The Geriatric Cat: Complex Management with Multiple Disorders

Margie Scherk
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Vancouver, Canada
Common Concurrent Diseases

1. Chronic kidney disease II-III + hyperthyroidism + hypertension + arthritis
2. Diabetes mellitus + IBD + chronic kidney disease II

But first...
Geriatric cats

- Improved health care and nutrition, vaccination, dental care
- Average life expectancy: 14-16 years
- 1983, 24% cats > 6 years
- 1996, 47% cats > 6 years
- 2007, 16% of 81 million > 11 years
  - “Senior”: 9-12 years;
  - “Geriatric”: 13+ years

That’s 13,527,000 cats!
Geriatric cats

- Importance of early detection!
- Raise awareness of subtle signs of sickness
- Getting to the vet with less distress:
Help cats live longer, healthier lives by creating a culture of life-long, preventive healthcare.
Always focus on 4 goals

1. Hydration
2. Analgesia
3. Nutrition
4. Behaviour/environment

Cause vs. result?
- Oral health
- Arthritis
- Renal disease
- Anemia
- Hypertension
- Weakness
- Muscle loss
- Inappetence
- Weight loss
- Constipation
Constipation

- Difficulty passing firm stool
- Indicator of progressive dehydration
- Cellular water content

Treat underlying dehydration before focusing on mobility or stool consistency
Pain of Dehydration

- Lethargy
- Inappetence
- Nausea
- Headache
- Grumpy/withdrawn
- Constipation
The Skinny Aging Cat

• Down-regulation of metabolic processes limited
  – Designed to eat many small meals/day
  – High protein, water, moderate fat

• Cats have a limited ability to store many nutrients
  – Potassium, sodium, B vitamins, Vitamin E and Vitamin K

Poor body condition, is a risk factor for illness & death

• Inappetance = urgency
• Anorexia = emergency
Effects of weight loss on longevity

• Study results:
  – Every 100g loss of weight increased the risk of death by 6.4%
  – Every 100g loss of lean body mass increased the risk of death by 20%
  – Every 100g loss of body fat increased the risk of death by 40%
Appetite Stimulants

- Cyproheptadine: 1 mg/cat PO q12h
- Mirtazapine: 2 mg/cat PO q48h
- Maropitant: 1 mg/kg SQ, PO q24h

- It isn’t enough that kitty eats; must calculate and monitor amount
- Supportive feeding: syringe feeding or large bore tube feeding
When To Start Supportive Feeding?

Severely malnourished cat (20% weight loss, body condition score 1-2/9). *Example: 6 kg => 4.8 kg*

Moderately malnourished (10% weight loss, BCS 3-4/9) with catabolic disease. *Eg: 6 kg => 5.4 kg*

Normal weight and condition if catabolic disease

Start *early*
Method of feeding?

- Oral assisted vs. tubes
- Nasoesophageal
- Esophageal
- Gastrostomy
- Jejunostomy
- Advantages and disadvantages
  - +/- anaesthetic, when start using, types of foods, patient acceptance
Esophagostomy Tubes

- Placement requires brief anaesthesia
- Size 14-16 Fr. red rubber feeding tube
- Carmalt forceps or long hemostats
- Injection port/prn adapter
- Bandage neck/kitty kollar (NOT an elizabethan collar)
- Clean stoma site BID for 3-5 days with warm water and disinfectant
7th -9th intercostal space
E-tube placement

Movie Susan Little
Mouth gags: a bad idea

Maxillary artery compression

- Cerebral ischemia
- Blindness

Barton-Lamb JL et al, Vet J, in press
Caloric densities

- Rebound™: 1 kcal/ml
- Clinicare™: 1 kcal/ml
- PVD CN: 1.2 kcal/ml
- Royal Canin Recovery: 1.23 kcal/ml
- Hill’s a/d: 1.3 kcal/ml
- Iams Maximum Calorie™: 2.1 kcal/ml
How much to feed? Example

3.3 kg sick BCS 3/9, healthy weight 4.8 kg BCS 5/9
4.8 kg X 50 kcal/kg/day = 240 kcal

240 kcal = 115 ml Eukanuba Maximum Calorie
OR 200 ml of Hill’s a/d or Royal Canin Recovery or PVD CN

Day 1 feed 38 ml of Max Cal or 66 ml of other diets
Day 2 feed 76 ml of Max Cal or 133 ml of other diets
Day 3 feed 115 ml Max Cal or 200 ml of other diets.
Tube care

- Post-operatively e-tube npo 1-2h
- Start with 6-10 cc of warm water only through the tube
- First feeding start with 6 cc of slurry and flush tube with 6 cc water
- After each feeding, flush
- If clogged, instill 6 cc cola for 10 minutes
  - Pancreatic enzymes, meat tenderizer
Kittykollar.com
Less scary than bandage
Cats can eat with tubes in place
Website has information about:
• Living with an E-Tube
• How to change collar
Using an e-tube is easy – video for staff and clients

Movie Susan Little
How often to feed?

• Based on caloric requirements & volume tolerance
  – Example: Start with 6 ml and increase by 6 ml increments to ~ 36-48 for most cats
  – 4 kg healthy weight cat: 95 ml Max Cal vs. 154 ml of the other diets.

  – Tolerance is very variable: be patient, don’t get disheartened
Trickle feeding

- Syringeable food
- Clean empty IV fluid bags and lines
  - 2 per day
- ½ volume into bag, fill line
- Connect via gravity drip or pump
How long to assist feed?

