Practical Hematology
Blood Loss Anemia

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Practical Hematology

1. **Anemia 101**
2. **Blood Loss Anemia**
3. Hemolysis
4. Non-Regenerative Anemias
5. Bone Marrow Disease
6. Transfusion Medicine
7. Cases
8. Polycythemia
9. Coagulopathy
10. Central IV Lines
11. Leukophilia
12. Leukopenias
13. Splenic Disease

Blood Loss Anemia

- **Blood Loss –** normal to low PP, iron deficiency with chronicity, evidence of blood loss
- **Localized bleeding –** internal, external, GI, urinary
  - Trauma/surgery
  - Neoplasia or infiltrative disease
  - parasites
- **Tendency for generalized bleeding**
  - coagulopathy

Blood Loss Anemia

- **Acute Blood Loss**
  - Trauma/surgery
  - Neoplasia
  - Bleeding GI ulcer
  - Abdominal cavity bleeding
- **Chronic Blood Loss**
  - Fleas or intestinal parasites
  - GI or urinary tract bleeding
  - Erosion of external artery
  - Vasculitis – epistaxis
- **Coagulopathy**

Acute Blood Loss

- **Total blood volume**
  - 8-10% of body weight in dogs
  - 6-8% of body weight in cats
- **<20% blood loss is well tolerated**
  - <8-10 ml/lb in dogs
  - <6-8 ml/lb in cats
- **30-40% blood loss**
  - Hypotension and shock
  - Weak pulses, cold extremities
  - Laterally recumbent
- **50% blood loss**
  - Can be fatal if over less than 2-3 hours

Acute Blood Loss

Response to Acute Blood Loss

- Within a few hours
  - EPO levels rise
  - Platelets drop no lower than 60,000/ul
    - Then rebound thrombocytosis
  - Stress leukogram is possible
- Within 2-3 days
  - Bone marrow response begins
  - Restoration of plasma volume
  - **Following PCV can grossly underestimate acute blood loss**

Acute Blood Loss

Response to Acute Blood Loss

- Maximum regenerative response within 7 days
  - Corrected retic % can be 3-7%
  - Absolute retics >100,000/ul
    - In cats, punctate retics may remain elevated for weeks
  - May have rebound thrombocytosis
- Recovery within 1-2 weeks

HALLMARK OF EXTERNAL BLOOD LOSS (triad)

1. Anemia
2. Hypoproteinemia – albumin and globulin
3. Reticulocytosis

Treating Acute Blood Loss

Stop the Bleeding

Replace fluid loss

Oxygen support

Treat underlying disorder

Treating Acute Blood Loss

Stop the Bleeding

1. **Assess coagulation status**

2. **External arterial bleeder**
   - Temporary
     - Cautery - silver nitrate, Kwik Stop, electrocautery
     - Epinephrine
   - Permanent
     - Excise abnormal tissue for biopsy
     - Reveal normal artery and ligate

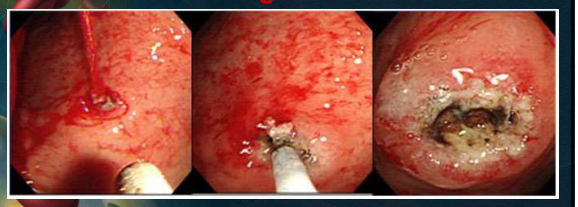
Treating Acute Blood Loss

Stop the Bleeding

3. **Abdominal bleeder**
   - diagnostic surgery as soon as vascular volume and oxygen carrying capacity restored

4. **GI bleeder**
   - Fecal occult blood testing???
   - Sucralfate PO – 1-3g in a slurry
   - Barium PO – 3-5 ml/lb

Treating Acute Blood Loss



4. **GI bleeder**
   - Fecal occult blood testing??
   - Sucralfate PO – 1-3g in a slurry
   - Barium PO – 3-5 ml/lb
   - Endoscopic cautery
   - surgery

