

A detailed illustration of various blood cells, including red blood cells (erythrocytes) and white blood cells (leukocytes), set against a dark blue background with a grid pattern. The cells are rendered in a 3D style with soft lighting and shadows, giving them a realistic appearance. The red blood cells are biconcave discs, while the white blood cells are larger and more irregular in shape.

# **Practical Hematology Blood Loss Anemia**

**Wendy Blount, DVM**



# 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

A vertical strip on the left side of the slide shows a microscopic view of several red blood cells. The cells are depicted as biconcave discs, with a reddish-brown color and a darker center, set against a background of other cells and a blue-greenish fluid.

## 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

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# 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

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# 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**

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# 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

A microscopic view of blood cells, including red blood cells and white blood cells, set against a dark blue background with a grid pattern. The red blood cells are prominent, showing their characteristic biconcave shape. The white blood cells are smaller and more varied in shape, some appearing as small spheres and others as larger, more complex structures.

# 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

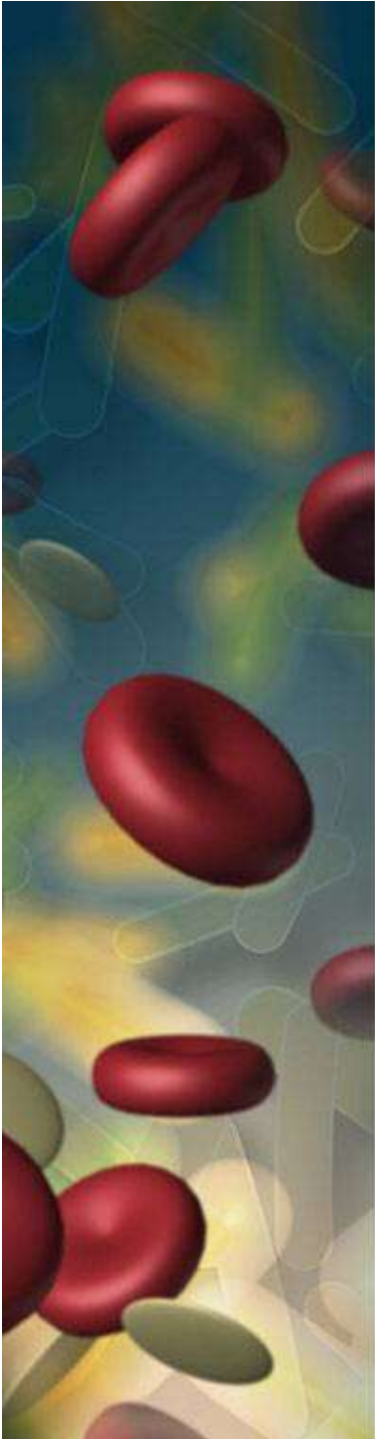
## Oxygen support

- 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**



A vertical strip on the left side of the slide shows a microscopic view of red blood cells. The cells are depicted as red, biconcave discs of various sizes and orientations, set against a background of green and yellowish light, suggesting a fluid environment.

## 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 tissues
  - liver, spleen and marrow
  - ferritin - soluble iron stores
  - Hemosiderin - insoluble iron stores

