group and Day 4 of placebo group

RESEARCH ARTICLE

Effect of probiotic treatment on the clinical course, intestinal microbiome, and toxigenic *Clostridium perfringens* in dogs with acute hemorrhagic diarrhea

Anna-Lena Ziese[1]*, Jan S. Suchodolski[2], Katrin Hartmann[1], Kathrin Busch[1], Alexandra Anderson[1], Fatima Sarwar[2], Natalie Sindern[1], Stefan Unterer[1]

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PARVOVIRUS TREATMENT

- Supportive care
  - IV fluids, electrolyte support, GI support, pain medications
- 2017 CSU Study evaluates inpatient v. outpatient survival rate
  - 90% survival inpatient v. 80% survival outpatient therapy
- Monoclonal Antibody Injection
  - Neutralizes the virus early in disease
  - Only one prospective study (performed by company who owns medication)
  - Dogs treated early in disease process had a 0% mortality – all lived!
- Fecal transplant!

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FECAL TRANSPLANT

- Fecal microbiota transplantation (FMT) aims to restore a healthy gut microbiome after disruption
- Transferring fecal microorganisms from a healthy dog to a recipient dog can help restore microbial balance dysbiosis
- Can be given orally, via an enema; or via endoscopy or colonscopy
- 4 popular hypotheses to mechanisms
    1. niche exclusion
    2. increase competition for nutrition
    3. production of antimicrobials
    4. increased production in secondary bile acids
- Newer development in human medicine with *C. difficile* patients

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FECAL TRANSPLANT

- 66 dogs evaluated with parvovirus
  - Split into standard treatment group and then standard treatment + FMT
- Utilized one healthy donor dog
- 10g donor feces + 10mL 0.9% NaCl given rectally into proximal portion of rectum
- Performed every 48h until resolution of diarrhea or a total of 5 applications

- Dogs that received standard treatment + FMT spent significantly less time in the hospital compared to dogs who received standard treatment alone
  - Avg 1.5 days compared to 5.5 days standard treatment
- Rapid clinical response indicates only 1 FMT per patient
- Hypothesized that diarrhea in parvo in perpetuated by intestinal dysbiosis, FMT reconstitutes intestinal microbiota leading to faster recovery

Received: 4 August 2017 | Revised: 21 December 2017 | Accepted: 18 January 2018
DOI: 10.1111/jvim.15072

STANDARD ARTICLE

Journal of Veterinary Internal Medicine Open Access
ACVIM American College of Veterinary Internal Medicine

Fecal microbiota transplantation in puppies with canine parvovirus infection

Giorgio Q. Pereira[1] | Lucas A. Gomes[1] | Iago S. Santos[1] | Alice F. Alfieri[2] | J. S. Weese[3] | Marcio C. Costa[4]

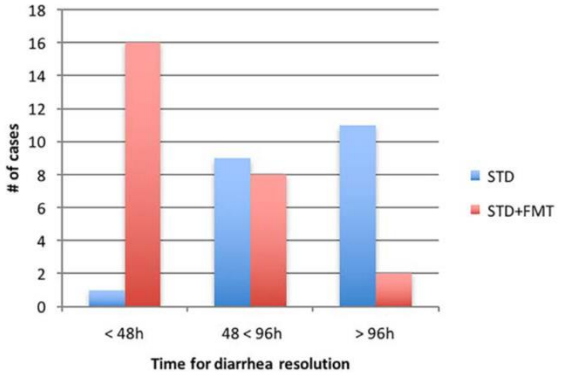

FIGURE 1 Time for resolution of diarrhea in survivor puppies with parvovirus infection treated with fecal microbiota transplantation (STD + FMT) compared to standard treatment (STD)

WHEN TO USE ANTIMICROBIALS

- 45-70% of dogs received antibiotics for acute diarrhea
- *Routine use of metronidazole is against the recommendation of treatment of acute diarrhea in humans (American College of Gastroenterology)*
  - Most human patients are treated with fluids, anti-motility agents, and diet changes
- Use of antimicrobials as empirical therapy in the management of uncomplicated or noninfectious diarrhea is not recommended due to adverse effects on the normal intestinal microflora, causing a dysbiosis.
  - Also promotes resistant bacteria
  - Concern for MRSA has been isolated from canine feces in the environment

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METRONIDAZOLE

- Nitroimidazole antibiotic, antiprotozoal, possibly immunomodulatory and anti-inflammatory effects
- Mechanism of action incompletely understood
    - Believed to inhibit bacterial DNA and induce oxidative damage primarily on anaerobic bacteria
- Administration of metronidazole to healthy dogs causes a significant shift in the microbiome, causing a dysbiosis for weeks

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WHEN TO USE ANTIMICROBIALS

- INDICATIONS FOR ANTIMICROBIALS
  - *Campylobacter – clinical for disease*
  - *Salmonellosis*
  - *Clostridium – concern for enterotoxigenic netF or immunocompromised patient*
  - *Giardia*
- Should be considered in situations where there is severe mucosal damage and high risk of bacterial translocation
- Hematochezia in immunocompromised patients
- Patients not improving with supportive care and rehydration >7 days

Contents lists available at ScienceDirect

Topics in Companion Animal Medicine

journal homepage: www.elsevier.com/locate/tcam

Review Article

The use of metronidazole in acute diarrhea in dogs: a narrative review

Connor Ellis [a], Adesola Odunayo [a,1,*], M Katherine Tolbert [b]

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[b] Gastrointestinal Laboratory, Department of Small Animal Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Texas A&M University, College Station, TX, USA

Table 1
Summary of studies reviewed for their assessment of the use of metronidazole for treatment of acute diarrhea.

