VITICUSGROUP™
WVC ANNUAL CONFERENCE
MARCH 2 - 5, 2025 | LAS VEGAS, NV

Help, My Patient is Pale!

Nancy A. Sanders, DVM
DACVIM (SAIM), DACVECC

Financial Disclosure

I have a direct relationship with IDEXX, but it **will not** influence the nature of my presentation.

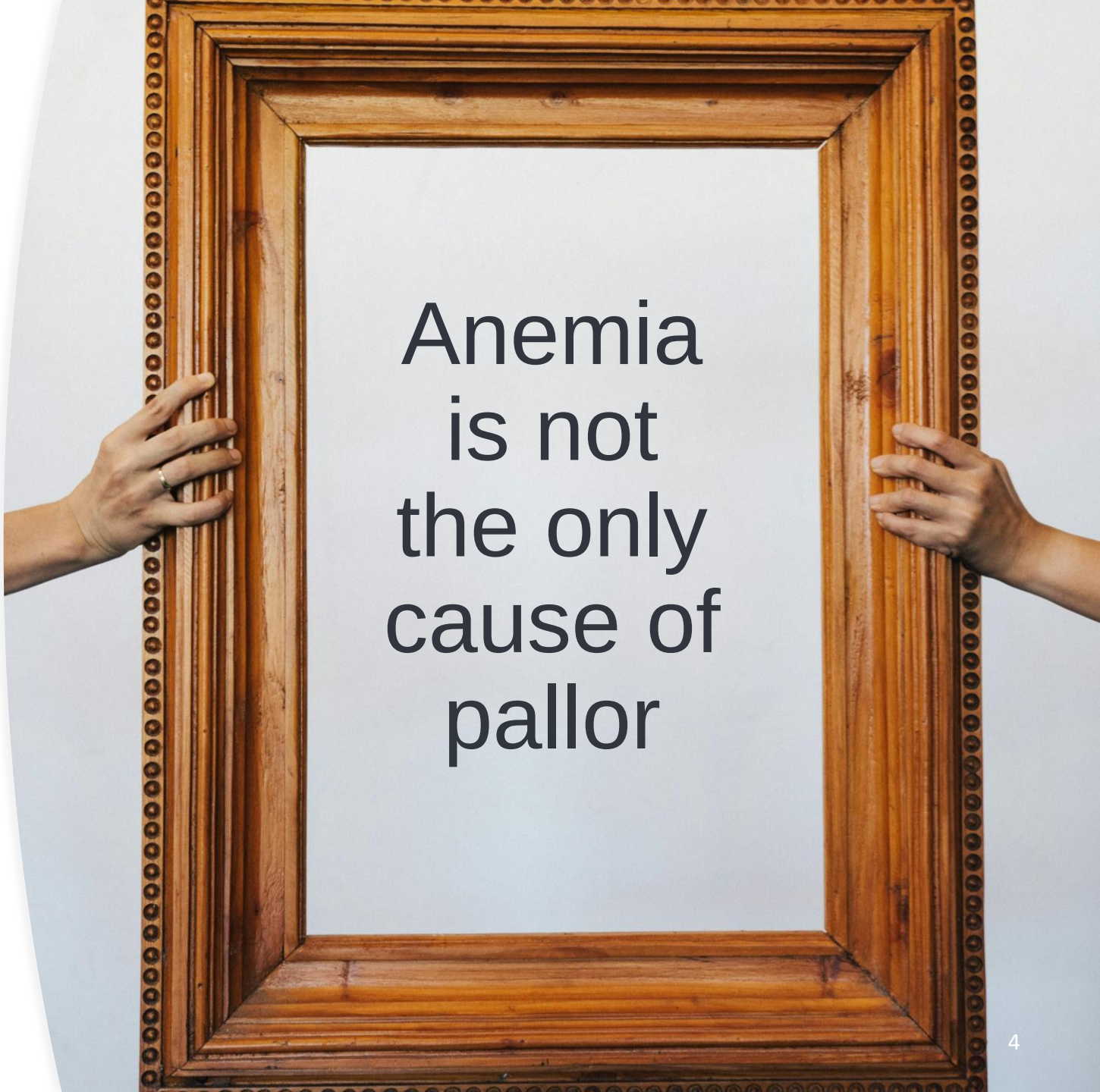
The information contained herein is intended to provide general guidance only. Diagnosis, treatment, and monitoring should be patient specific and is the responsibility of the veterinarian providing primary care.

Learning Objectives

1. Appreciate that pallor can result from a variety of issues
2. Recognize that a sound medical work-up begins with a complete patient history, thorough physical exam, deductive thought, and common sense
3. Improve confidence in choosing first- and second-tier diagnostics for the individual pale patient
4. Understand that specific treatment of the pale patient depends upon a definitive diagnosis

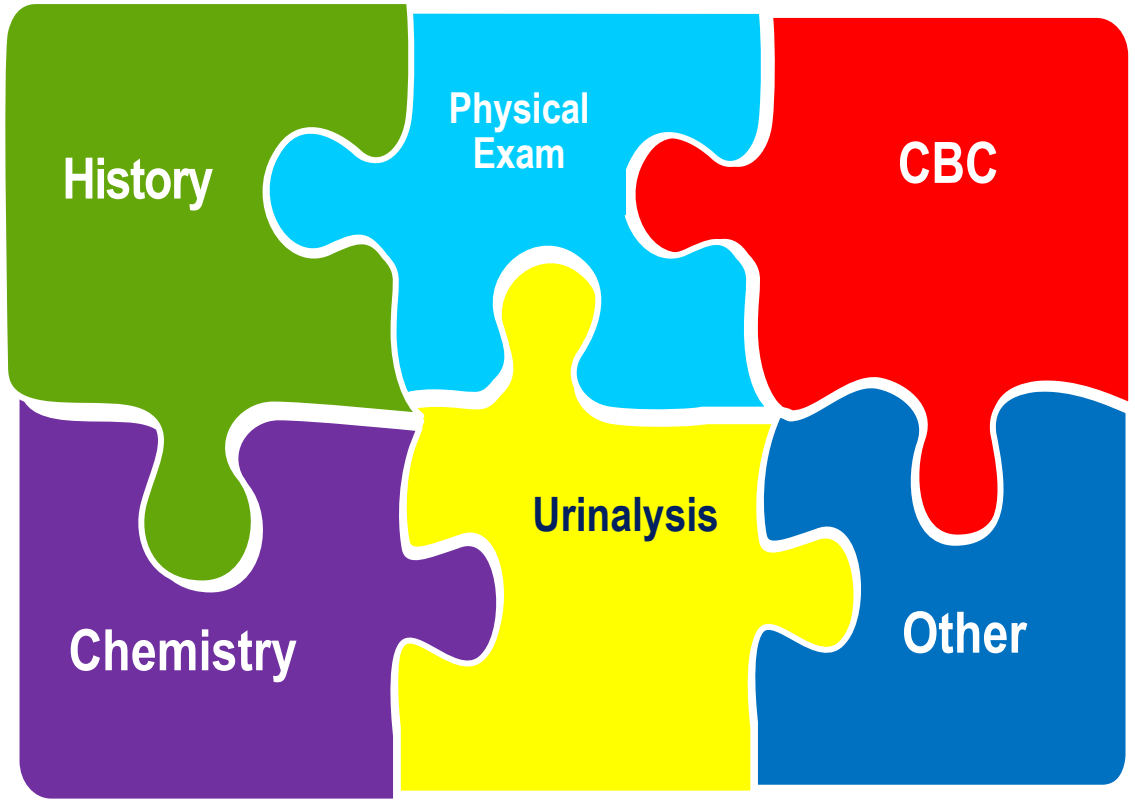
Differentials for pallor

1. Anemia
2. Poor perfusion



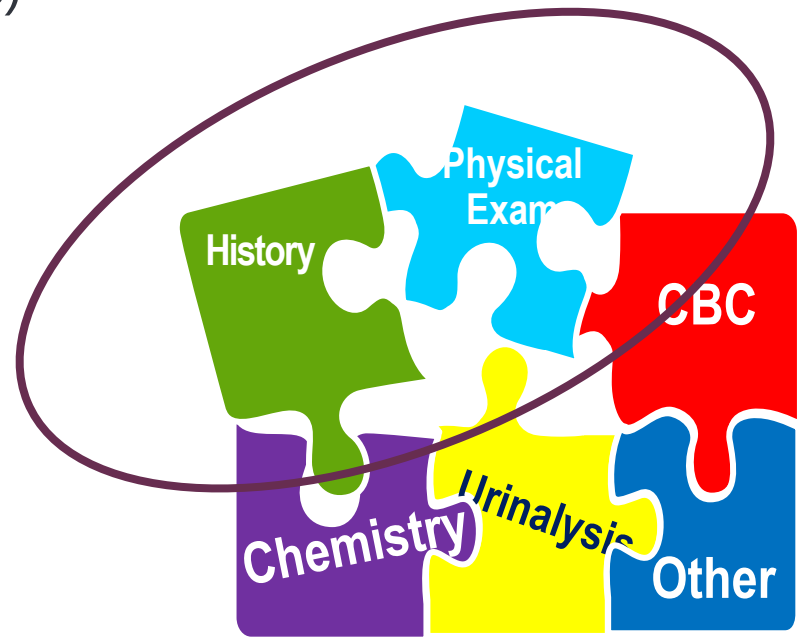
Evaluation of the pale pet

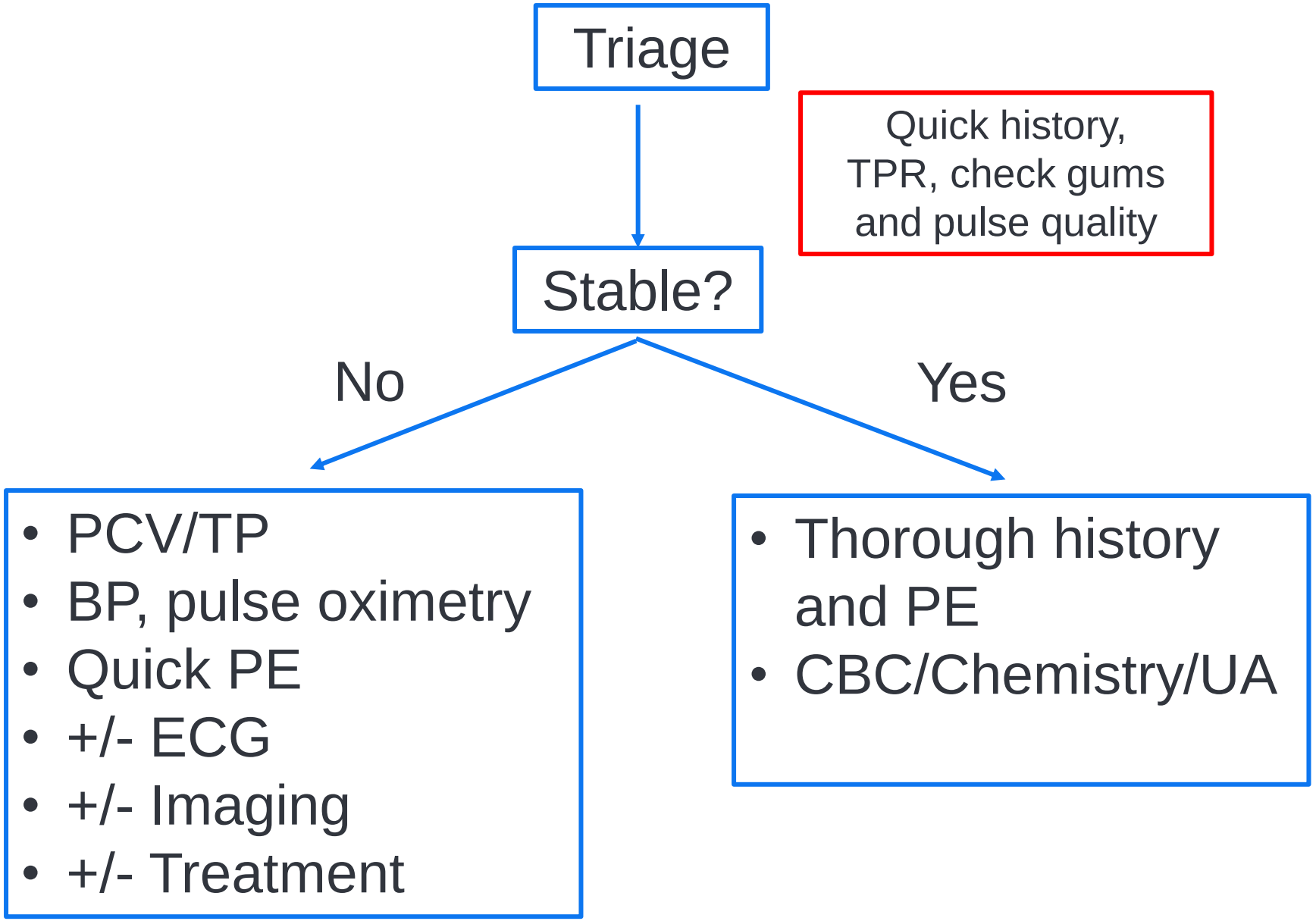
Evaluation of the veterinary patient is part art, part science