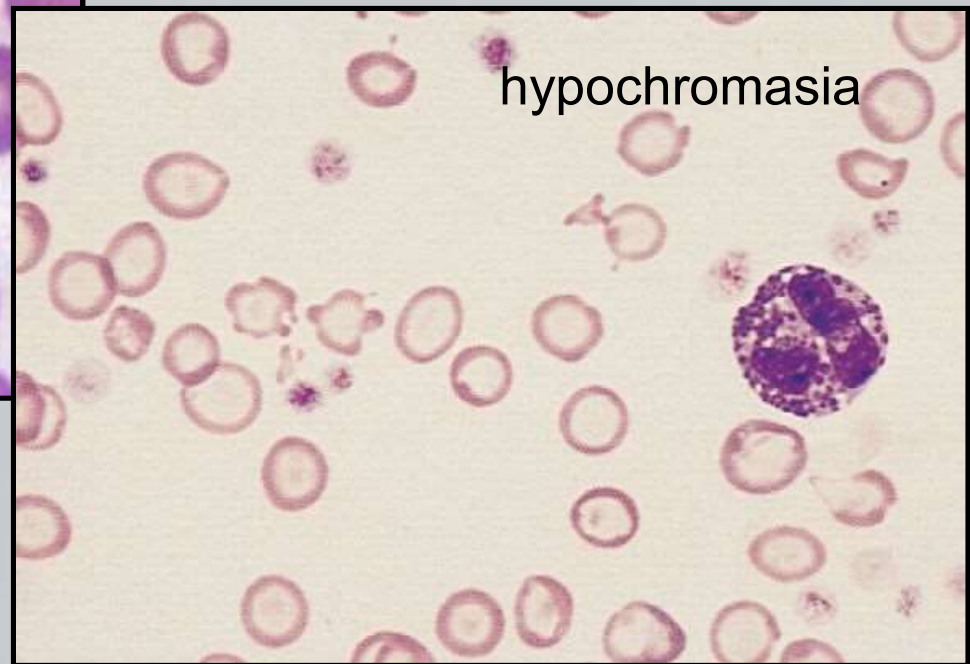
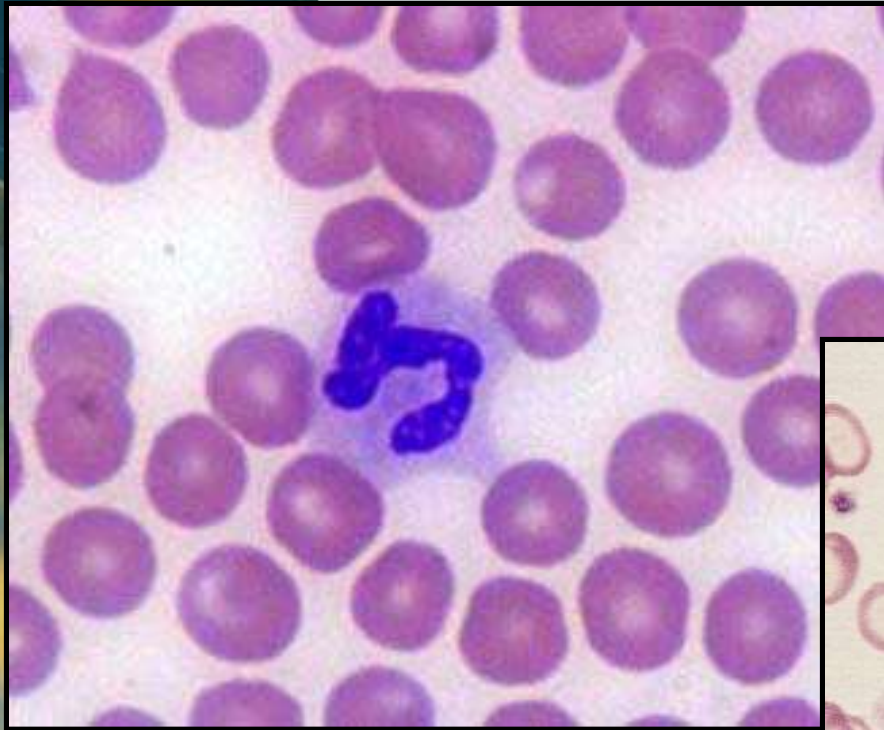
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# Chronic Blood Loss

- 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)



A vertical strip on the left side of the slide shows a microscopic view of red blood cells. The cells are depicted in various shades of red and brown, with some appearing as biconcave discs and others as more irregular shapes. The background is a mix of blue and green, suggesting a fluid environment.