Study, year published	Population	Study design	Sample size (n)	Control	Treatment	Outcomes assessed	Results
Fenimore et al. 2017[32]	Shelter dogs with AD	Prospective, randomized, placebo-controlled, blinded treatment trial	32 dogs without systemic illness, fever	Yes	MTZ +/- FortiFlora®, +/- additional deworming	Number of normal stools	Dogs given FortiFlora® and MTZ had more normal stool than dogs on MTZ alone
Ortiz et al. 2018[31]	Dogs with AHDS requiring hospitalization	Prospective, randomized, placebo-controlled, blinded treatment trial	34 dogs, diarrhea of <3 days, receiving A/C	Yes	A/C, IV fluids, buprenorphine, omeprazole, and either MTZ or saline	Hospitalization time, scoring of disease severity	No significant difference in either outcome among groups
Pignataro et al. 2021[34]	Dogs with AD	Prospective, randomized, single-blinded treatment trial	30 dogs without comorbidities	No	MTZ-spiramycin combo vs. synbiotic	Time to resolution of diarrhea	Synbiotic group recovered one day faster
Shmalberg et al. 2019[30]	Dogs with AD	Double-blinded, placebo controlled, randomized clinical trial	60 dogs without comorbidities or severe AHDS	Yes	MTZ vs. placebo vs. probiotic	Number of days until first formed stool	No significant difference among any groups
Langlois et al. 2020[1]	Dogs with AD without evidence of infection by parasites, Giardia, or parvovirus	Double-blinded, placebo controlled, randomized clinical trial	31 dogs, 14 treated with MTZ, 17 as control	Yes	MTZ vs. placebo	Time to resolution of diarrhea	Dogs treated with MTZ had diarrhea resolve about 36 hours earlier than dogs treated with placebo
Chaitman et al. 2020[33]	Dogs with AD	Prospective clinical trial	18 dogs, 11 FMT, 7 MTZ	Yes	FMT vs. MTZ	qPCR canine dysbiosis index, fecal consistency at day 7 and day 28	Dysbiosis index increased in MTZ dogs and decreased in FMT dogs. Persistent dysbiosis was noted at day 28 in MTZ dogs.
Rudinsky et al., 2022[29]	Dogs with AD	Prospective, randomized, blinded clinical trial	59 dogs, 19 diet, 20 diet and MTZ, 20 diet and fiber	Yes	Diet with MTZ vs. diet with supplemental fiber	Time to resolution of diarrhea, fecal score, relapse, qPCR canine dysbiosis index	MTZ group had longer time to resolution of diarrhea and a worse dysbiosis index at days 7 to 10

Abbreviations: MTZ – metronidazole, AHDS – acute hemorrhagic diarrhea syndrome, AD – acute diarrhea, A/C – amoxicillin/clavulanate, IV – intravenous, FMT – fecal microbiome transplant

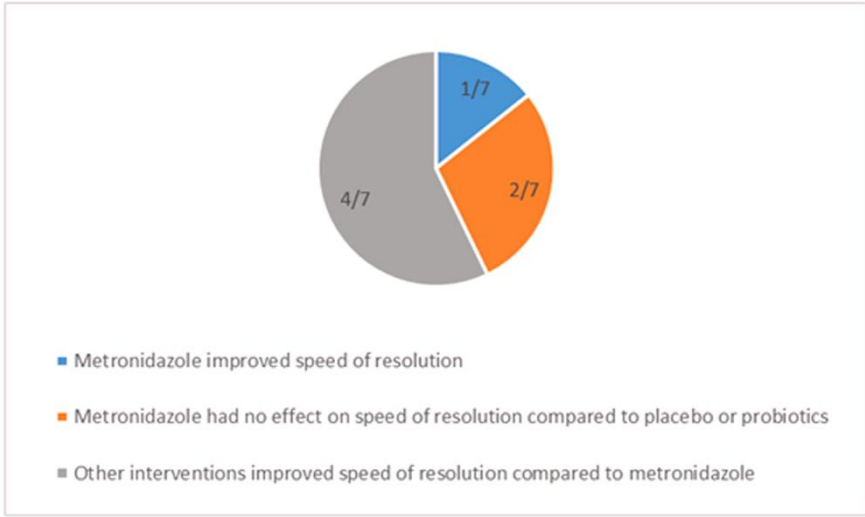

Fig. 1. Summary of the outcome of treatment of acute diarrhea with metronidazole in 7 veterinary studies.

ARE WE DONE YET?

- A fecal screening and outpatient therapy with probiotics, high fiber low fat diet should be prioritized in a stable patient with acute diarrhea
- Trialing adding fiber to the diet prior to reaching for antibiotic therapy
- Utilize POCUS to aid in your workup!
- Reach for metronidazole or other antibiotic therapy in an immunocompromised patient with hematochezia or concerns for sepsis secondary to GI translocation

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QUESTIONS?

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