History and physical examination are SO important

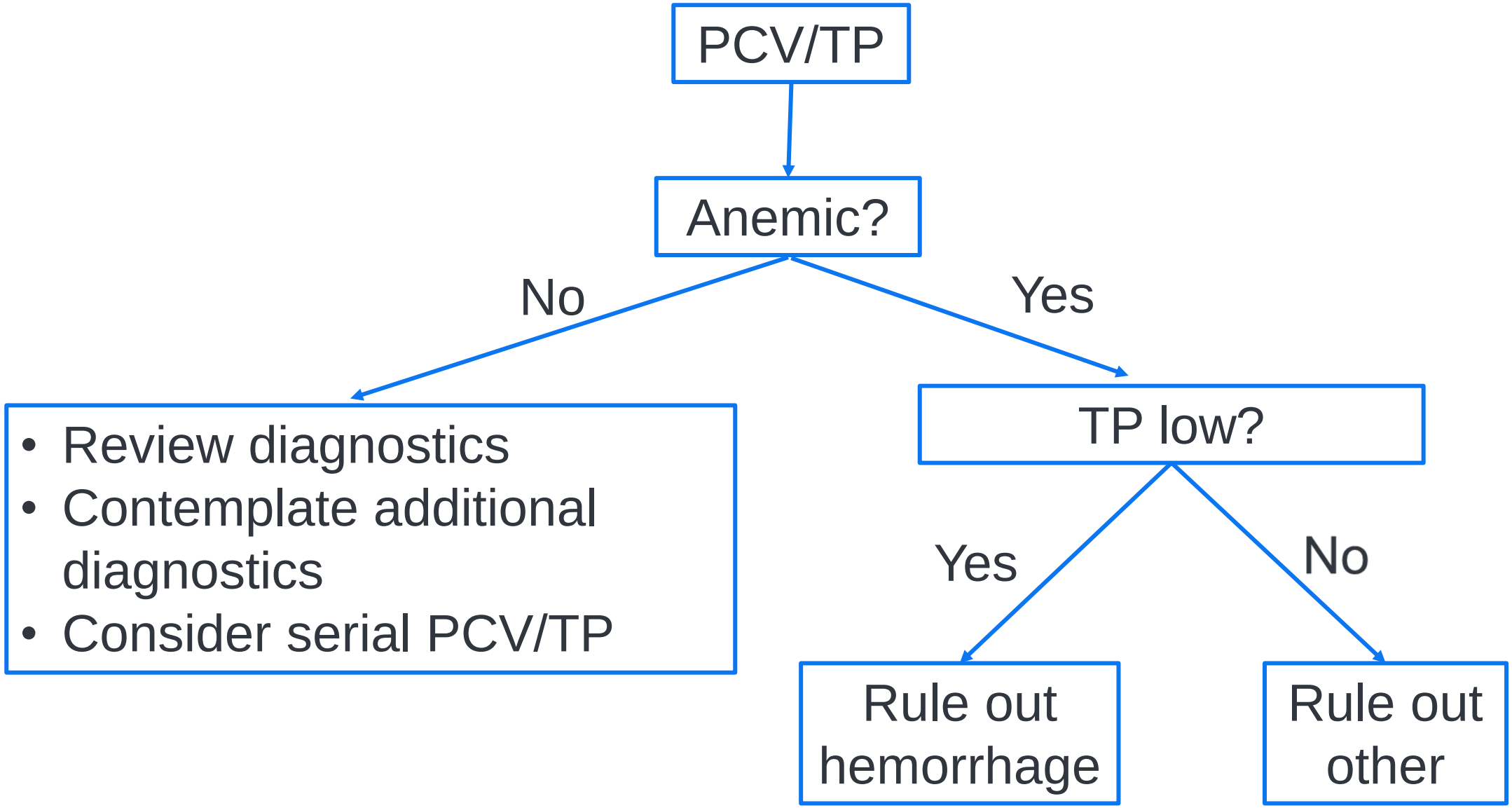
- History
  - Clinical signs
  - Current/recent medications
  - Exposures (toxins, plants, vectors, infectious agents)
  - Routine/preventative care
  - Diet
  - Concurrent conditions
  - Prior labs & medical records
- PE
  - Gums> color, moisture, CRT
  - Rectal !!
  - Retinal
  - Weight
  - Trends




Triage
Quick history, TPR, check gums and pulse quality
Stable?
No
Yes
• PCV/TP
• BP, pulse oximetry
• Quick PE
• +/- ECG
• +/- Imaging
• +/- Treatment
• Thorough history and PE
• CBC/Chemistry/UA

The unstable pale patient might look like…

- Collapsed
- Tachycardic (profound and/or persistent)
- Bradycardic
- Arrhythmias
- Tachypneic (persistent)
- Dyspneic
- Abnormal heart or lung sounds
- Abnormal heart rate or rhythm
- Weak or bounding pulses
- History or evidence of trauma or pain


PCV/TP
Anemic?
No
Yes
• Review diagnostics
• Contemplate additional diagnostics
• Consider serial PCV/TP
TP low?
Yes
No
Rule out hemorrhage
Rule out other

Pale patient, anemic.

"My patient is anemic." Next question...

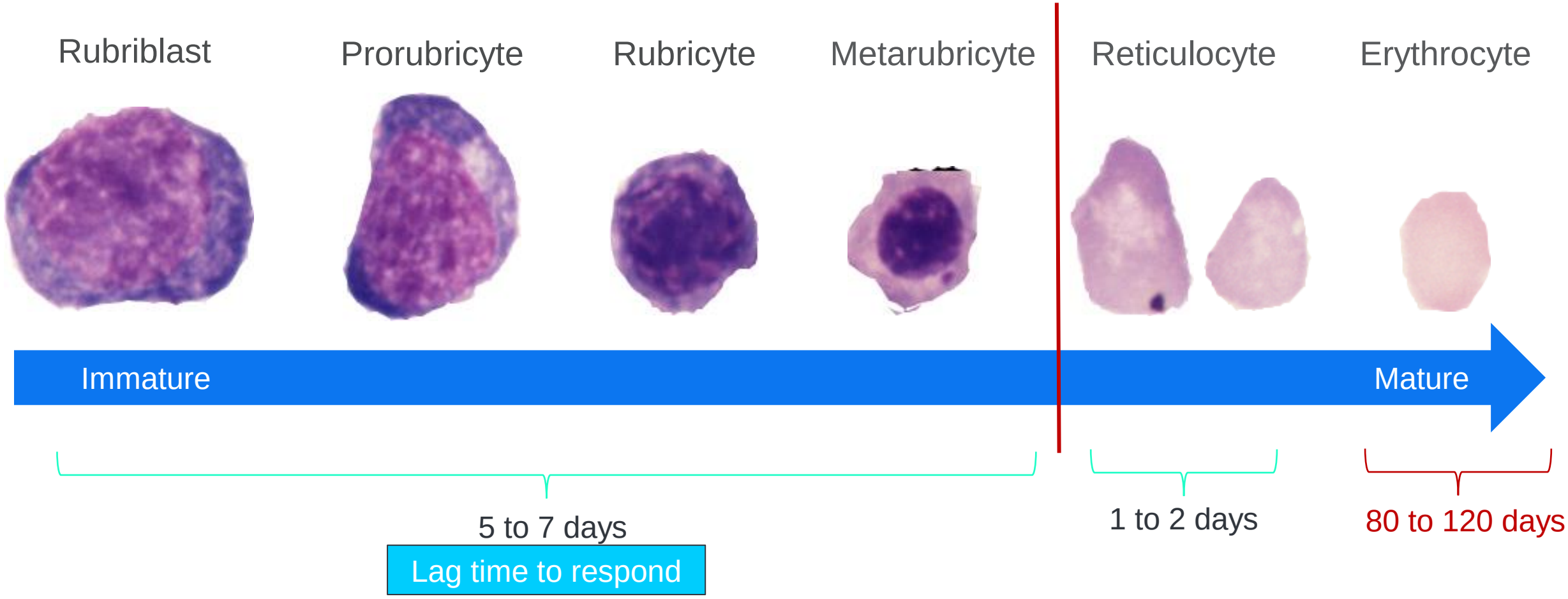
Regenerative?

Hemorrhage
Hemolysis

Non-regenerative?

Chronic disease, e.g., CKD
Cancer, chemotherapy
Bone marrow disease
Acute hemorrhage (pre-regenerative)

Reticulocytes key to classifying anemia

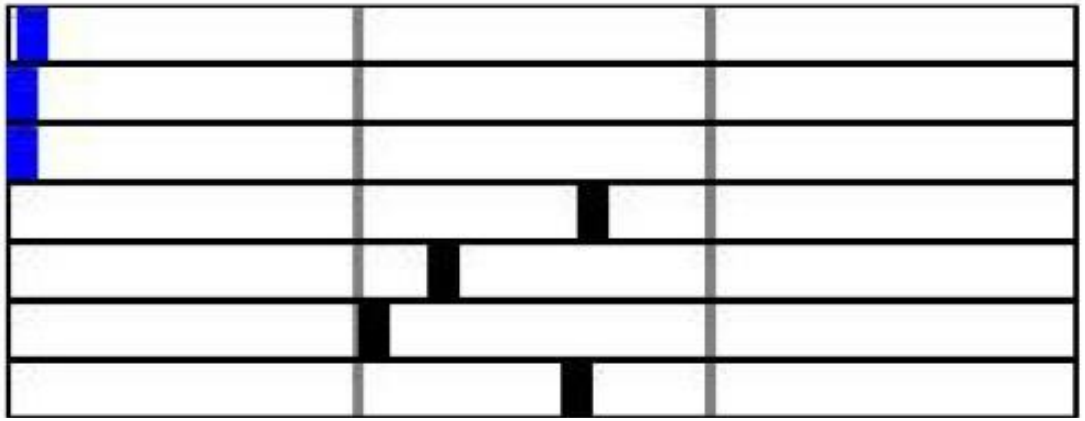


RBC parameters – read between the lines

1. Absolute reticulocyte count most accurate way to determine regeneration
   - Classic changes in RBC indices (↑ MCV, ↓ MCHC) in only 8-11% with regenerative anemia
2. Reticulocytosis without anemia may indicate underlying disease
3. Look at PCV in relation to total solids for important clues
   - Acute or chronic hemorrhage, hemolysis
4. Reticulocyte-hemoglobin (retic-Hgb) is early marker of iron deficiency
   - RBC indices are mean values – slow to change when new cells produced

Regenerative or nonregenerative?

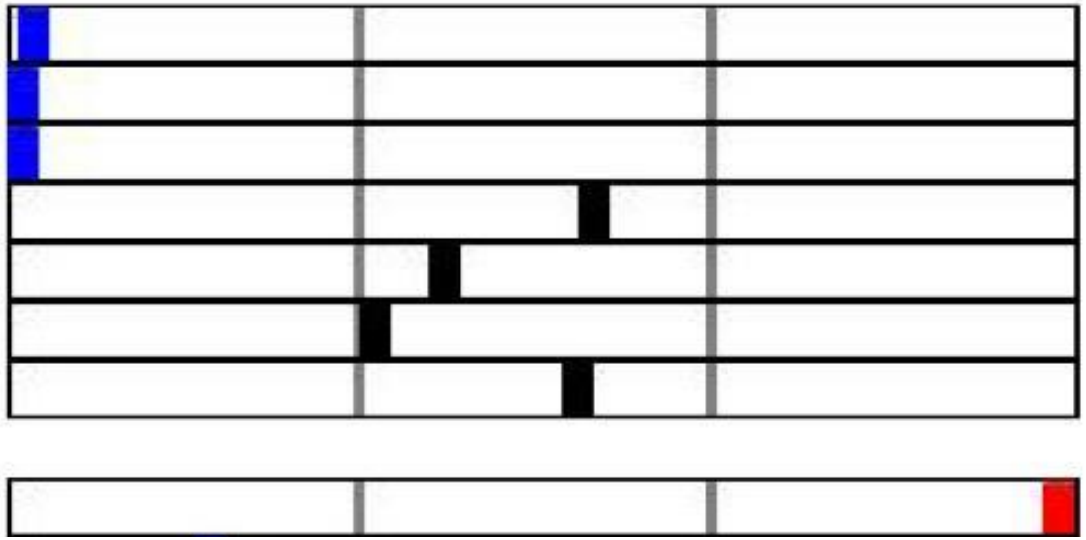
Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx (May 13, 2019 2:41 AM)					
RBC	2.28 M/µL	5.65 - 8.87	LOW		
HCT	15.9 %	37.3 - 61.7	LOW		
HGB	5.1 g/dL	13.1 - 20.5	LOW		
MCV	69.7 fL	61.6 - 73.5			
MCH	22.4 pg	21.2 - 25.9			
MCHC	32.1 g/dL	32.0 - 37.9			
RDW	18.7 %	13.6 - 21.7			



Regenerative anemia, normal RBC indices

ProCyte Dx (May 13, 2019 2:41 AM)

Test	Results	Reference Interval	
RBC	2.28 M/µL	5.65 - 8.87	LOW
HCT	15.9 %	37.3 - 61.7	LOW
HGB	5.1 g/dL	13.1 - 20.5	LOW
MCV	69.7 fL	61.6 - 73.5	
MCH	22.4 pg	21.2 - 25.9	
MCHC	32.1 g/dL	32.0 - 37.9	
RDW	18.7 %	13.6 - 21.7	
%RETIC	18.2 %		
RETIC	413.8 K/µL	10.0 - 110.0	HIGH