Treating Acute Blood Loss

Replace fluid loss

- crystalloids
  - 10 ml/lb bolus and then reassess
  - 1-2 ml/lb/hr when hypovolemia replaced
- Colloids
  - Hetastarch
    - 5 ml/lb over 5-15 minutes
    - repeat once if needed
  - Oxyglobin
    - 3-5 ml/kg added to fluids running at 0.5-2ml/lb/hr (CRI)
    - Or 10 ml/kg/hr for up to 3 hours (bolus)
- If IV access is difficult, try intraosseous

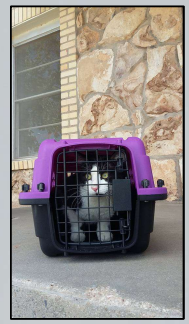
Treating Acute Blood Loss

Oxygen support

- Transfusion – RBC or whole blood
- Oxyglobin
- Oxygen – nasal, flow-by, mask, intubate

Treat underlying disorder

Attendee 3
Big Spring TX



Treating Acute Blood Loss

Transfusion

- PCV threshold higher for acute blood loss
  - 20-25% with signs of hypoxia
  - Or if going to surgery
    - Improves oxygen carrying capacity
    - May improve hemostasis
- Normally, transfusion of 10 ml/lb whole blood is given over a minimum of 2 hours
  - Pretreat with dexamethasone
  - Give as fast as is tolerated
- Collect blood from the abdomen, pass through filter and re-administer (use anticoagulant)
  - No limitation on administration rate

Treating Acute Blood Loss

HemoNate filter JorVet J0522H

HemoTap Spike JorVet J0522T

Chronic Blood Loss

CHRONIC EXTERNAL BLOOD LOSS IS THE MOST COMMON CAUSE OF IRON DEFICIENCY ANEMIA IN DOGS AND CATS

- **Also CRF (chronic renal failure)**
- **Increased gastrin causes GI ulceration**

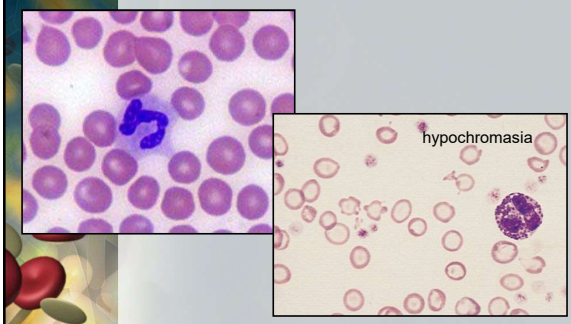
- Chronic blood loss is usually markedly regenerative
  - Increased retics, RDW, anisocytosis
  - Retics may be >500,000/ul or 10%+ corrected
  - Polychromasia less pronounced
  - Only becomes non-regenerative if very chronic
- Absent iron stores in issues
  - liver, spleen and marrow
  - ferritin - soluble iron stores
  - Hemosiderin - insoluble iron stores

Chronic Blood Loss

- Low **serum iron** - <60 ug/dl
- Low **transferrin** saturation - <20%
  - Transferrin is serum protein that transports iron
  - Normally 20-60% saturated
  - Determined by measuring **UIBC** – unbound iron binding capacity, which is increased
- Increased **TIBC** (iron binding capacity)
  - Increased transferrin

Chronic Blood Loss

- Low Hb, low HCT, low MCHC (hypochromasia)



Chronic Blood Loss

- Low Hb, low HCT, low MCHC (hypochromasia)
  - Microcytosis (low MCV) – small RBC
    - leptocytes, dacryoctyes, schistocytes
- RBC become stiffer & more susceptible to lysis
- Thrombocytosis
  - May exceed 1,000,000/ul
  - Mechanism unknown
  - **Platelets >1 million warrants search for blood loss, if pet is not splenectomized**
- Low globulins and albumin
- **Suspect if highly regenerative anemia with no IMHA markers**

Chronic Blood Loss

Causes of chronic blood loss and IDA

- GI hemorrhage – **MOST COMMON**
  - Including inflammatory bowel disease
    - Both iron malabsorption and bleeding
  - Ulcer or aneurysm
  - Neoplasia
  - Liver disease – coagulopathy and ulcers
- Parasitism
  - Fleas
  - hookworms
  - Rarely whipworms
- Chronic externally bleeding neoplasia

