Canine and Feline Small Intestinal Disease (SID)

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Laboratory Tests
- Complete Blood Count
- Serum Biochemical Profile
- Urinalysis
- All often unremarkable in SID
Dysfunction in Small Intestinal Disease

- Premucosal
  - intraluminal
- Mucosal
- Postmucosal
  - hemolymphatic

**Dysfunction in Small Intestinal Disease**

- Premucosal
  - EPI!
  - SIBO / Dysbiosis
  - (Bile acid deficiency)
  - (Gastric acid hypersecretion)
  - (both very rare)
Dysfunction in Small Intestinal Disease

- **Mucosal**
  - Idiopathic inflammatory bowel disease (IBD)
  - Specific infectious enteropathies
    - (histoplasmosis, phycomycosis, salmon poisoning, other microbes - "dysbiosis")
  - Neoplastic enteropathies
    - (lymphoma, adenocarcinoma)

- **Postmucosal**
  - Lymphatic obstruction
    - Neoplastic, granulomatous
    - Idiopathic lymphangiectasia
  - Vascular disease
    - Portal hypertension
    - Decreased cardiac output
Small Intestinal Disease

- There is no single "perfect" (sensitive and specific) test for small intestinal disease in dogs or cats!
- Even intestinal biopsy is often not very useful
- Do what is easy, inexpensive, minimally invasive, and most likely to change how you manage the patient first
- Take time to explain the complexities to clients, and that patience may be required to find the best management practices

Cobalamin and folate in dogs and cats

- Folate – FF
- Folate First

4 year old female spayed Chihuahua

- Chronic diarrhea
- Getting worse
- Some days "not quite herself" or "not hungry"
- Weight loss (still plump!)
4 year old female spayed Chihuahua

- Physical exam – NR
- In house CBC, panel and UA – NR
- Whole body radiographs – NR
- GI Panel to GI Lab

4 year old female spayed Chihuahua

- TLI – 5 ug/L (5-35ug/L)
- Folate 1.5 ug/L (7.2-17.4 ug/L)
- Cobalamin 530 ng/L (250-950 ng/L)

Subnormal serum folate

- Increased utilization
- Decreased absorption
- Decreased intake

- Folate supplementation
  - Diarrhea resolved over 2-3 weeks
  - Serum folate normalized at 5 weeks

1 year old intact male Golden Retriever

- Chronic diarrhea
- Otherwise healthy
- Guide dog training facility
1 year old intact male  
Golden Retriever

- Physical exam – NR
- CBC, panel and UA – NR
- Abdominal radiographs – NR
- Abdominal ultrasound – NR
- Gastroscopy and Duodenoscopy - Minimal to mild lymphocytic inflammatory bowel disease
- GI Panel to GI Lab

1 year old intact male  
Golden Retriever

- TLI – 6.5 ug/L  
  (5-35ug/L)
- Folate 35.5 ug/L  
  (7.2-17.4 ug/L)
- Cobalamin 325 ng/L  
  (250-950 ng/L)

Supranormal serum folate

- Increased uptake
  - Exogenous sources
    - Diet (other oral intake)
    - Supplementation
  - Endogenous
    - Intestinal microflora (“SIBO”, dysbiosis)
    - Mixed Exogenous and Endogenous

1 year old intact male  
Golden Retriever

- Tylosin for 6 weeks
- Highly digestible low residue diet containing a prebiotic
- Change environment

- Stool improved markedly within one week.
Folate

- Also known as vitamin B9, folacin or folic acid
- Methyl group transfer (homocysteine to methionine)
- Rapidly dividing cells
- From Latin – folium (leaf)

Folate absorption

- Passive transfer across specific carriers located only in the upper small intestine
- Oral supplementation easily overcomes malabsorption!

Serum Folate

- Decreased with disease of the upper small intestine
- Decreased with dietary insufficiency
Folate Deficiency – Dogs and Cats

- Diarrhea?
- Anorexia? Weight loss?
- Hair coat – quality and color?

Humans – megaloblastic anemia
Role in heart disease, spina bifida, depression, infertility, retinal degeneration, others

Serum Folate in Cats With EPI

Control Range

Serum Folate (µg/l)
**Cobalamin**
- Also known as vitamin B12
- Cyanocobalamin & others
- Methyl group transfer functions related to folate (homocysteine to methionine)
- Rapidly dividing cells
- Pernicious anemia in man

**Cobalamin**
- All made by bacteria until cyanocobalamin was synthesized by man
- Plentiful in liver and meat products
- Plentiful in dog and cat foods
- Very little needed to maintain normal function

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**INTRINSIC FACTOR - COBALAMIN**

**COBALAMIN ABSORPTION**

Ileal Cells

Intrinsic Factor

Cobalamin Complex

Bloodstream
**Cobalamin absorption**

- Active transfer in a complex form across specific carriers located only in the last 10% of the small intestine (ileum)

- Oral supplementation often does not overcome malabsorption!