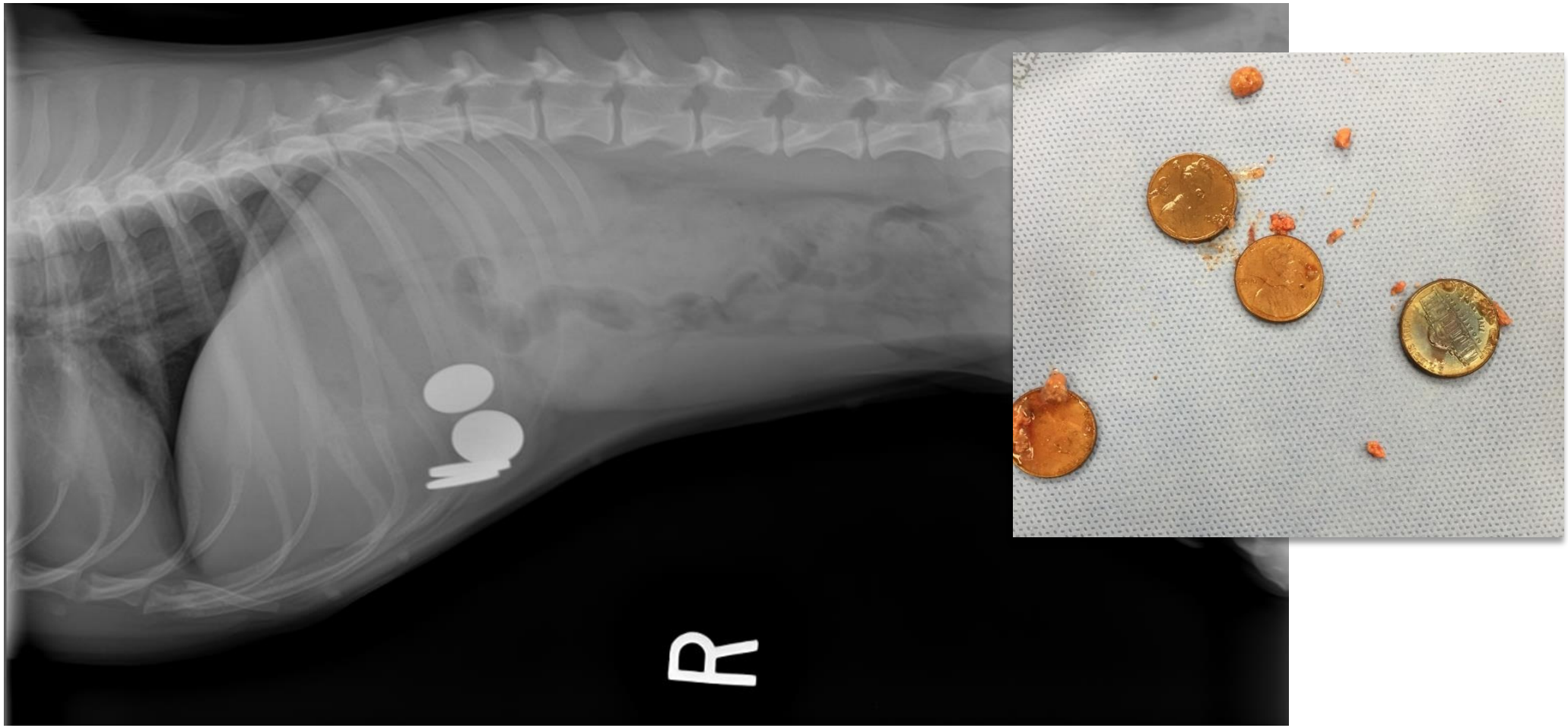
If regenerative, is it hemorrhage or hemolysis?

Finding	Hemorrhage	Hemolysis
Evidence of bleeding (internal or external)	Usually yes, not always	No
Total protein (chemistry better than refractometer)	Usually low, may be normal	Normal to high
Spherocytes	No	Often, not always
RBC changes other than spherocytosis	Maybe (microangiopathy/ schistocytes etc.)	Maybe (ghost cells)
Hemoglobinuria	Usually not, occasionally yes (cavity bleed)	Usually yes
Bilirubinuria	Usually not, occasionally yes (chronic cavity bleed)	Usually yes
Serum bilirubin	Normal, occasionally slightly elevated (cavity bleed)	Normal to markedly increased
Autoagglutination	No	Often, not always
Hyperdynamic pulses	Bounding, short and snappy, or thready	Often bounding
Coomb's	Negative	Positive or negative

If regenerative, is it hemorrhage or hemolysis?

Finding	Hemorrhage	Hemolysis
Evidence of bleeding (internal or external)	Usually yes, not always	No
Total protein (chemistry better than refractometer)	Usually low, may be normal	Normal to high
Spherocytes	No	Often, not always
RBC changes other than spherocytosis	Maybe (microangiopathy/ schistocytes etc.)	Maybe (ghost cells)
Hemoglobinuria	Usually not, occasionally yes (cavity bleed)	Usually yes
Bilirubinuria	Usually not, occasionally yes (chronic cavity bleed)	Usually yes
Serum bilirubin	Normal, occasionally slightly elevated (cavity bleed)	Normal to markedly increased
Autoagglutination	No	Often, not always
Hyperdynamic pulses	Bounding, short and snappy, or thready	Often bounding
Coomb's	Negative	Positive or negative

Not all hemolysis is immune-mediated



RBC parameters – between the lines

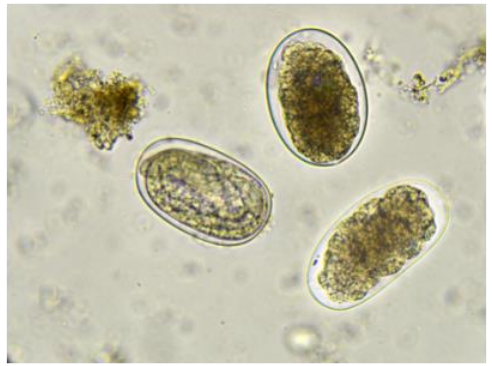
1. Absolute reticulocyte count most accurate way to determine regeneration
   - Classic changes in RBC indices (↑ MCV, ↓ MCHC) in only 8-11% with regenerative anemia

2. Reticulocytosis without anemia may indicate underlying disease

3. Look at PCV in relation to total solids for important clues
   - Acute or chronic hemorrhage, hemolysis

4. Reticulocyte-hemoglobin (retic-Hgb) is early marker of iron deficiency
   - RBC indices are mean values – slow to change when new cells produced

Reticulocyte count high in 5-10% dogs *without* anemia*



Reticulocytosis without anemia

Healthy pet (<135,000)

- Splenic contraction
- *Mild* bleeding/hemolysis
- Hookworm (microcytosis)

Geriatric pet 'ADR'

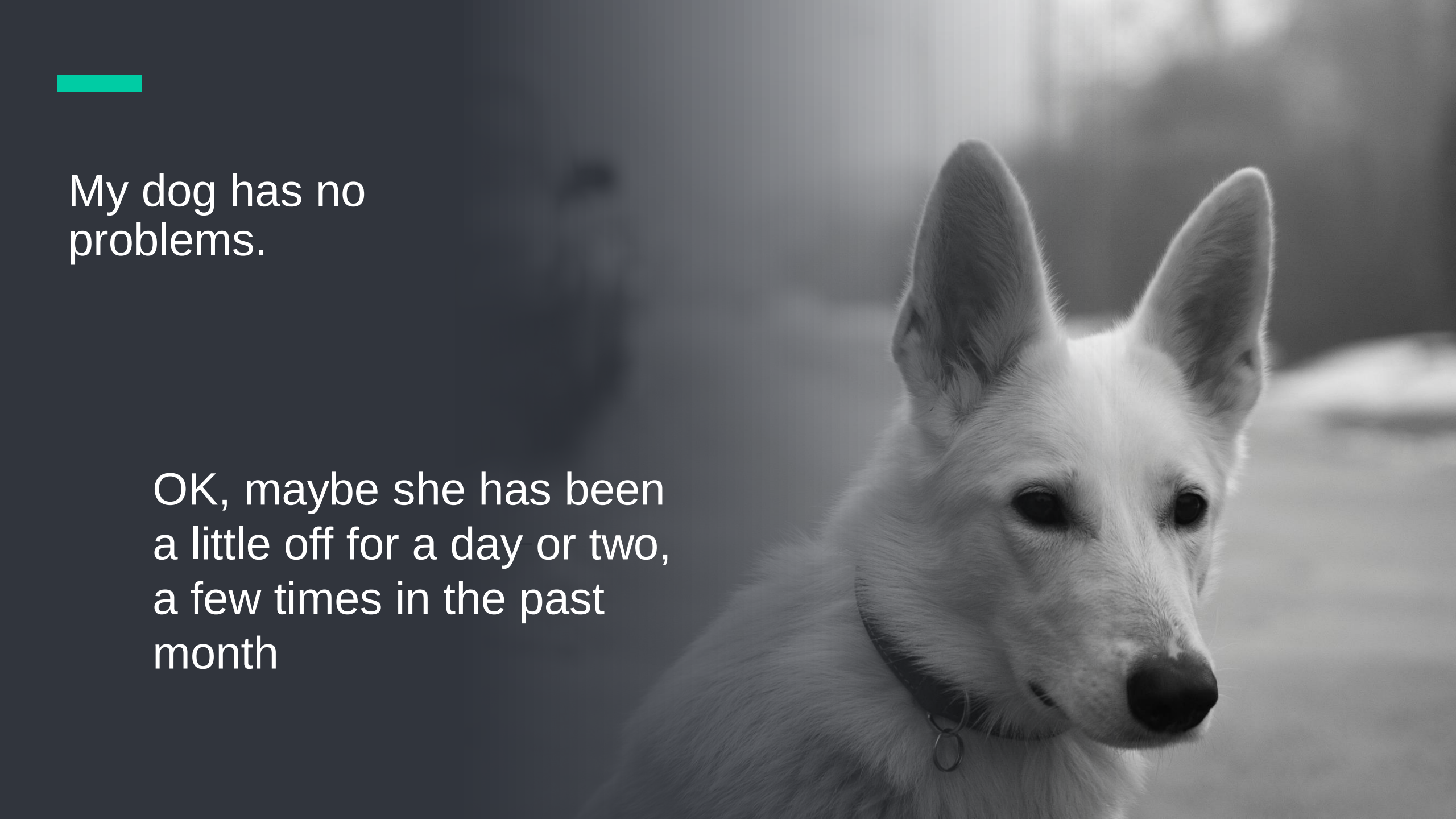
- *Occult* bleeding/hemolysis
  - Splenic tumor
  - Other cancer
- Other

*I million CBCs, Dr. DeNicola

IDEXX data on file

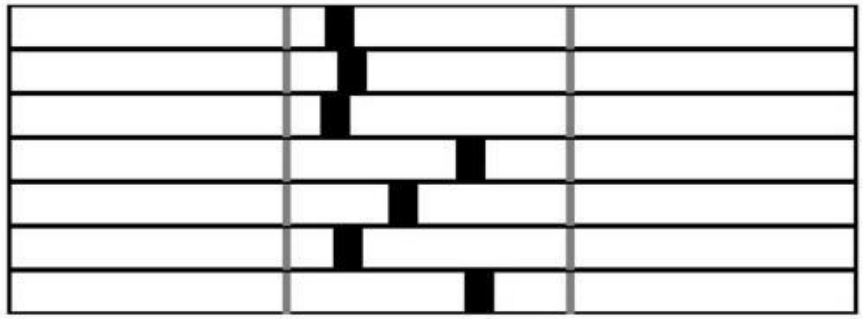
My dog has no problems.