- How long can you leave tubes in?
- When to remove?
- How do we determine success?
  - Weight gain
  - Coat quality
  - Increased energy
  - Muscle recovery
  - Client-noted improvements
Concurrent Diseases

1. Chronic kidney disease II=III + hyperthyroidism + hypertension + arthritis

2. Diabetes mellitus + IBD + chronic kidney disease II
CKD + HT$_4$ + HT + DJD
CKD + HT₄ + HT + DJD

• Buffy: 15 year old DSH NM
• 2 years inappropriate usg
  – What is inappropriate usg level?
• Has been doing well, stable weight, eating geriatric/senior dry and canned foods
• Last month, slowing down
• Last week, inappetant and less interactive
  – Vomited twice
### Physical Exam

<table>
<thead>
<tr>
<th>1) Attitude/Appearance</th>
<th>2) Oral Cavity/Teeth</th>
<th>3) Mucous Membranes</th>
<th>4) Integumentary</th>
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<td>□ N □ A □ NE</td>
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<tr>
<td>BCS ___________ /</td>
<td>Breath odour ________</td>
<td>Colour __________</td>
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<tr>
<td>Muscle</td>
<td></td>
<td>CRT __________ SEC</td>
<td>Skin tent:</td>
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<tr>
<td>Condition _______</td>
<td></td>
<td>Moisture _________</td>
<td>Present □</td>
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<td></td>
<td></td>
<td></td>
<td>Absent □</td>
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<table>
<thead>
<tr>
<th>5) Eyes</th>
<th>6) Ears</th>
<th>7) Cardiovascular</th>
<th>8) Respiratory</th>
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<table>
<thead>
<tr>
<th>9) Gastrointestinal</th>
<th>10) Musculoskeletal</th>
<th>11) Lymph Nodes</th>
<th>12) Urogenital</th>
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<tr>
<th>13) Nervous System</th>
<th>14) Pain</th>
<th><strong>Cuff</strong></th>
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<tr>
<td>□ N □ A □ NE</td>
<td>□ Y __________/10 □ N</td>
<td>BP __________</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Size __________</td>
</tr>
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<td>Limb __________</td>
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| T ___________ PR _______ HR _______ RR _______ Wt _______ % wt Δ _______ |
| Frequency □ AM □ PM □ Free choice # _____ Meals Amount _______ |

Diet_________________________________________________________ □ Treats □ Supplements

□ Indoors □ Outdoors □ Contact with others ____________________

**N** = Normal  
**A** = Abnormal  
**NE** = Not Examined

Other observations/findings ______________________________________

__________________________________________________________________________________________________
Examination findings

- Body weight = 7.2 lb (3.3 kg), previous visit 8 months ago for fleas, he weighed 10.5 lb. (4.8 kg, BCS 6/9) weight loss of 3.3 lb. (1.5 kg)
  - 31% weight loss
  - BCS 3/9
  - Muscle wasting
- Rectal temperature = 37.9 C/ 100.2F
- Blood pressure: 190, size 2, RH
- Depressed and quiet
- Subdued energy, lying quietly in client's lap
Body condition scores

CALORIC INTAKE

UNDER IDEAL

IDEAL

OVER IDEAL
9. Ribs not palpable under heavy fat cover. Heavy fat deposits over lumbar area, face and limbs.
Muscle condition score

PROTEIN adequacy
Muscle condition score

Image courtesy of Mark Peterson

Sarcopenic obesity
Body & Muscle condition scores

**UNDER IDEAL**

**IDEAL**

**OVER IDEAL**
9. Ribs not palpable under heavy fat cover. Heavy fat deposits over lumbar area, face and limbs.
HDO (High-definition oscillometry)

PetMap
• Moderate muscle wasting of face and head, dorsal trunk and hindquarters
• Sunken eyes, slightly dull
• Iris atrophy (moderate)
• Direct ophthalmic exam: no abnormalities noted
• Otoscopic exam: superficial flaky golden waxy material, scant
• Pale pink oral mucous mbr, moist
• Capillary refill time ~1.5 seconds
• Mod dental calculus & gingivitis
• Cervical palpation: blip/bleb

• Moderate skin tent
• Dull "greasy-looking", spiky coat
• Reluctant to jump up or walk around room

Photo courtesy D Paepe
• Thoracic compressibility, decreased
• Cardiac auscultation: holosystolic murmur over sternum, not ausculted elsewhere, grade 2/6, heart rate = 196 bpm
• Femoral pulses, present and strong, pulse rate = 190 bpm, no deficit apparent

• Lungs quiet, respiratory rate = 54 pm
• Tracheal auscultation no abnormalities noted
- Abdominal palpation: "doughy"
- Mildly thickened intestinal loops
- Hard fecal material in descending colon
- No apparent discomfort or abdominal masses palpated

- ~ 4 cm diameter urinary bladder
- Kidneys bilaterally smooth and ~ 2 cm in length
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<td>BCS 3/9 /</td>
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<td>Colour Pale pink</td>
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<td>Muscle Condition 0</td>
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<td>CRT 1-2 SEC</td>
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<td>Moisture +</td>
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**T 37.9C PR _____ HR 196 RR 54 Wt 3.3kg % wt Δ 31%**

Frequency □ AM □ PM □ Free choice # 2 Meals Amount ¼ can RC

Diet ___________________________ Dry g/d 6 Greenies □ Treats □ Supplements

□ Indoors □ Outdoors □ Contact with others ____________________________

**Other observations/findings**

Cervical bleb

N = Normal
A = Abnormal
NE = Not Examined
What are Buffy’s problems?