**Inherited Selective Cobalamin Malabsorption**

- First recognized in Giant Schnauzers

- Anorexia

- Failure to gain weight

- 7-12 weeks of age
Cobalamin Deficiency In Dogs
- Mild non-regenerative anemia
- Mild neutropenia
- Hypersegmented neutrophils
- Giant platelets
- Usually none of the above!

Inherited Selective Cobalamin Malabsorption
- Giant Schnauzer
- Border Collie
- Beagle
- Komondor
- Other dog breeds
- Cat?
Cobalamin deficient cats

Intestinal Mucosal Changes in Cobalamin Deficient Humans

Before Supplementation

After Supplementation

Effects of Bacteria on Folate and Cobalamin

Folate synthesis

Cobalamin binding

Increased serum folate

Cobalamin malabsorption
**Intestinal Obstruction**

- Neoplasia
- Foreign body
- Intussusception
- Stricture
- Herniation / Incarceration
- Diverticulae
- Adhesion
- Regional Enteritis
- Phycomycosis
- Pseudo-Obstruction

**Therapy for Bacterial Overgrowth in the Small Intestine**

- Metronidazole
  - 20mg/kg q12h
- Tylosin
  - 15mg/kg q12h
- Diet change !!!

**Small Intestinal Disease?**

- Is pancreatic function adequate?
- Is there dietary sensitivity?
- Is there specific GI infection?
- Is there malabsorption?
- Is there protein-losing enteropathy?
- Is there SIBO / dysbiosis?
- Is there neoplasia?
- Is there villous atrophy?
- Is there intestinal inflammation?

**Therapeutic options**

- Treat specific underlying disease - infectious, obstructive or neoplastic
- Dietary manipulations
  - low fat (dog) or carbohydrate (cat)
  - highly digestible (low non-fermentable fiber)
  - adequate fermentable fiber
  - MCT oil / Purina EN
  - Novel antigen (elimination) or hydrolysed
- Antibiotics, Prebiotics, Probiotics – SIBO (ARD)
- Vitamin supplements
- Glucocorticoids - prednisolone
- Immunosuppressives
  - azathioprine, chlorambucil
  - cyclosporine, other potent immunosuppressives?
POSTULATED MECHANISM OF PREDNISONE ACTION

- Prednisone + Receptor
- DNA
- Expression
- Translation
- Post-translational Processing

Natasha

- 12 yo F(S) DSH Cat
- Gradual weight loss
- Increasingly irritable

Natasha

- CBC, serum biochemical panel, urinalysis, fecal parasite exam
- Abdominal ultrasound
- Clean teeth and dental radiographs
- Serum T4
- Serum fTLI, fPL, folate, cobalamin
- Serum tocopherol
- Fecal α₁-proteinase inhibitor
Natasha

- Increased serum fTLI, fPL
- Subnormal serum cobalamin
- Subnormal serum tocopherol
- Increased fecal $\alpha_1$-proteinase inhibitor

- Chronic enteropathy and chronic pancreatitis
- Classical "skinny old cat"

Natasha

- Low carb / high protein diet
- Cobalamin SQ
- Oral tocopherol supplement
- Consider oral prednisolone reducing to 2.5 mg every other day
Low Fat Digestibility Incidence

Normal Fat Digestibility

Low Fat Digestibility

SKINNY OLD CATS: What Changes...What It means...How to feed them?
Identifying cats with reduced digestive capacity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Abnormal level</th>
<th>Percent with low-MD (&gt;50%) digestibility</th>
<th>Percent with low-MD (&gt;70%) digestibility</th>
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<tbody>
<tr>
<td>Vitamin E</td>
<td>&lt; 0.5 mg/L</td>
<td>90</td>
<td>62</td>
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<tr>
<td>Vitamin B12</td>
<td>&lt; 100 mg/L</td>
<td>82</td>
<td>42</td>
</tr>
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→ Serum vitamin E and B12 have a strong inverse association with reduced digestive function
→ Easy to perform under clinical conditions vs. digestibility testing

Nestlé Purina PetCare Research