OK, maybe she has been a little off for a day or two, a few times in the past month

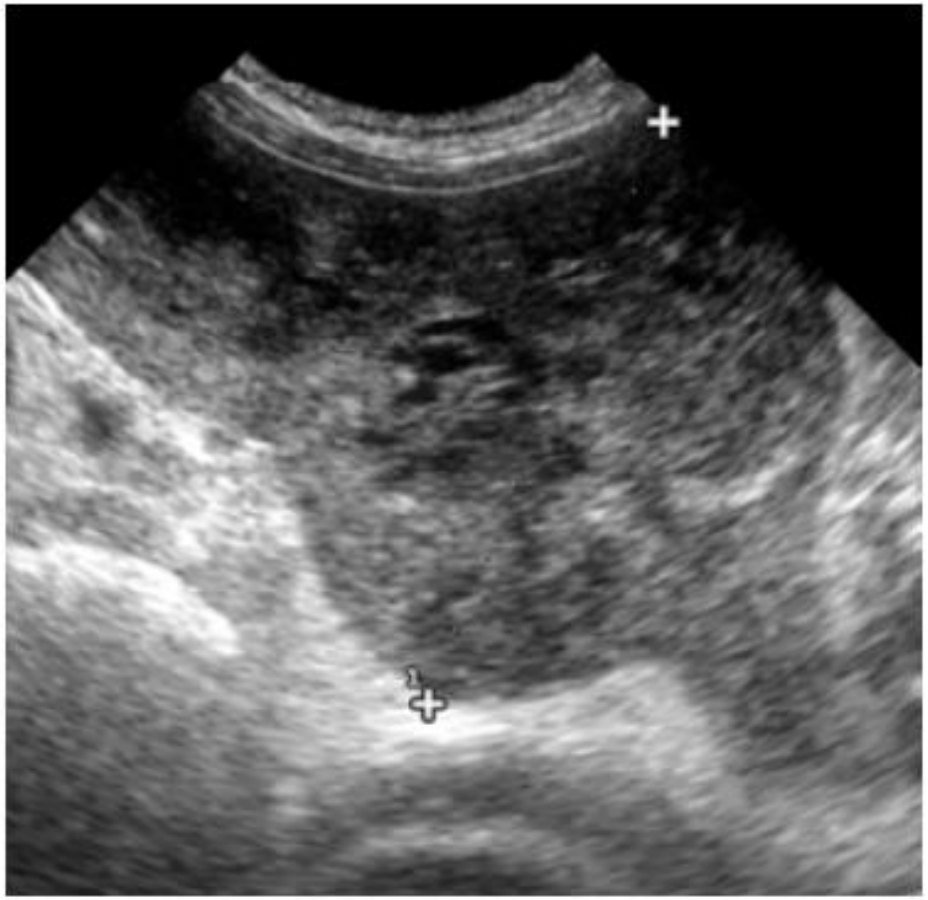


10-year-old, spayed female mixed-breed dog

Test	Results	Reference Interval	LOW	NORMAL	HIGH
ProCyte Dx					
RBC	6.2 x10^12/L	5.7 - 8.9			
HCT	43.2 %	37.5 - 61.7			
HGB	14.4 g/dL	13.1 - 20.5			
MCV	69.4 fL	61.6 - 73.5			
MCH	23.1 pg	21.2 - 25.9			
MCHC	33.3 g/dL	32.0 - 37.9			
RDW	19.1 %	13.6 - 21.7			



Find this before it ruptures...



Nonregenerative anemia has diverse etiologies

Extramedullary

- Anemia of chronic or inflammatory disease
- Kidney disease
- Endocrinopathies
- GI malabsorption
- Iron deficiency
- Chronic blood loss
- Liver and pancreatic disease
- Neoplasia

Medullary

- Primary
  - Aplastic anemia
  - Myelodysplastic syndrome
  - Myelophthisis
  - Bone marrow necrosis
- Secondary
  - Infectious, immune-mediated
  - Drugs & toxins
  - Neoplasia

Ettinger SJ, Feldman EC, Cote E, eds. *Textbook of Veterinary Internal Medicine*, 8th ed. St. Louis, MO: Elsevier; 2017.

RBC parameters – between the lines

1. Absolute reticulocyte count most accurate way to determine regeneration
   - Classic changes in RBC indices (↑ MCV, ↓ MCHC) in only 8-11% with regenerative anemia

2. Reticulocytosis without anemia may indicate underlying disease

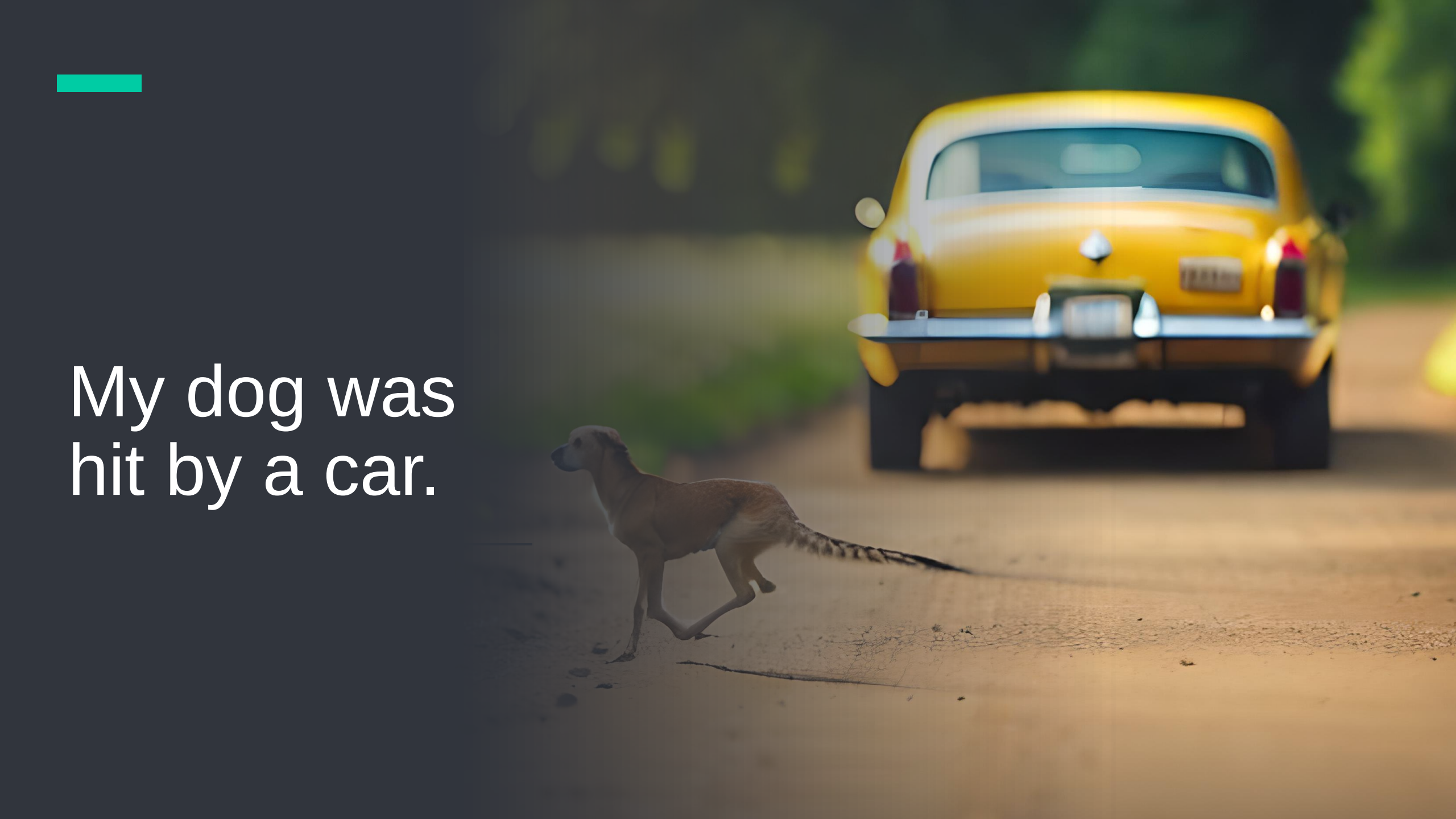
3. Evaluate PCV in relation to total solids for important clues
   - Acute or chronic hemorrhage, hemolysis

4. Reticulocyte-hemoglobin (retic-Hgb) is early marker of iron deficiency
   - RBC indices are mean values – slow to change when new cells produced

Interpreting PCV/TS in emergency patients

Condition/situation	PCV	TP
Normal/no issue	N	N
Hemoconcentration	↑	↑
Acute hemorrhage	N or ↓	N or ↓
Chronic hemorrhage	↓	↓or N
Hemolysis	↓	N or ↑
Balanced regeneration (hemorrhage)	N	N
Balanced regeneration (hemolysis)	N	↑ or N

My dog was hit by a car.



5-yr-old, FS, mixed breed dog: Hit by car. Ambulatory but limping. A little pale. Bright, alert, responsive

Time	T	P	R	PCV	TS	DEXT	AZO	Na	K	Lact	BP	UOP
10 am	100	160	Pant	45	5.0	160	5–15	147	4.4	4.4	100	

Could this dog be bleeding?

After 2 hours of fluid therapy…

Time	T	P	R	PCV	TS	DEXT	AZO	Na	K	Lact	BP	UOP
10 am	100	160	Pant	45	5.0	160	5–15	147	4.4	4.4	100	
Noon	98	**280**	Pant	**24**	**1.2**	142	**30-40**	144	4.0	**6.5**	78	80

My dog is suddenly weak, and her abdomen is distended.

“She NEVER eats anything she should not…”

[redacted] Patient management

Canine | Dachshund | Male | 20 y

2017 Jan 21 2015 Nov 5 Apr 3

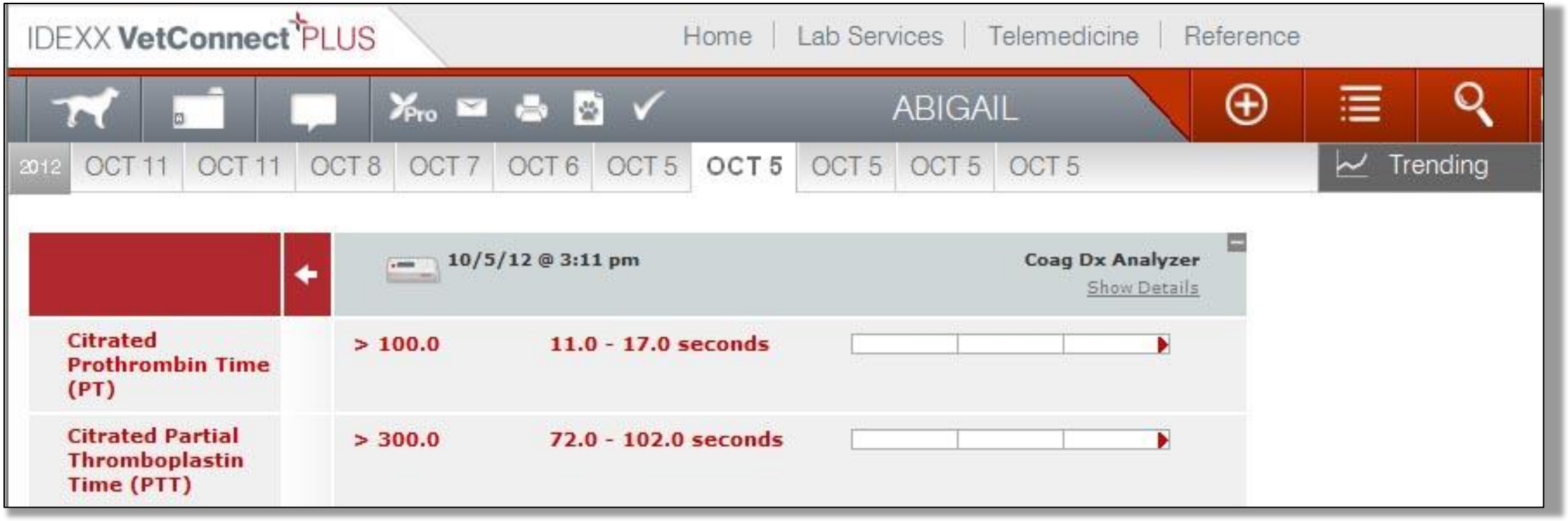
Result Details

Hematology

	11/5/15 3:51 AM	
RBC	2.52	5.39 - 8.70 M/µL
Hematocrit	18.7	38.3 - 56.5 %
Hemoglobin	6.1	13.4 - 20.7 g/dL
MCV	74	59 - 76 fL
MCH	24.2	21.9 - 26.1 pg
MCHC	32.6	32.6 - 39.2 g/dL
% Reticulocytes	9.9	%
Reticulocytes	249	10 - 110 K/µL
Nucleated RBCs	8	0 - 2 per 100 WBC
Platelets	377	143 - 448 K/µL
Polychromasia	MODERATE	
Anisocytosis	MODERATE	

BUN	12	9 - 31 mg/dL
BUN: Creatinine Ratio	24.0	
Phosphorus	4.5	2.5 - 6.1 mg/dL
Calcium	8.2	8.4 - 11.8 mg/dL
Sodium	149	142 - 152 mmol/L
Potassium	4.4	4.0 - 5.4 mmol/L
Na: K Ratio	34	28 - 37
Chloride	120	108 - 119 mmol/L
TCO2 (Bicarbonate)	17	13 - 27 mmol/L
Anion Gap	16	11 - 26 mmol/L
Total Protein	3.9	5.5 - 7.5 g/dL
Albumin	1.7	2.7 - 3.9 g/dL
Globulin	2.2	2.4 - 4.0 g/dL
Albumin: Globulin Ratio	0.8	0.7 - 1.5