- Vomiting
- Dehydration
- Lethargy
- Inappetance
- Weight loss: 31%
  \[
  \frac{4.8-3.3}{4.8} = \frac{1.5}{4.8} = 0.314 = 31%
  \]
- Muscle wasting
- Hypertensive (confirm)
- Moderate dental disease
- Pale mucous membranes
- Cervical blip
- Cardiac murmur
- Decreased thoracic compressibility
- Thick intestinal loops
- Decreased mobility?
What are your differentials?
Differentials

- Chronic kidney disease
- Hyperthyroidism
- Dental disease
- Neoplasia (lymphoma)
- Pancreatitis
- Cholangitis
- IBD
- Degenerative joint disease

- Triaditis
- Cholecystitis
- Inadequate food
- Malabsorption
- Ureteroliths/
  nephroliths
- Urethral obstruction
- FeLV/FIV/FIP
Is Muscle Wasting Normal In Old Cats?

a. Yes
b. No
c. It depends

Mean loss of 34% LBM in cats > eight years of age
What’s Normal And What’s Not?

Categories from AAFP Senior Care Guidelines
Normal Musculoskeletal Changes

- Bones should be slightly more palpable but have good quantity surrounding muscle mass
- Normal for joints to deteriorate

Image from coveredincathair.com
Sarcopenia

• Occurs with normal aging independent of disease
• It is “characterized by gradual, progressive, generalized loss of skeletal muscle mass and strength with a risk of adverse clinical outcomes, such as physical disability, poor quality of life and death “

“Poverty of the flesh”

Cruz-Jentoft AJ. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. Age and ageing. 2010
Differentials for unhealthy muscle loss:

- Inadequate dietary protein
- Sarcopenia
- DJD
- Cachexia?

Sarcopenia

- In cats: lean body mass decreases after 11 years
- Related to increased morbidity & mortality

Image courtesy of Mark Peterson
Muscle Wasting: Diet

- Protein & fat digestibility ↓
- Inappropriate dietary recommendations
  - Reassess
  - Dietary trial of n=1
  - Nutritional assessment
  - Body condition score
  - Muscle condition score
Differentials

• Chronic kidney disease
• Hyperthyroidism
• Dental disease
• Neoplasia (lymphoma)
• Pancreatitis
• Cholangitis
• IBD
• Degenerative joint disease
• Triaditis
• Cholecystitis
• Inadequate food
• Malabsorption
• Ureteroliths/ nephroliths
• Urethral obstruction
• FeLV/FIV/FIP
What do you recommend?
Plan: Therapeutics & Diagnostics

1. Geriatric/senior panel
2. Agitated cystocentesis urinalysis
3. Repeat BP
4. IV fluids
   type?
   additives?
5. PCV/TS, BG
6. Well padded kennel with hiding place
7. Smorgasbord, tempt feed +/- syringe feed
   caloric intake!
8. Thoracic radiographs?
Urine sediment yield
Agitated cystocentesis
Fluids

Replacement solution with 35 mEq KCl/litre
1 cc Vit B complex
Rate: 8% deficit of 4.8 kg = 384 ml
maintenance 60 ml/kg/day = 288 ml
ongoing losses = ?
672 ml

672 ml/24 hours = 28 ml/hour

Monitor BW & PCV/TS q12-24h,
Auscult lungs q6-8h
Repeat BP = 185
Lab results
## Interpretation of lab results

<table>
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<tr>
<th>Parameter</th>
<th>Value</th>
<th>Normal Range</th>
<th>Notes</th>
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<tbody>
<tr>
<td>WBC</td>
<td>12.2</td>
<td>(5.5 - 19.0)</td>
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<tr>
<td>RBC</td>
<td>5.60</td>
<td>(5.00 - 10.00)</td>
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<tr>
<td>HGB</td>
<td>82.0</td>
<td>(80 - 150)</td>
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<tr>
<td>HCT</td>
<td>0.28</td>
<td>(0.32 - 0.45)</td>
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<td>MCV</td>
<td>41</td>
<td>(39 - 55)</td>
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<tr>
<td>MCH</td>
<td>13.0</td>
<td>(12.0 - 18.0)</td>
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<tr>
<td>MCHC</td>
<td>305</td>
<td>(300 - 360)</td>
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<tr>
<td>RDW</td>
<td>7.6</td>
<td>(7.0 - 17.0)</td>
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<tr>
<td>Platelet count</td>
<td>INV</td>
<td></td>
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<tr>
<td>Reticulocytes</td>
<td>&lt; 1%</td>
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<tr>
<td>Basophils</td>
<td>0</td>
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<td>Eosinophils</td>
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<td>Bands</td>
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<td>Polymorphs</td>
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<tr>
<td>Lymphocytes</td>
<td>1560</td>
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<tr>
<td>Monocytes</td>
<td>0</td>
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<td></td>
</tr>
<tr>
<td>Aniso slight, poikilo slight, echino slight</td>
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<td></td>
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<tr>
<td>Platelets clumped, platelet estimate adequate numbers, variability in platelet size apparent</td>
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<tr>
<td>Slight toxic change, occasional doehle bodies</td>
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<td></td>
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<tr>
<td>Few stimulated lymphs present</td>
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## Interpretation of lab results