Iron supplementation is rarely needed unless there is chronic external blood loss or CRF

Chronic Blood Loss

Clinical Signs

- Onset insidious - develops over weeks
- Seem quite well for severe anemia (<15-20%)
- Sudden death can occur
- Most common presenting signs
  - Pallor, exercise intolerance – syncope
  - pica – eating dirt, rocks, etc.
  - Intermittent abdominal pain, poor appetite, increased thirst relieves gastric pain
  - ± vomiting or hematemesis
- Melena is not always obvious when there is significant chronic GI bleeding
  - Bleeding can be intermittent
  - Fecal cytology to look for RBC can help

Chronic Blood Loss

Clinical Signs

- Decreased blood viscosity
  - Bounding pulses
  - Physiologic murmur
  - Gallop rhythm
- Increased blood volume
  - Cardiac eccentric hypertrophy (dilation)
  - congestive heart failure
- Depletion of iron from body tissues
  - Muscle weakness
  - Abnormal behavior
  - Dry brittle Skin and nails, hair loss, abnormally shaped nails

Treating Chronic Blood Loss

Correct Anemia - Transfusion

Treat underlying disorder

Correct Iron Deficiency

Treating Chronic Blood Loss

Correct Anemia - Transfusion

- Anemia severe enough to cause clinical signs (PCV <15-20%)
- Or preparing for corrective surgery
- Conservative transfusion volume to avoid precipitating CHF
  - Volume overload more of a problem in cats than in dogs
  - Use packed cells
- Correction of anemia results in resolution of cardiomegaly within several weeks

Treating Chronic Blood Loss

Treat Underlying Disorder – GI ulceration

- **Antacids**
  1. Omeprazole 1 mg/kg PO BID for severe ulcers
     - 30 minutes before feeding, at least 2 weeks
     - Taper to prevent acid rebound
  2. Famotidine 1 mg/kg PO BID x 7 days
- **Protectants**
  - Sucralfate ½-1g PO TID x 7-10d
    - NPO 1 hr before or 2 hours after
  - Barium 3-5 mg/lb once
- **Butorphanol or Buprenorphine for pain**

Treating Chronic Blood Loss

Treat Underlying Disorder - others

- **Deworm/deflea after patient is stabilized**
- **If GI Bleeding confirmed**
  - **Abdominal US**
  - **Endoscopy, Diagnostic Laparotomy**
  - **Fecal Cytology**
- **Confirm blood loss has resolved by monitoring reticulocyte count**
  - **< 40,0000/ul**
  - **Retics more sensitive than PCV for monitoring chronic blood loss**

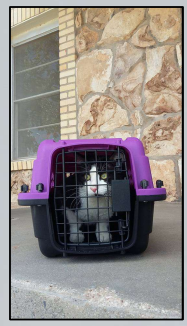
Treating Chronic Blood Loss

Correct Iron Deficiency

- **Ferrous sulfate 5 mg/lb/day PO**
- **Give with a meal**
- **Continue for weeks to months**
- **Serology to confirm iron stores are replete**
  - TIBC – falls back to normal
  - Transferrin – 20-60% saturated
  - UIBC – falls ba to normal
  - Iron – 60-230 ug/dl

Marked increase in low MCV and MCHC 10-14 days after iron supplementation is the best evidence for a diagnosis of IDA

Attendee 4
City TX



Acknowledgements

Chapter 2: The Complete Blood Count, Bone Marrow Examination, and Blood Banking

- Douglass Weiss and Harold Tvedten
- Small Animal Clinical Diagnosis by Laboratory Methods, eds Michael D Willard and Harold Tvedten, 5th Ed 2012

Chapter 3: Erythrocyte Disorders

- Douglass Weiss and Harold Tvedten
- Small Animal Clinical Diagnosis by Laboratory Methods, eds Michael D Willard and Harold Tvedten, 5th Ed 2012

Acknowledgements

Chapter 59: Pallor

- Wallace B Morrison
- Textbook of Veterinary Internal Medicine, eds Stephen J Ettinger and Edward C Feldman, 6th Ed 2003

Challenging Anemia Cases

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