Another cause of hemorrhage…



RBC parameters – between the lines

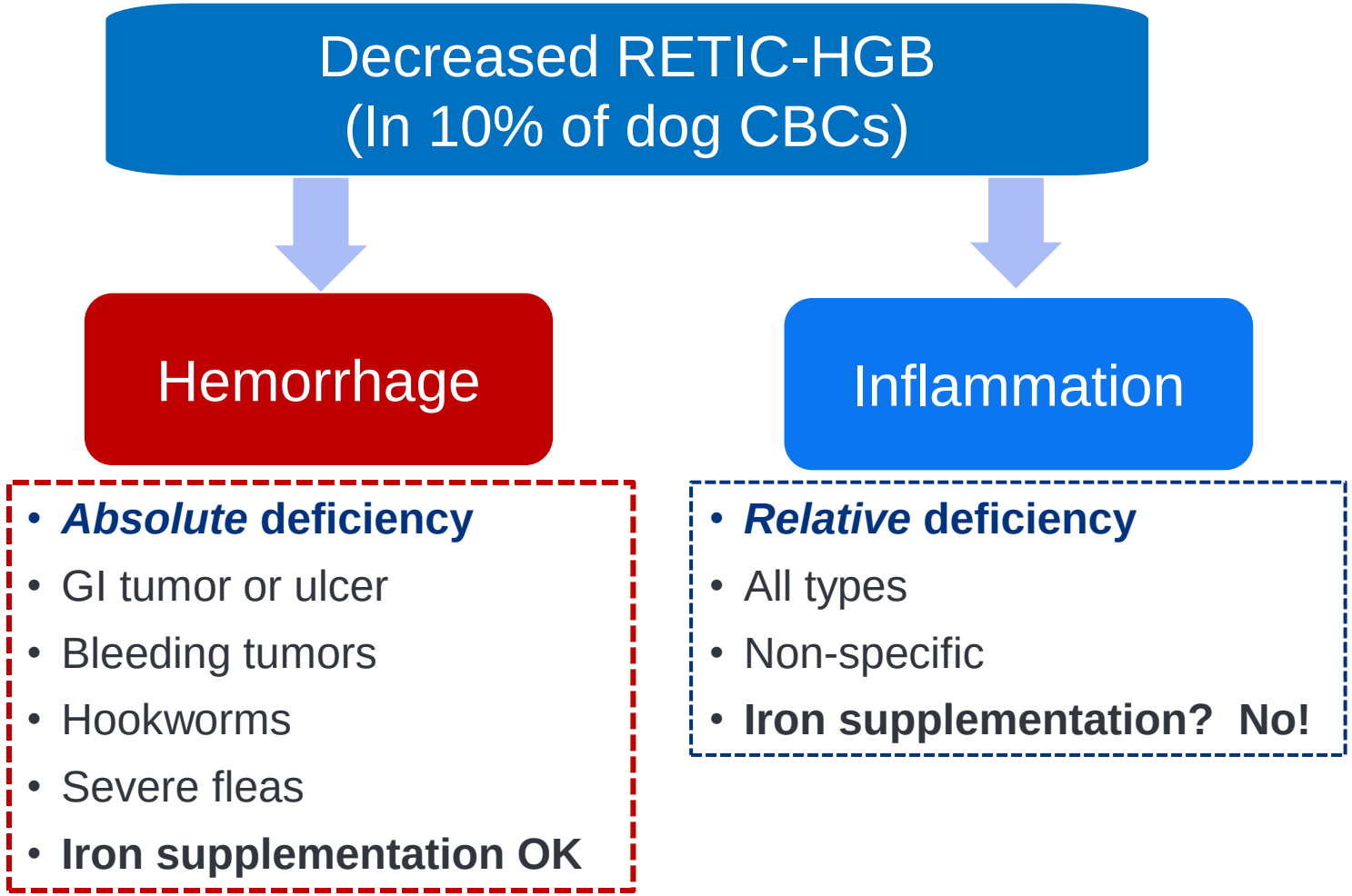
1. Absolute reticulocyte count most accurate way to determine regeneration
   - Classic changes in RBC indices (↑ MCV, ↓ MCHC) in only 8-11% with regenerative anemia

2. Look at PCV in relation to total solids for important clues.
   - Acute hemorrhage, hemolysis

3. Reticulocytosis without anemia may indicate underlying disease

4. Reticulocyte-hemoglobin (retic-Hgb) is early marker of iron deficiency
   - RBC indices are mean values – slow to change when new cells produced

Reticulocyte hemoglobin reveals decreased iron availability in **days** (not months)



My dog has been a little off.

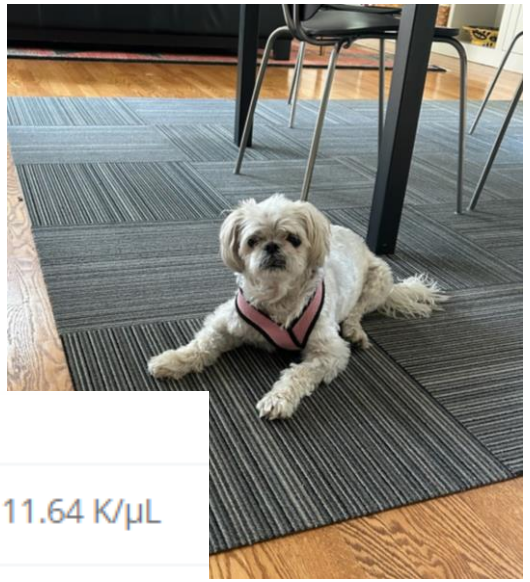
“Misty”

Canine | Shih Tzu | Female | 11 y | Profile

2021 Mar 23 | 2020 Sep 18 | Sep 17 | Sep 11 | Feb 21

Result Details

Hematology	9/17/20 9:30 AM	
RBC	5.17	5.65 - 8.87 M/µL
Hematocrit	28.7	37.3 - 61.7 %
Hemoglobin	10.1	13.1 - 20.5 g/dL
MCV	55.5	61.6 - 73.5 fL
MCH	19.5	21.2 - 25.9 pg
MCHC	35.2	32.0 - 37.9 g/dL
RDW	22.1	13.6 - 21.7 %
% Reticulocyte	1.4	%
Reticulocytes	72.4	10.0 - 110.0 K/µL
Reticulocyte Hemoglobin	15.1	22.3 - 29.6 pg
WBC	16.44	5.05 - 16.76 K/µL
% Neutrophils	84.3	%
% Basophils	0.4	%
Neutrophils	13.85	2.95 - 11.64 K/µL
Lymphocytes	1.41	
Monocytes	0.56	
Eosinophils	0.55	
Basophils	0.07	
Platelets	514	148 - 484 K/µL
PDW	16.8	9.
MPV	13.2	8.
Plateletcrit	0.68	0.14 - 0.46 %



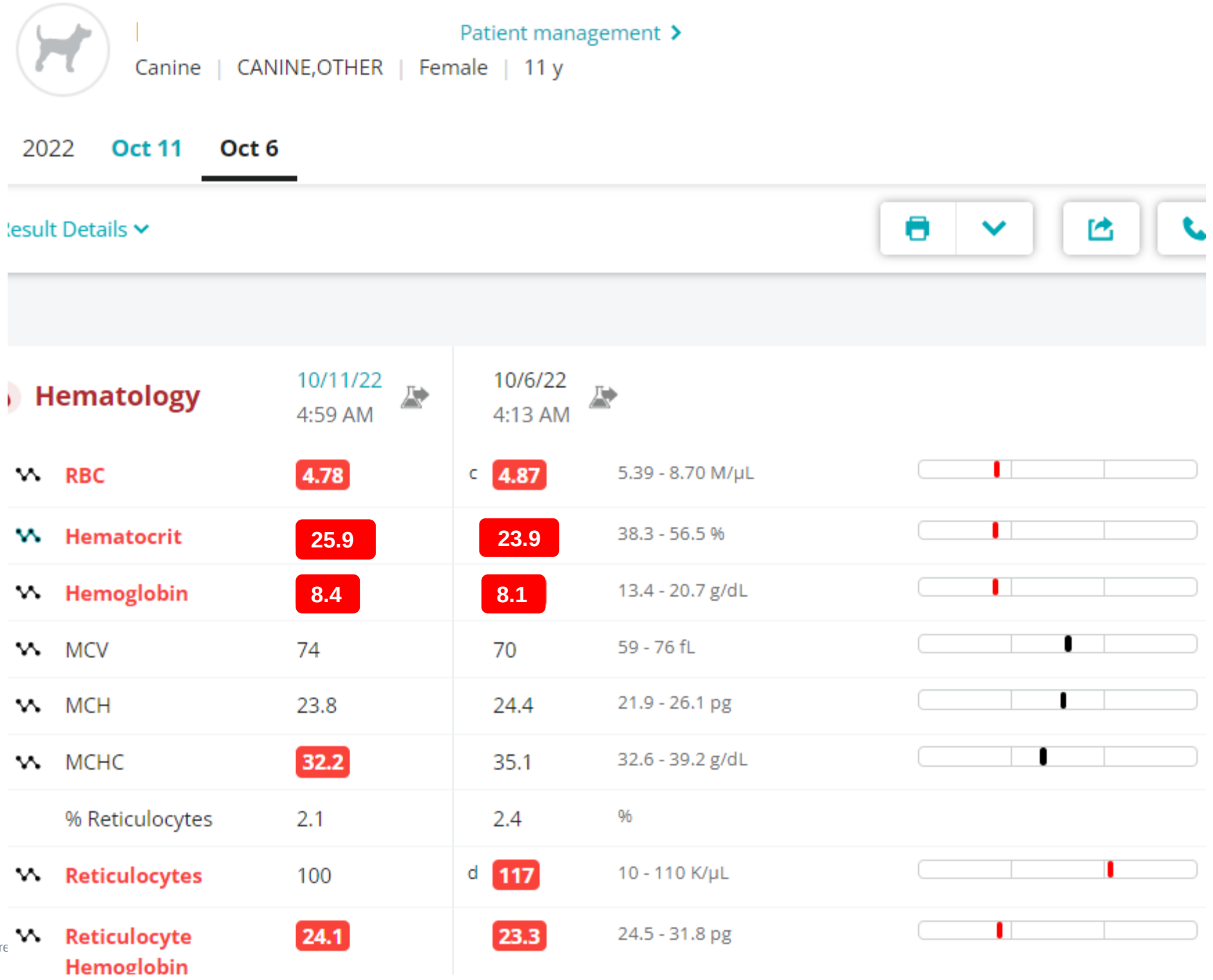
Microcytic hypochromic, non-regenerative anemia
=
Classic iron deficiency anemia

Thrombocytosis is another clue!

Routine check-up. You note the patient is pale.

Rest of PE is unremarkable...

“Molly”