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<td>(3.5 – 13)</td>
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<td>Creatinine</td>
<td>1002</td>
<td>(87.5- 177)</td>
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<td>Sodium</td>
<td>156</td>
<td>(145 - 160)</td>
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<td>Potassium</td>
<td>3.8</td>
<td>(3.5 - 5.8)</td>
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<td>Calcium</td>
<td>2.69</td>
<td>(1.61 – 2.68)</td>
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<td>Phosphorus</td>
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<td>(1.61 – 2.25)</td>
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<tr>
<td>Total protein</td>
<td>88</td>
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<tr>
<td>Albumin</td>
<td>28</td>
<td>(26 – 40)</td>
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<tr>
<td>Globulin</td>
<td>60</td>
<td>(26 – 51)</td>
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<td>Albumin: globulin</td>
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<td>(0.5 - 2.0)</td>
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<td>Bilirubin tot</td>
<td>0</td>
<td>(0 – 8.0)</td>
</tr>
<tr>
<td>SAP</td>
<td>65</td>
<td>(10 - 70)</td>
</tr>
<tr>
<td>ALT</td>
<td>50</td>
<td>(5 - 65)</td>
</tr>
<tr>
<td>Chloride</td>
<td>116</td>
<td>(117 - 128)</td>
</tr>
<tr>
<td>tCO₂</td>
<td>10</td>
<td>(17 - 24)</td>
</tr>
<tr>
<td>Calc osm</td>
<td>328.6</td>
<td>(280.0 - 305.0)</td>
</tr>
<tr>
<td>Anion gap</td>
<td>35</td>
<td>(13 - 25)</td>
</tr>
<tr>
<td>CPK</td>
<td>110</td>
<td>(10 - 100)</td>
</tr>
<tr>
<td>Amylase</td>
<td>1206</td>
<td>(500 - 800)</td>
</tr>
<tr>
<td>Lipase</td>
<td>87</td>
<td>(0 - 200)</td>
</tr>
<tr>
<td>Gamma gt</td>
<td>2</td>
<td>(1-8)</td>
</tr>
<tr>
<td>Chol</td>
<td>5.20</td>
<td>(1.88 - 4.38)</td>
</tr>
<tr>
<td>T4</td>
<td>45.0</td>
<td>(19.3 – 50.2)</td>
</tr>
</tbody>
</table>

Sample moderately lipemic
Urinalysis

- Colour: pale clear yellow
- Spec gravity 1.012
- pH 7.5
- Protein 0.3 g/L
- Glucose neg
- Ketones pos
- Bilirubin pos
- Urobil normal,
- Hemoglobin trace
- Wbc neg,
- Rbc 0-3/hpf,
- Bacteria neg,
- Crystals neg
Chemistries & electrolytes

- Lipemia
- Azotemia (severe) prerenal and renal
  - *IRIS Stage* = ?

<table>
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<td>Usually inappetance, weight loss, PU/PD</td>
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<td>Stable for long periods of time</td>
<td>Stable for long periods of time</td>
<td>May progress</td>
<td>Fragile</td>
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<td>Modify progression: phosphorus restriction, omega 3 fatty acids?</td>
<td>Ameliorate uremic signs: protein restriction, anti-emetics, erythropoietin, fluid therapy, appetite stimulants, dialysis</td>
</tr>
</tbody>
</table>
Important!

• ONE CAN’T STAGE or PROGNOSTICATE UNTIL CAT IS REHYDRATED!
Chemistries & electrolytes

- Lipemia
- Azotemia (severe) prerenal and renal
- Hypoglycemia
- Hypokalemia
- Hypercalcemia
- Hyperglobulinemia
- Hypochloremia
- Hyperamylasemia
- Metabolic acidosis
- Pay attention to T4 (euthyroid sick?) and bilirubin
Therapeutic implications?
Revised treatment plan

1. Culture urine???
2. Reassess daily
3. Continue IV fluids + KCl, recalculate dose daily based on PCV and **TS**
4. K gluconate 2 mEq PO BID
5. Feed/syringe high quality, calorically dense diet
   – Restrict protein? Phosphorus?
   – Place tube?
Questions about protein

1. What is optimal amount of protein for cat with renal disease? How much restriction is necessary?
2. Do different types of kidney disease require different dietary therapies?
3. At what point in disease progression should protein restriction be implemented?
4. Does the type of protein fed make a difference?
5. Does every meal have to be restricted?
6. Will a cat in > stage 2 benefit if phosphorus is restricted by other means?
7. Might some cats with advanced disease benefit from increased protein levels?
Protein restriction?

- Monitor for **protein: calorie malnutrition**
  - Weight loss
  - Hypoalbuminemia
  - Poor hair coat quality
  - Muscle wasting

- Growth or convalescent diets
# Feline reduced protein and phosphorus diets; non-acidifying

<table>
<thead>
<tr>
<th>Nutrients of Concern (/100 kcal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>kcals/can or cup</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>Hill's j/d (5.5 oz can)</td>
</tr>
<tr>
<td>Hill's y/d (5.5 oz can)</td>
</tr>
<tr>
<td>Hill's g/d (5.5 oz can)</td>
</tr>
<tr>
<td>Purina NF (5.5 oz can)</td>
</tr>
<tr>
<td>Iams renal plus (6 oz can)</td>
</tr>
<tr>
<td>Hill's l/d (5.5 oz can)</td>
</tr>
<tr>
<td>Hill's k/d chicken (5.5 oz can)</td>
</tr>
<tr>
<td>Royal Canin renal LP modified (6 oz can)</td>
</tr>
<tr>
<td>Royal Canin renal LP modified (3.0 oz can)</td>
</tr>
</tbody>
</table>