## Chronic Blood Loss

- Low Hb, low HCT, low MCHC (hypochromasia)
  - Microcytosis (low MCV) – small RBC
    - leptocytes, dacryocytes, 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**

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# 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**

A vertical strip on the left side of the slide shows a microscopic view of several red blood cells (erythrocytes) in a fluid medium. The cells are depicted as biconcave discs, with some in sharp focus and others blurred in the background, creating a sense of depth. The colors range from deep red to a lighter, more translucent red, set against a dark, slightly greenish-blue background.

# 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

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# 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

A microscopic view of blood cells, including red blood cells and white blood cells, set against a dark blue background with a grid pattern. The red blood cells are prominent, showing their characteristic biconcave disc shape. The white blood cells are smaller and more varied in shape, some appearing as small spheres and others as larger, more complex structures. The overall scene is illuminated with a soft, yellowish light, creating a sense of depth and highlighting the textures of the cells.

# Treating Chronic Blood Loss

**Correct Anemia - Transfusion**

**Treat underlying disorder**

**Correct Iron Deficiency**



A microscopic view of blood cells, including red blood cells and white blood cells, set against a dark blue background with a grid pattern.

# 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**

A microscopic view of blood cells, including red blood cells and white blood cells, set against a dark blue background with a grid pattern.

# 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
  - $< 40,000/\mu\text{l}$
  - Retics more sensitive than PCV for monitoring chronic blood loss

A microscopic view of red blood cells (erythrocytes) in a blood vessel. The cells are shown as biconcave discs, some in focus and others blurred in the background. The lighting is dramatic, with a dark blue background and highlights on the cells, giving them a three-dimensional appearance.

# Treating Chronic Blood Loss

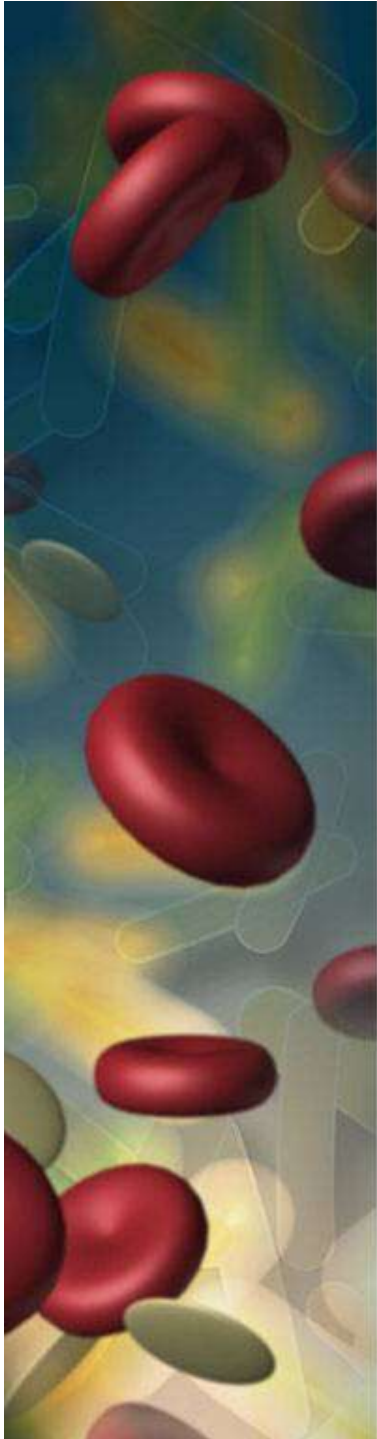
## Correct Iron Deficiency

- 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 back 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

## CityTX





# 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, 5<sup>th</sup> 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, 5<sup>th</sup> Ed 2012

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# Acknowledgements

## Chapter 59: Pallor

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

## Challenging Anemia Cases

- Crystal Hoh, ACVIM
- Heart of Texas Veterinary Specialty Center
- CAVMA CE