Patient management >

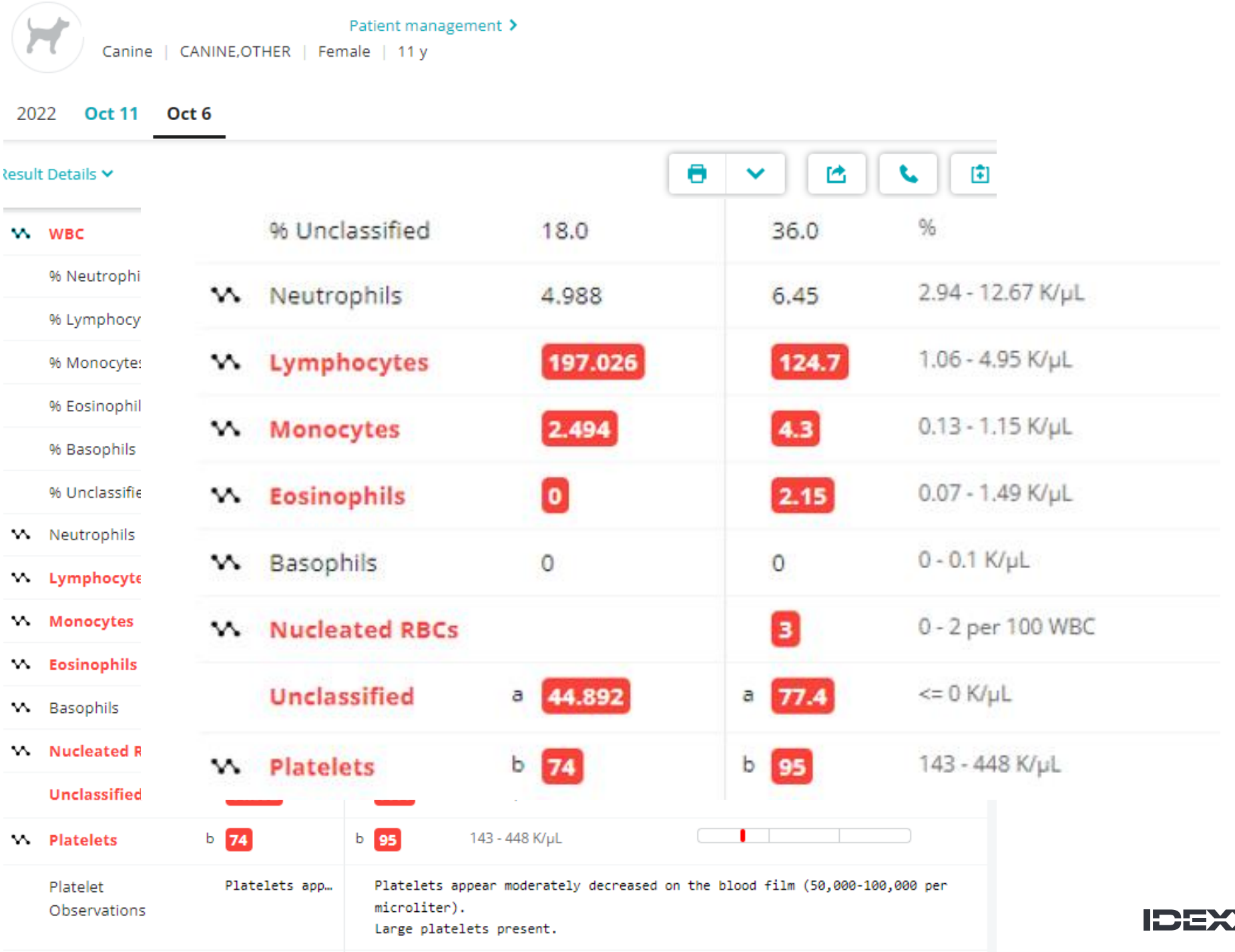
Canine | CANINE,OTHER | Female | 11 y

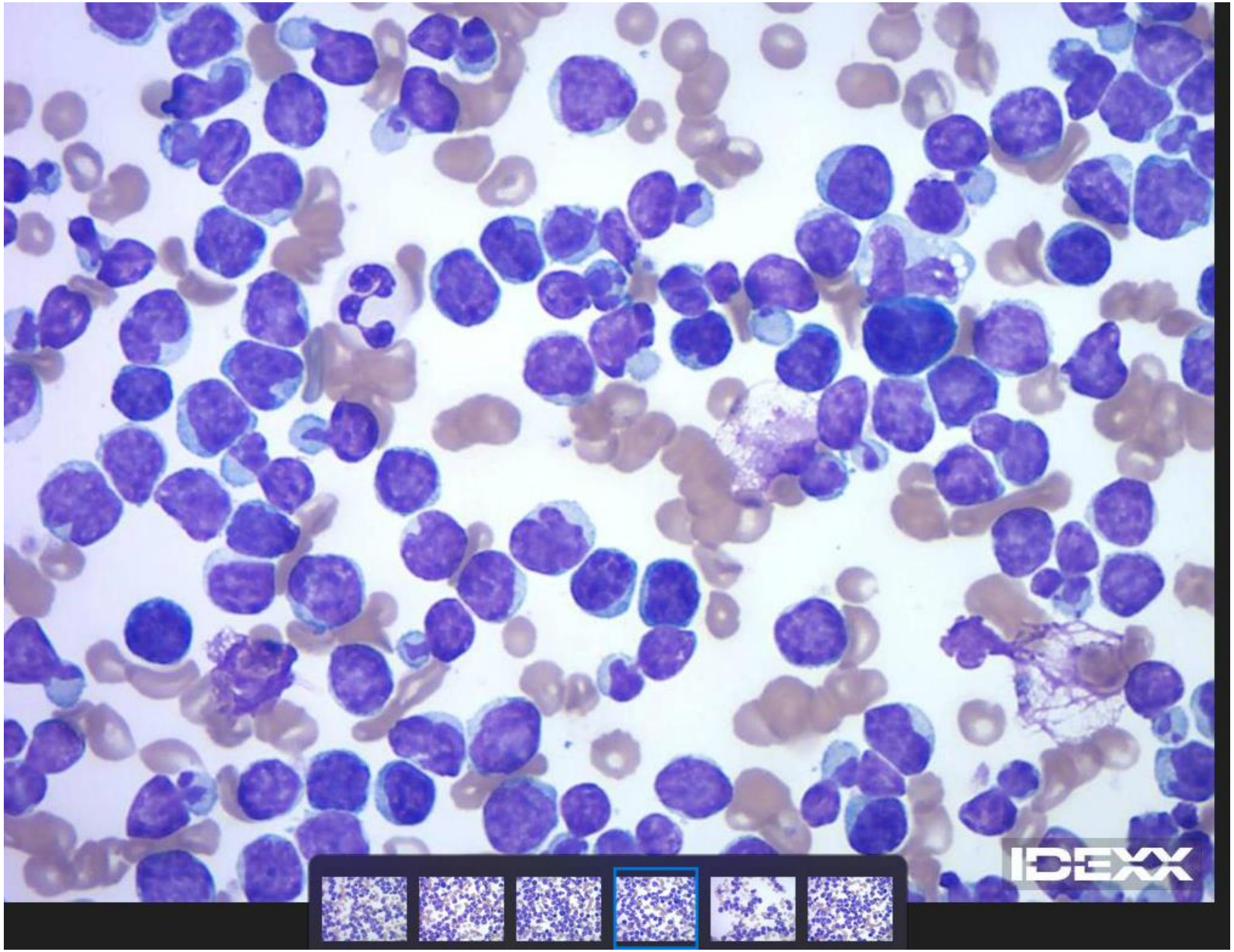
2022 **Oct 11** **Oct 6**

esult Details

Hematology	10/11/22 4:59 AM		10/6/22 4:13 AM		
RBC	4.78		c 4.87		5.39 - 8.70 M/µL
Hematocrit	25.9		23.9		38.3 - 56.5 %
Hemoglobin	8.4		8.1		13.4 - 20.7 g/dL
MCV	74		70		59 - 76 fL
MCH	23.8		24.4		21.9 - 26.1 pg
MCHC	32.2		35.1		32.6 - 39.2 g/dL
% Reticulocytes	2.1		2.4		%
Reticulocytes	100		d 117		10 - 110 K/µL
Reticulocyte Hemoglobin	24.1		23.3		24.5 - 31.8 pg

“Molly”




IDEXX

Treatment of the anemic patient

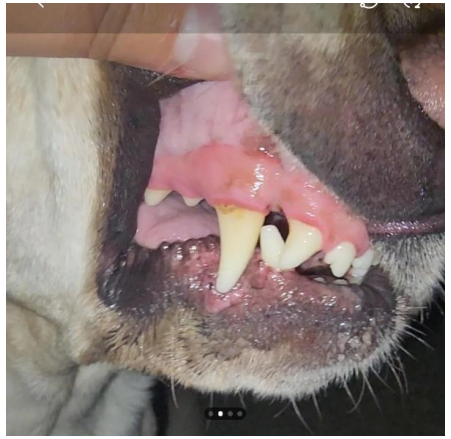
- Supportive care, as indicated
  - Transfusion, IF indicated
  - Fluid therapy, IF indicated
  - Oxygen supplementation, IF indicated
- Definitive treatment is case-specific and may include:
  - Hemostasis of some sort
  - Surgery
  - Immunosuppressive medications
  - Vitamin K
  - Chemotherapy
  - Iron supplementation
  - Deworming

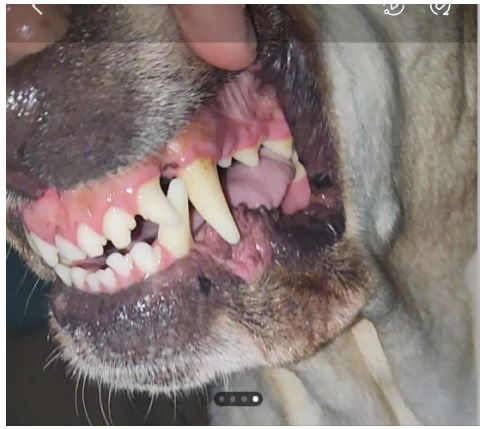
Pale patient, not anemic

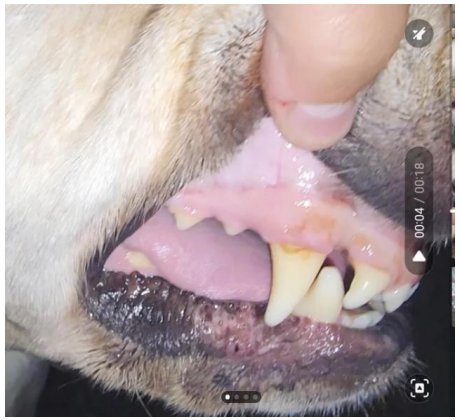
What are non-anemic causes of pallor?

- Inaccurate owner assessment
- Pigmentation issue (zebra)
- Peracute hemorrhage (pre-anemic)
- Transient or intermittent issue
  - Pain
  - Nausea
  - GI disease
  - Psychological?

1. Poor perfusion
   - Shock
     - Hypovolemic shock
     - Distributive shock
     - Cardiogenic shock
     - Anaphylaxis
     - Sepsis/SIR
2. Pulmonary hypertension







Pallor associated with GI disease and nausea is multifactorial

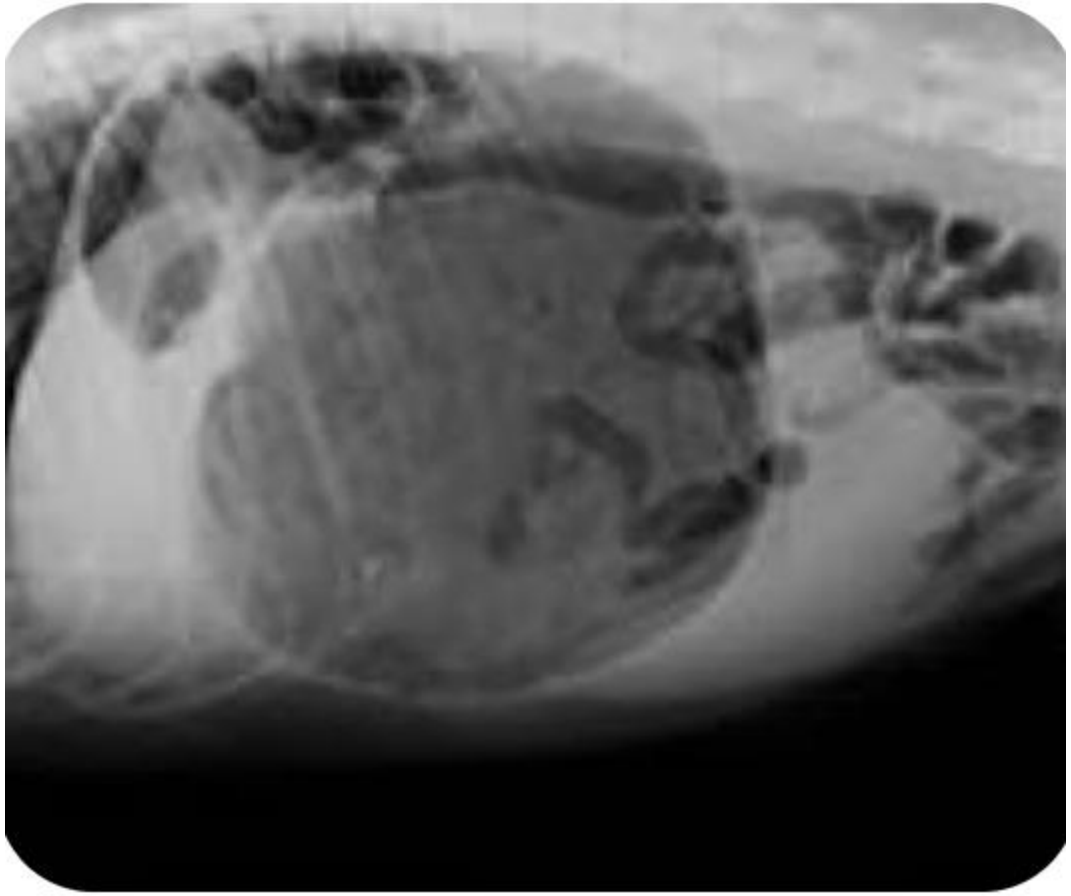
- Activation of sympathetic nervous system> vasoconstriction
- Increased vagal tone > bradycardia
- Fluid losses> hypotension
- Electrolyte disturbances> weakness, cardiac effects
  - Metabolic alkalosis> dizziness, fatigue> pallor
- Blood loss

Pallor associated with hypovolemia (not anemic)

- Acute hemorrhage (pre-anemic)
- Decreased fluid intake
- Excess fluid output
  - GI loss
  - PU/PD (renal, endocrine, drugs, other)
  - Fever
  - Excessive exercise or panting
  - Heat stroke
- Pooling of fluid
  - Compartment syndrome
  - GI