As at December 2012
Diet composition for endocrine disease

<table>
<thead>
<tr>
<th></th>
<th>Protein</th>
<th>Carbohydrates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes Mellitus</td>
<td>&gt;40% calories; &gt; 55% dry matter</td>
<td>&lt;10% calories; &lt; 15% dry matter</td>
</tr>
<tr>
<td>Hyperthyroidism</td>
<td>40% calories; &gt; 55% dry matter &lt; 250 mg phos/100 kcal</td>
<td>&lt;15% calories; &lt; 20% dry matter</td>
</tr>
</tbody>
</table>

Peterson, Vet Clin N Am 2014

Williams JVIM 2010 Association of iatrogenic hypothyroidism with azotemia and decreased survival time in cats treated for hyperthyroidism
6. Amlodipine 0.625 mg PO SID
7. Amphojel 90 mg/kg PO TID with food?
8. Appetite stimulant
   • Cyproheptadine 1 mg PO BID
   • Mirtazapine 2 mg po q48h
   • 50 kcal/kg ideal weight/day
     • 50 X 4.8 = 240 kcal/day
9. Consider calcitriol?
10. Repeat CBC, chemistry, T4 after 3 days
Progress:

Days 1-3:

- Buffy started to eat enthusiastically after 36 hrs of fluids and syringe feeding!
- Much brighter
- Cardiac murmur resolved
- Urinating voluminously
- BM day 3 dry and small
- Day 3 gallop rhythm appeared loudest over sternum, but also ausculted over mitral valve grade 3/6
- BP 185 mm Hg size 2 RH
Day 3 lab results

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>Normal Range</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>wbc</td>
<td>13.6</td>
<td>(5.5 - 19.0)</td>
<td></td>
</tr>
<tr>
<td>rbc</td>
<td>4.80</td>
<td>(5.00 - 10.00)</td>
<td>Slight toxic change, occasional doehle bodies</td>
</tr>
<tr>
<td>Hgb</td>
<td>75.0</td>
<td>(80 - 150)</td>
<td>Few stimulated lymphs present</td>
</tr>
<tr>
<td>Hct</td>
<td>0.20</td>
<td>(0.24 - 0.45)</td>
<td></td>
</tr>
<tr>
<td>Reticulocytes</td>
<td>&lt; 1%</td>
<td></td>
<td></td>
</tr>
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</table>
# Interpretation of lab results

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUN</td>
<td>21.6</td>
<td>(3.5 – 13)</td>
</tr>
<tr>
<td>Creatinine</td>
<td>276</td>
<td>(87.5 - 177)</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.1</td>
<td>(3.5 - 5.8)</td>
</tr>
<tr>
<td>Albumin</td>
<td>24</td>
<td>(26 – 40)</td>
</tr>
<tr>
<td>Albumin: globulin</td>
<td>0.44</td>
<td>(0.5 - 2.0)</td>
</tr>
<tr>
<td>Bilirubin total</td>
<td>11.97</td>
<td>(0 – 8.0)</td>
</tr>
<tr>
<td>Amylase</td>
<td>1251</td>
<td>(500 - 800)</td>
</tr>
<tr>
<td>Gamma gt</td>
<td>5</td>
<td>(1-8)</td>
</tr>
<tr>
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Chemistries & electrolytes

- IRIS Stage = ?
- Hyperthyroid

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<td>Ameliorate uremic signs: protein restriction, anti-emetics, erythropoietin, fluid therapy, appetite stimulation, dialysis, etc.</td>
</tr>
<tr>
<td>Proteinuria</td>
<td>classify</td>
<td>classify</td>
<td>classify</td>
<td>classify</td>
</tr>
</tbody>
</table>
Stage 1

- Usg $\leq 1.035$ while dehydrated prior to inc Cr
- Usg $> 1.040$ but has
  - Pyelonephritis,
  - Abnormal shape or size
  - Painful kidney(s)
  - Abnormalities on renal imaging,
  - Persistent renal
  - Abnormal renal biopsy results
Stages 2-4

- Based on increased Cr levels in HYDRATED cat
- Stage 2: Cr may be high “normal” because it is insensitive screening test
- Cr is affected by:
  - Muscle mass
  - Renal blood flow:
    - Dehydration
    - Uncontrolled hyperthyroidism
Hypertension

• 60% of cats with CKD have hypertension (Kobayashi) (Stiles)
• Using higher cut-off value, a study of 103 cats with CKD, 20 (19.4%) were found to have systolic BPs in excess of 175 mm Hg. (Syme 2002)
• May promote progression? (glomerular injury)

• Treat when systolic pressure is consistently > 160mm Hg
  – Earlier if hypertensive complications are present
Management of CKD: systolic BP

- ACVIM Panel on Hypertension (Consensus statement 2007 – www.acvim.org)
- Believe increases > 160 mm Hg

<table>
<thead>
<tr>
<th>Systolic BP mm Hg</th>
<th>Risk of target organ damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 150</td>
<td>Minimal</td>
</tr>
<tr>
<td>150-159</td>
<td>Low</td>
</tr>
<tr>
<td>160-179</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt; 180</td>
<td>High</td>
</tr>
</tbody>
</table>

- Target organs = brain, eye, kidneys, heart
Treating hyperT4 may exacerbate CKD

1. By reducing cardiac output, GFR is reduced (as much as 50%)
   a) Revealing CKD
   b) Worsening previously recognized CKD
2. Should see these changes by 4 weeks of euthyroidism
3. Cannot predict
4. Initial treatment of choice is methimazole
Assess renal function beforehand

• usg low initially?