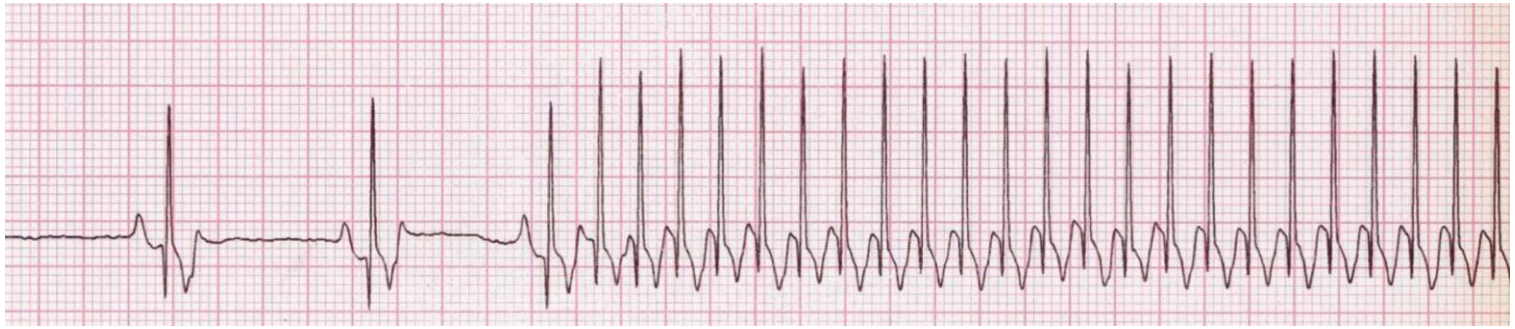
Distributive shock

- GDV
- Compartment syndrome



Cardiogenic shock

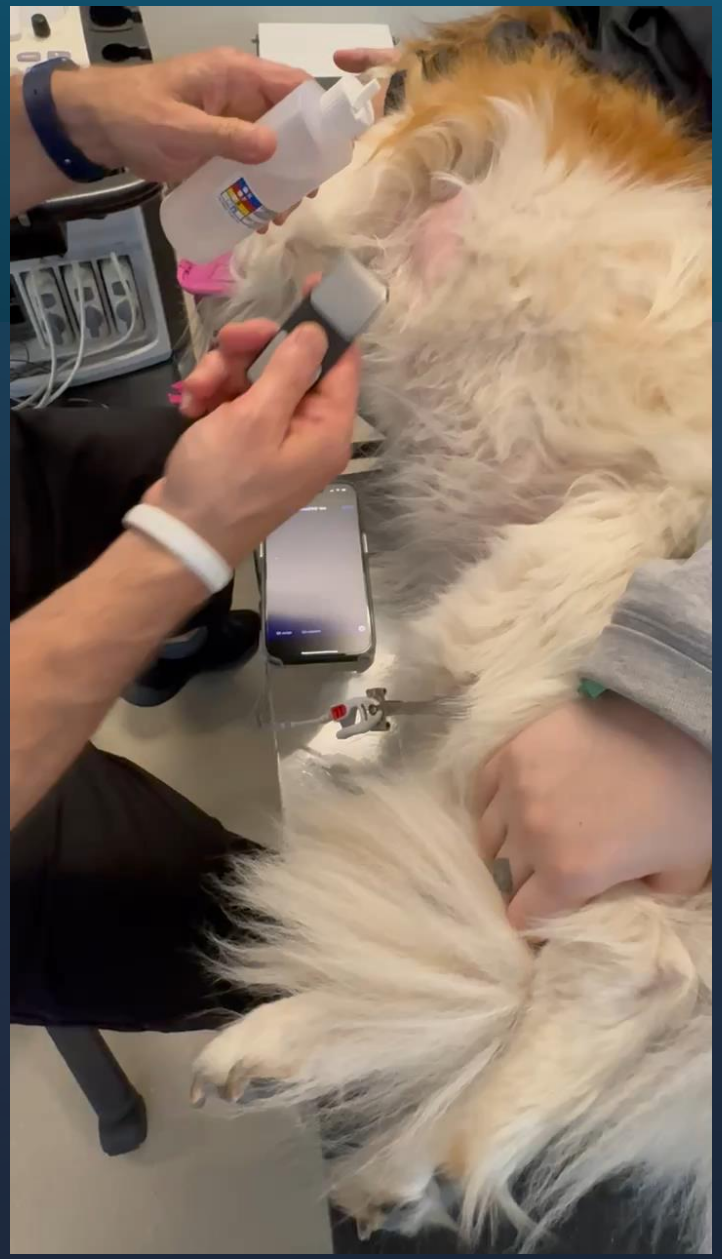
- Left-sided CHF
  - Severe MVD/MR
- Right-sided CHF
  - Severe TR
  - Pericardial effusion
  - Congenital disorders
- Bicavitary CHF
  - DCM
- Arrythmias
  - Primary
  - Secondary



KardiaMobile® device

Courtesy Dr. Carl Sammarco

Electrocardiogram Vectors by Vecteezy



Video courtesy of
Dr. Carl Sammarco

My dog has collapsed

“Jojo”, 14-year-old female spayed Eskimo

- History:
  - Acutely collapsed
  - Rapid, shallow breathing
- PE:
  - Laterally recumbent
  - Responsive, appropriate mentation
  - Tachypneic, tachycardia, irregularly irregular HR
  - Pale moist gums, cannot assess CRT
  - Muffled heart sounds, poor pulses
- Labs:
  - PCV/TP = 35%/5.5 g/dl
  - ECG: sinus tachycardia with VPCs, electrical alternans

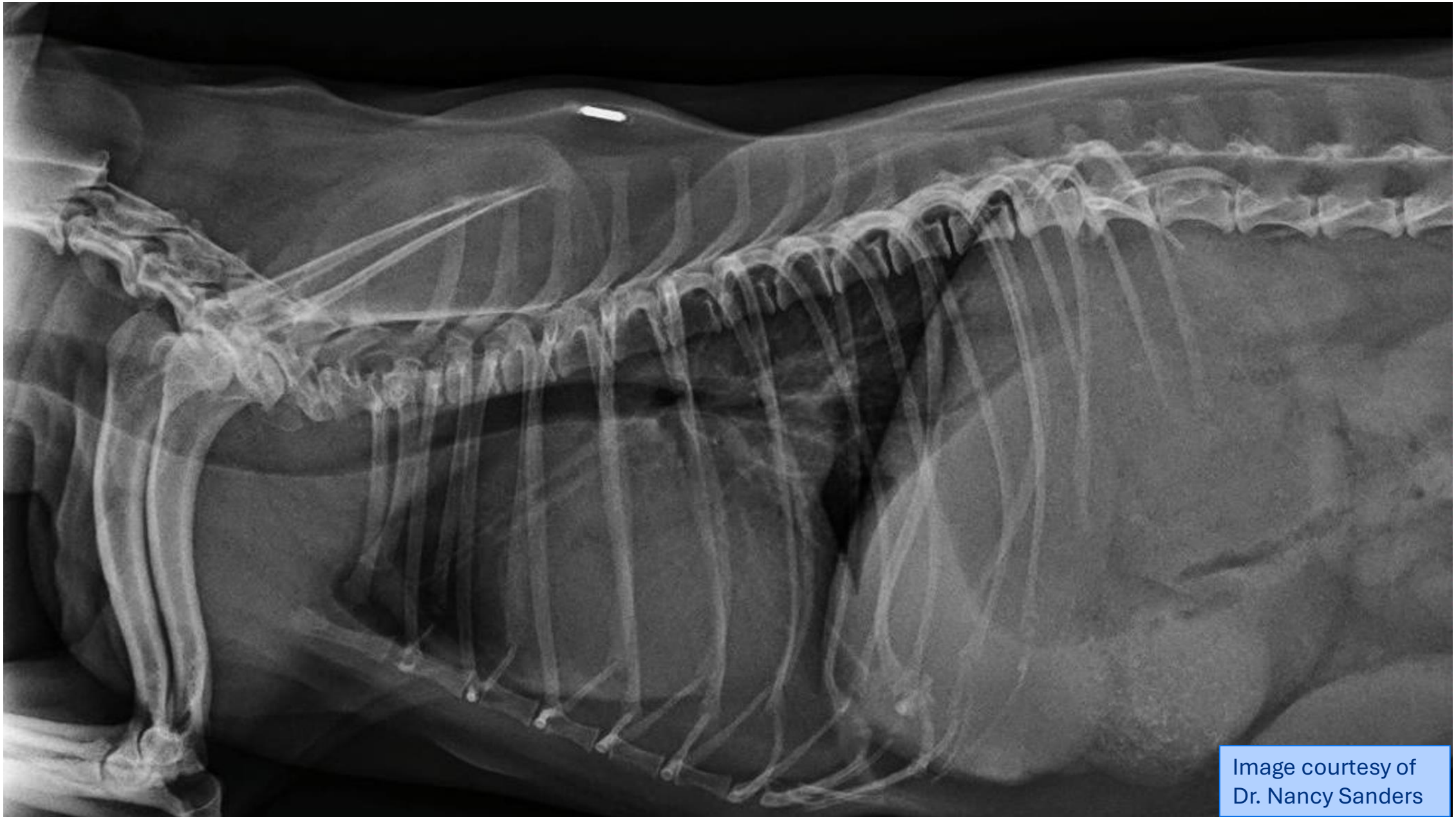
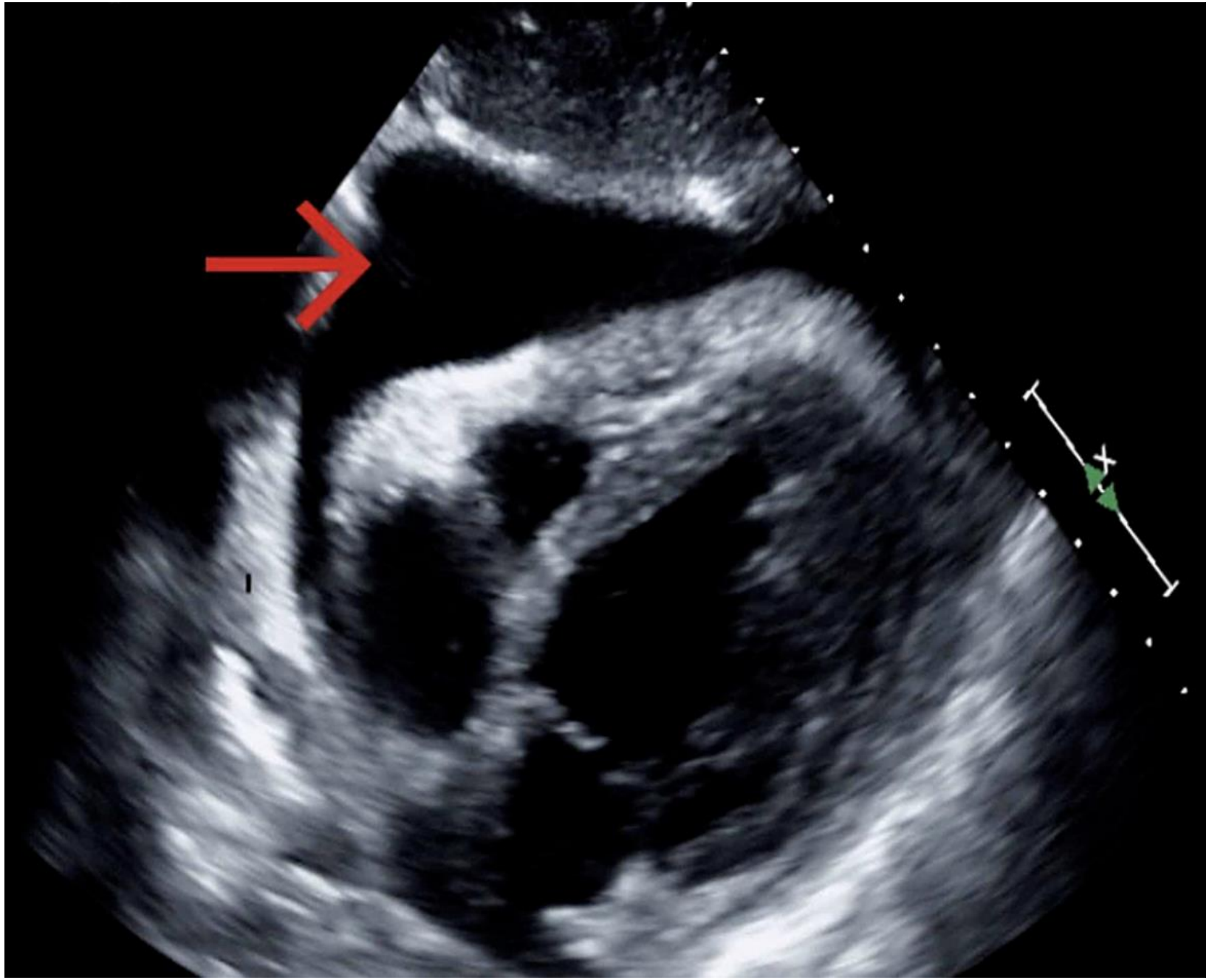


Image courtesy of
Dr. Nancy Sanders



Pericardial effusion

Septic shock & systemic inflammatory response syndrome (SIRS)

- Infection or systemic inflammation
- Inflammatory cytokines
- Tissue edema, effusions, secretions
- Hypovolemia
- Hypoglycemia
- Multiple organ dysfunction (MODS)

Crunch

-13-year-old m/c Labrador
-Vomiting
-Lethargic
-Hyporexic
-Not quite right for weeks to maybe months

Crunch physical examination

- TPR: 97 F/140/48
- Mm pale, CRT 3.5 seconds
- Severely dehydrated
- Painful abdomen
- Bloody diarrhea on rectal glove

ER Management

- IV fluids, pain meds
- Abdominal radiographs
- Systolic blood pressure: 85 mmHg
- CBC/chemistry/urinalysis
  - PCV/TP = 37%/5.6 g/dl
  - WBC and diff = NR
  - Platelets = 76,000/*u*L
  - BG = 75 mg/dL
  - BUN = 70mg/dL, creat = 1.8 mg/dL, SDMA 21 *u*g/dL
  - Albumin = 2.8 mg/dL
  - ALT = 960 U/L
  - T.bili = 1.9 mg/dL
  - UA: USG = 1.025, 2+ bilirubinuria, rest NR