• In one study, if GFR > 2.25ml/kg/min: won’t develop renal insufficiency after $^{131}$I
  – Not confirmed in another study

• Consider: treat initially with methimazole and assess renal function once euthyroid status achieved
Summary of CKD + HT4:

- Is the increase in BUN and SC significant?
- Cat may do better with compensated renal disease than in hyperthyroid state
- Treat each case individually
- Inform client of risk of unmasking pre-existing renal disease
- Treat the CKD
• If renal insufficiency becomes apparent:
  – L-thyroxine or
  – Reduce methimazole dose
  – Balance thyroid and renal function
Day 3 recommendations:

Therapeutic impact:

- Switch to SQ fluids, daily at home
  - 60 ml/kg ideal/day (288 ml/day)
- Start Tapazole
- Cosequin/Cartophen/Adequan
- Continue amlodipine

- A canned, calorically dense diet: 261 kcal/d
- Recheck after 10-14 days (weight, BP, exam)
  - +/- schedule echocardiogram
  - +/- erythropoetin
  - +/- NSAID
### Table: Basal Energy Requirement for Ideal Body Weight

<table>
<thead>
<tr>
<th>Body Weight (kg)</th>
<th>RER*</th>
<th>Kcal/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>39</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>88</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
<td>110</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>130</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>149</td>
</tr>
<tr>
<td>7</td>
<td>50</td>
<td>167</td>
</tr>
<tr>
<td>8</td>
<td>50</td>
<td>184</td>
</tr>
<tr>
<td>9</td>
<td>50</td>
<td>201</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>218</td>
</tr>
<tr>
<td>15</td>
<td>50</td>
<td>295</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
<td>366</td>
</tr>
<tr>
<td>25</td>
<td>50</td>
<td>433</td>
</tr>
</tbody>
</table>

RER = [BW(kg)^0.75 * 70]

- **Growth DER (Kcal/day):** Growing kittens = 2.5 X RER
- **Maintenance DER (Kcal/day):**
  - Normal, neutered adult = 1.2 X RER
  - Intact adult = 1.4 X RER
  - Obese prone = 1.0 X RER
  - For weight loss = 0.8 X RER

**Example Calculations:**

50 kcal/kg ideal weight/day
50 X 4.8 = 240 kcal/day

1.2 X 218 = 261.6 kcal/day

Reassess!!!
What are cats designed to eat?

Daily energy intake from:
- Crude protein 52%
- Crude fat 46%
- Nitrogen free extract 2%

Plantinga: Dietary nutrient profile of free-roaming feral cats, 2011 Br J Nutrition
Protein Requirements of Aging Cats Based on Preservation of LBM

- Study in adult cats showed that cats need >5g/kg body weight to maintain LBM
  - Young cats, 2 months, Laflamme JFMS 2013
Discrepancy between use of lean body mass or nitrogen balance to determine protein requirements for adult cats

Abstract
This study was undertaken to contrast the minimum protein intake needed to maintain nitrogen balance or lean body mass (LBM) in adult cats using a prospective evaluation of 24 adult, neutered male cats fed one to three different diets. Following a 1-month baseline period during which all cats consumed a 34% protein diet, cats were fed a 20% (LO), 26% (MOD) or 34% (HI) protein diet for 2 months. During the baseline period and following the 2-month feeding period, nitrogen balance was assessed using a 96-h complete collection of urine and feces, and LBM was assessed using dual energy X-ray absorptiometry. Weight loss increased in a linear manner with decreasing protein intake ($P < 0.01$), despite no significant difference in calorie intake. Linear regression of the data indicated that approximately 1.5 g protein/kg (2.1 g/kg$^{0.75}$) body weight is needed to maintain nitrogen balance, while 5.2 g protein/kg (7.8 g/kg$^{0.75}$) body weight is needed to maintain LBM. This study provides evidence that nitrogen balance studies are inadequate for determining optimum protein requirements. Animals, including cats, can adapt to low protein intake and maintain nitrogen balance while depleting LBM. Loss of LBM and an associated reduction in protein turnover can result in compromised immune function and increased morbidity. Current Association of American Feed Control Officials (AAFCO) and National Research Council (NRC) standards for protein adequacy may not provide adequate protein to support LBM. The minimum daily protein requirement for adult cats appears to be at least 5.2 g/kg (7.8 g/kg$^{0.75}$) body weight, well in excess of current AAFCO and NRC recommendations. Further research is needed to determine the effect, if any, of body condition, age and gender on protein requirements.
Protein Requirements of Aging Cats Based on Preservation of LBM

• Determine the apparent protein requirements of aging cats based on the amount needed to maintain LBM
  – Geriatric cats, 6 month study
• At the end of 3 months (n = 39), linear regression of protein intake on LBM indicated a mean daily intake of 4.8g protein/kg body weight was needed to maintain LBM. At 6 months (n = 38), the regression indicated 5.4g protein/kg body weight was needed to maintain LBM.
  – Laflamme poster ACVIM 2013
Phosphorus

- Hyperphosphatemia reflects decreased GFR
- In dogs, believed that phosphorus restriction may be renoprotective
- Restriction in moderate azotemia (stage 2-4) affects detrimental effects (soft tissue mineralization)
- Difficult to have diet replete in protein and restricted adequately in phosphorus
New

- Renal secondary hyperparathyroidism is more prevalent than hyperphosphatemia!
- FGF-23 (fibroblast growth factor-23)
  - A phosphatonin
  - Increases in response to decreased renal phosphate clearance
    - => inhibits calcitriol and increases phosphate $\text{FE}_p$
- Consider measuring PTH to ensure that phosphorus restriction is adequate even when serum phosphorus within IRIS recommended range
Phosphorus targets

• Increase GFR and decrease absorbed phosphorus
• Reducing phosphorus intake to maintain serum phos between
  – 1.29-1.61 mmol/L (4.0-5.0 mg/dL) protects functional nephrons, improves survival

<table>
<thead>
<tr>
<th>IRIS Stage</th>
<th>Target Phosphate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Any phos restriction?</td>
</tr>
<tr>
<td>Stage 2</td>
<td>0.81 -1.45 mmol/L (2.5-4.5 mg/dL)</td>
</tr>
<tr>
<td>Stage 3</td>
<td>0.81 -1.61 mmol/L (2.5-5.0 mg/dL)</td>
</tr>
<tr>
<td>Stage 4</td>
<td>0.81 -1.94 mmol/L (2.5-6.0 mg/dL)</td>
</tr>
</tbody>
</table>
Phosphorus

- Restriction in moderate azotemia (stage 2-4) reduces risk for renal secondary hyperparathyroidism

- Intestinal phosphate binders
  - Within 2 hours of meal
  - Amphogel, Renalgel, sucralfate
  - Epakitin, Renalzin, Pronefra
Phos, Protein?

Chicken meat
Food
Chicken is the most common type of poultry in the world, and is prepared as food in a wide variety of ways, varying by region and culture.

Nutrition Facts
Chicken, breast

<table>
<thead>
<tr>
<th>Amount Per 100 grams</th>
<th>% Daily Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories 172</td>
<td></td>
</tr>
<tr>
<td>Total fat 9 g</td>
<td>13%</td>
</tr>
<tr>
<td>Saturated fat 2.7 g</td>
<td>13%</td>
</tr>
<tr>
<td>Polyunsaturated fat 2 g</td>
<td></td>
</tr>
<tr>
<td>Monounsaturated fat 3.8 g</td>
<td></td>
</tr>
<tr>
<td>Trans fat 0.1 g</td>
<td></td>
</tr>
<tr>
<td>Cholesterol 64 mg</td>
<td>21%</td>
</tr>
<tr>
<td>Sodium 83 mg</td>
<td>2%</td>
</tr>
<tr>
<td>Potassium 220 mg</td>
<td>8%</td>
</tr>
<tr>
<td>Total Carbohydrate 0 g</td>
<td></td>
</tr>
<tr>
<td>Dietary fiber 0 g</td>
<td>0%</td>
</tr>
<tr>
<td>Sugar 0 g</td>
<td></td>
</tr>
<tr>
<td>Protein 21 g</td>
<td>42%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.
Diet choice will depend on

- Phosphorus levels
- Potassium levels
- Uremic or not?
- Proteinuric or not?
- Need to individualize and reassess
- Protein restriction? Every meal?
2 month recheck

- Doing very well; clients notice not jumping as well and less active
How do we detect pain?

• Normalization of behaviours after analgesics given = pain was present
  – Re-evaluate often!
ISFM AND AAFP CONSENSUS GUIDELINES

Long-term use of NSAIDs in cats

- Andy Sparkes
- Rediun Heine
- Duncan Lascelles
- Richard Malik
- Sheilah Robertson
- Llibertat Real Sampietro
- Margie Scherk
- Polly Taylor

www.icatcare.org/vets/guidelines
www.catvets.com/professionals/guidelines/publications/
Pain medication (NSAIDs) and your cat

A ‘painkiller’ known as a ‘non-steroidal anti-inflammatory drug’ (or NSAID) has been prescribed for your cat. These drugs are commonly used in humans and animals to help relieve pain, fever and inflammation – most commonly associated with degenerative joint disease. Controlling your cat’s pain is crucial for its welfare. Many cats greatly benefit from these drugs, having better mobility, less pain, increased appetite and an improved quality of life.

Degenerative joint disease (DJD) in cats

Degenerative joint disease (including osteoarthritis) is common, especially in older cats. As with other conditions, cats may mask the signs of this disease.

Problems and behaviour changes in cats with DJD include:

- **Decreased activity** – eg, sleeping more, not moving around as much, playing or hunting less
- **Decreased mobility** – eg, reduced willingness to jump, not jumping as high, difficulty using the litter tray, stiffness, and sometimes obvious lameness
- **Decreased grooming** – reduced time or difficulty grooming, a poor coat, overgrown claws
- **Altered personality** – less keen to interact with people or pets, seeking solitude, ‘grumpier’
- **Other signs** – may include aggression or vocalisation when touched and loss of appetite

Understanding these changes helps alert you and your vet to the possible existence of pain and DJD, and will help you monitor whether therapy is helpful or not.

Are NSAIDs safe in cats?

NSAIDs play a vital role in therapy for many cats, but differences between cats and other animals mean you should only ever use a drug that has been specifically prescribed for your cat by your veterinarian. Many human drugs such as aspirin, ibuprofen and paracetamol/acetaminophen can be highly toxic to cats – administering these is life-threatening.

Adverse effects can be seen with NSAIDs, just as with all drugs. Some patients may be at increased risk of adverse effects (eg, older cats and cats with certain other diseases). Your veterinarian may then recommend increased monitoring and careful adjustment of therapy to find the lowest effective dose of the drug for your cat.

What adverse effects should I look out for?

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www.isfm.net/toolbox       www.catvets.com/professionals/guidelines/publications
Meloxicam Safety & Efficacy: Evidence


Long-term safety, efficacy and palatability of oral meloxicam at 0.01–0.03 mg/kg for treatment of osteoarthritic pain in cats

Marcus N Gunew BVSc, BSc(Vet), MACVSc, Victor H Menrath BAgr, BVSc, FACVSc, Rhett D Marshall BVSc, MACVSc

- Safe, efficacious and palatable for OA pain at 0.01-0.03 mg/kg PO q24h
- Mean treatment duration of 5.8 months
- No deleterious effect on renal function was detected in cats studied.
- Gastrointestinal upset in 4% of cats was the only adverse effect noted.
Meloxicam Safety & Efficacy: Evidence


- Cats over seven years of age treated for a minimum of 6 months with a daily maintenance dose of 0.02 mg/kg meloxicam and concluded that this dose *does not hasten progression of renal disease in aged cats or aged cats with pre-existent stable IRIS stage 1-3 renal disease.*
# Progression of CKD

<table>
<thead>
<tr>
<th>Cats w DJD and CKD + meloxicam</th>
<th>Cats w DJD + meloxicam</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Cats DJD CKD" /></td>
<td><img src="image2.png" alt="Cats DJD meloxicam" /></td>
</tr>
<tr>
<td>Cats w CKD</td>
<td>Age-matched cats</td>
</tr>
</tbody>
</table>

Gowan, 2011
Metabolism and excretion

<table>
<thead>
<tr>
<th></th>
<th>Metabolites</th>
<th>Unchanged meloxicam</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine</td>
<td>19%</td>
<td>2%</td>
<td>21%</td>
</tr>
<tr>
<td>Feces</td>
<td>30%</td>
<td>49%</td>
<td>79%</td>
</tr>
</tbody>
</table>

- Major route of excretion of meloxicam in the cat = fecal
- The main pathway of biotransformation is oxidation
- No conjugated metabolites were detected

Grude´ P et al. J.Vet Pharmacol Therap. 2010
Long-term use of NSAIDs in cats

- Andy Sparkes
- Rediuin Heine
- Duncan Lascelles
- Richard Malik
- Sheilah Robertson
- Llibertat Real Sampietro
- Margie Scherk
- Polly Taylor

www.icatcare.org/vets/guidelines
www.catvets.com/professionals/guidelines/publications/
Pain medication (NSAIDs) and your cat

A ‘painkiller’ known as a ‘non-steroidal anti-inflammatory drug’ (or NSAID) has been prescribed for your cat. These drugs are commonly used in humans and animals to help relieve pain, fever and inflammation – most commonly associated with degenerative joint disease. Controlling your cat’s pain is crucial for its welfare. Many cats greatly benefit from these drugs, having better mobility, less pain, increased appetite and an improved quality of life.

Degenerative joint disease (DJD) in cats

Degenerative joint disease (including osteoarthritis) is common, especially in older cats. As with other conditions, cats may mask the signs of this disease.

Problems and behaviour changes in cats with DJD include:

- Decreased activity – eg, sleeping more, not moving around as much, playing or hunting less
- Decreased mobility – eg, reduced willingness to jump, not jumping as high, difficulty using the litter tray, stiffness, and sometimes obvious lameness
- Decreased grooming – reduced time or difficulty grooming, a poor coat, overgrown claws
- Altered personality – less keen to interact with people or pets, seeking solitude, ‘grumpier’
- Other signs – may include aggression or vocalisation when touched and loss of appetite

Understanding these changes helps alert you and your vet to the possible existence of pain and DJD, and will help you monitor whether therapy is helpful or not.

Are NSAIDs safe in cats?

NSAIDs play a vital role in therapy for many cats, but differences between cats and other animals mean you should only ever use a drug that has been specifically prescribed for your cat by your veterinarian. Many human drugs such as aspirin, ibuprofen and paracetamol/acetaminophen can be highly toxic to cats – administering these is life-threatening.

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www.isfm.net/toolbox  www.catvets.com/professionals/guidelines/publications
Meloxicam use?

• Use lowest effective dose
  – Titrate: But not above label dose
  – Re-evaluate your patient!
• Use cautiously or not at all in cats with moderate-severe (IRIS stages 3, 4) renal disease
  – Ensure/optimize hydration
• Avoid in patients with known bleeding disorders or pre-existing GI bleeding
  • Multimodal therapy
Meloxicam doses for feline arthritis

- 0.1 mg/kg PO on day 1, then 0.05 mg/kg PO q24h

- All doses are based on lean, hydrated weight.
- Monitor & reassess frequently
Robenacoxib doses for feline arthritis

- 1 mg/kg PO SID (with a range of 1-2.4 mg/kg); once daily for a maximum of 6 days.

- All doses are based on lean, hydrated weight.
- Monitor & reassess frequently
King et al, 2015

Conclusions and relevance
Robenacoxib was well tolerated when administered daily for 1 month in cats with osteoarthritis, including cats with evidence of concurrent CKD (IRIS 1-4). There was no clinical indication of damage to the gastrointestinal tract, kidney or liver.
Protocol for Musculoskeletal Pain

- NSAID +/- opioid +/- gabapentin
- Environmental modifications
Simon's Cat
Thank you for your participation!

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