Consider Catalyst® or SNAP® cPL™

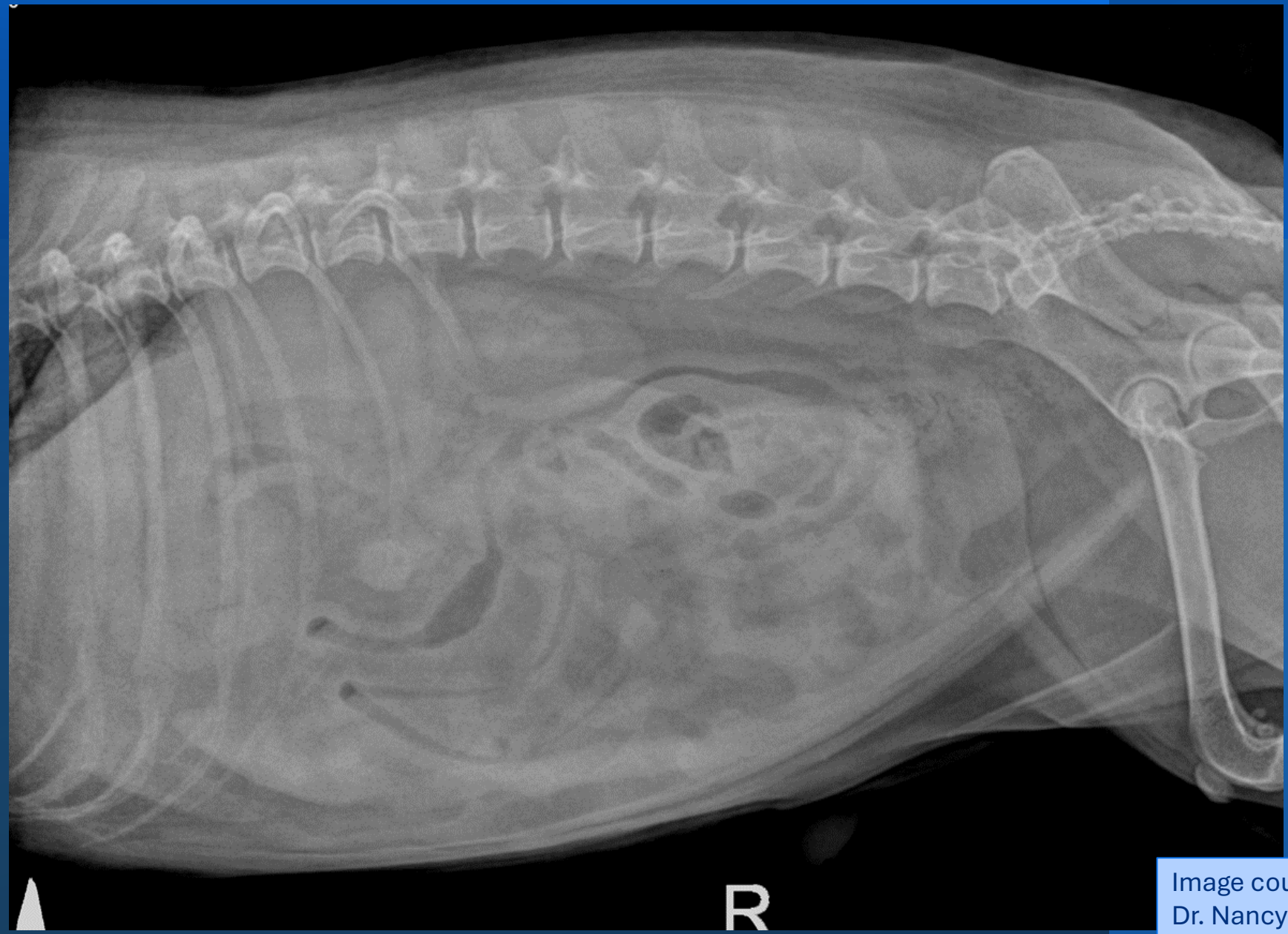


Image courtesy of
Dr. Nancy Sanders

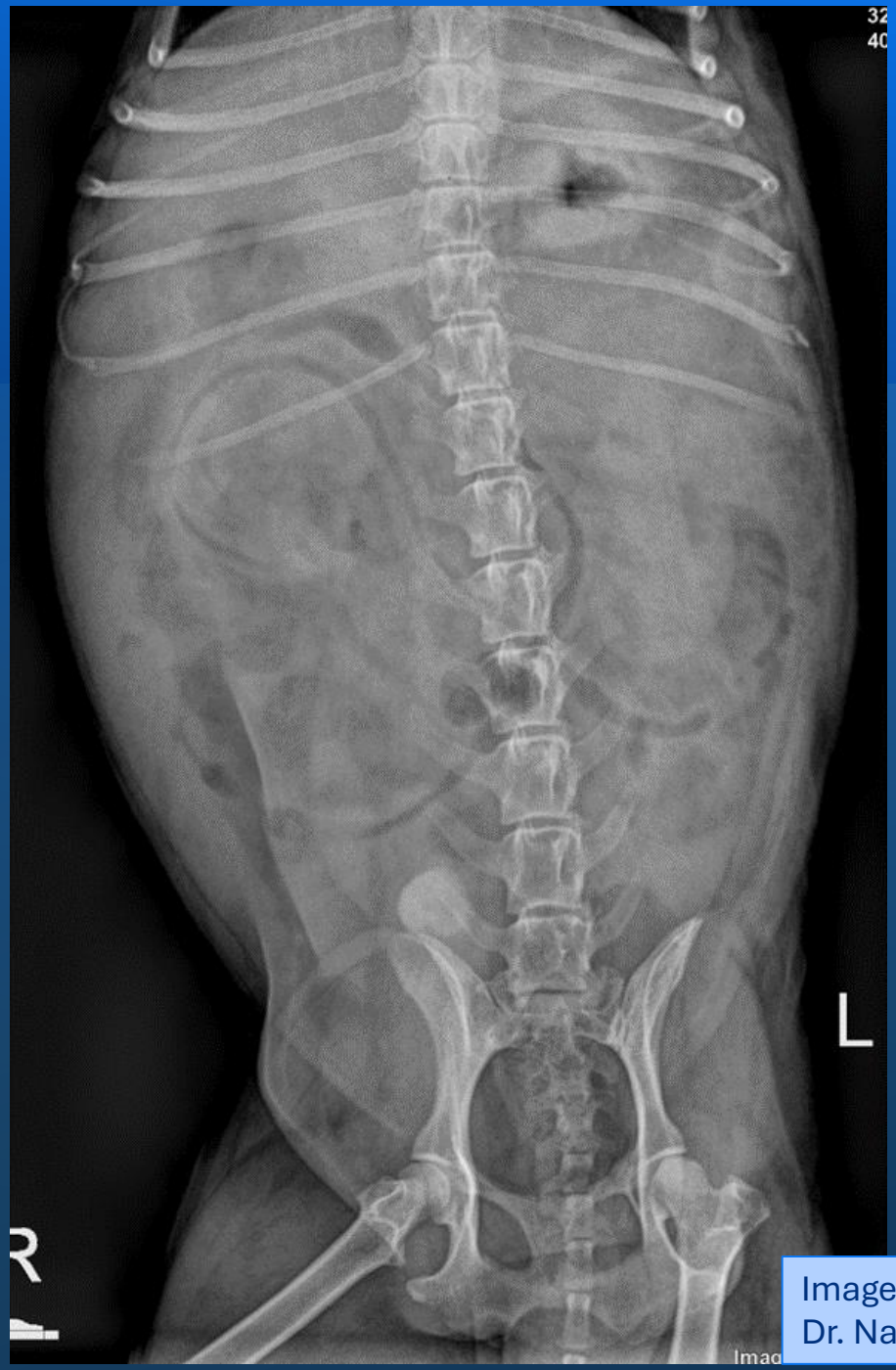
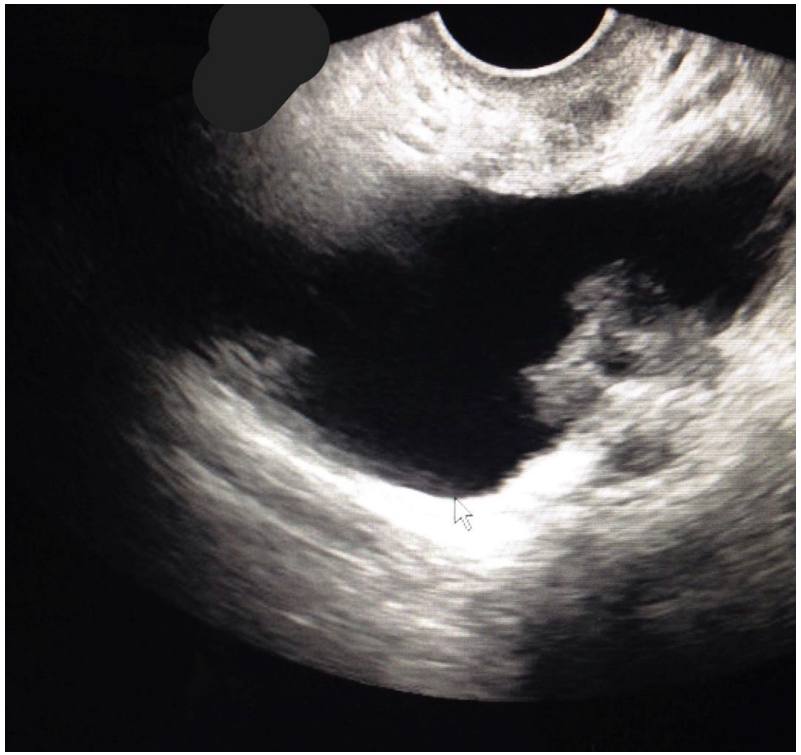
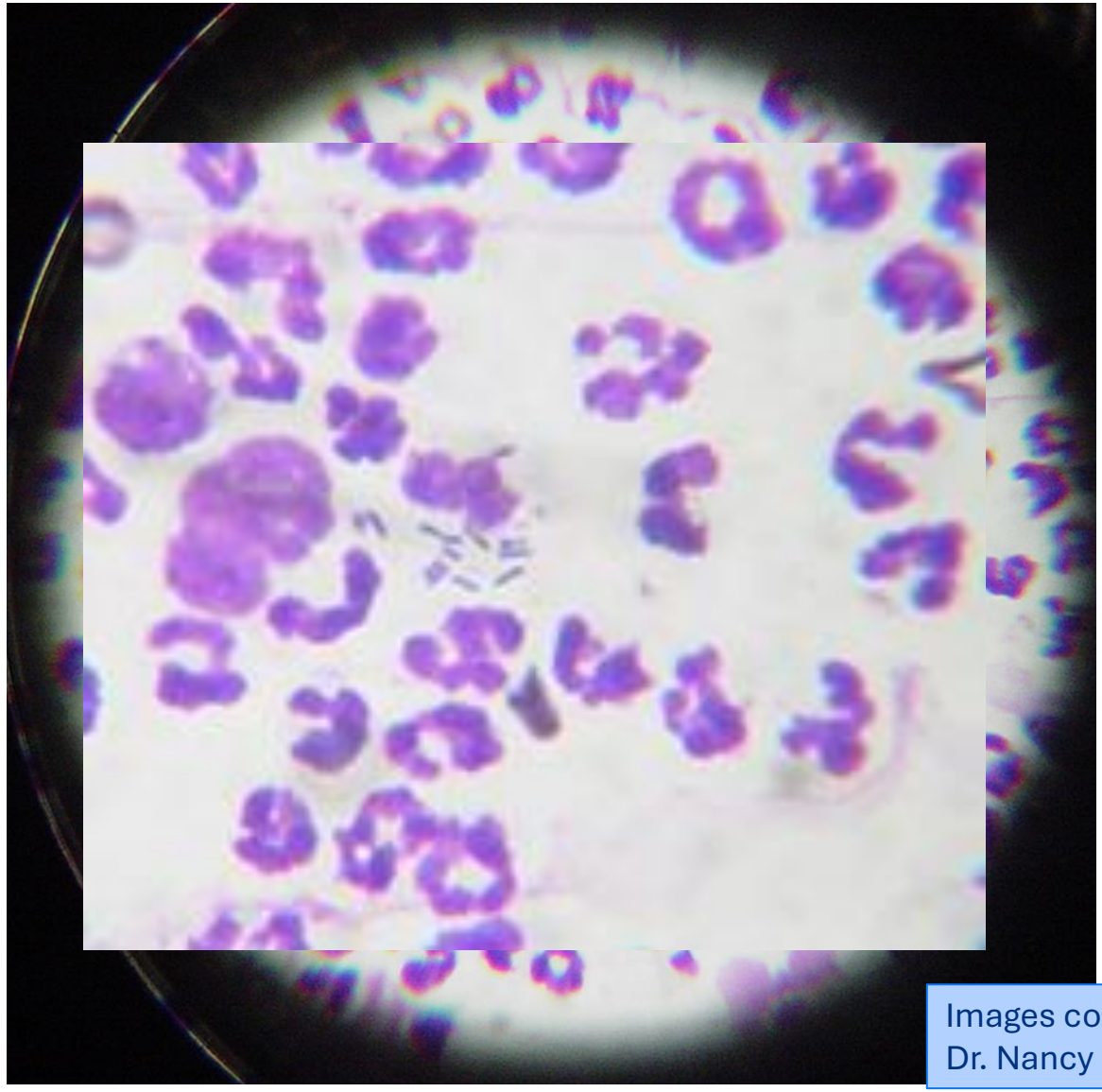


Image courtesy of
Dr. Nancy Sanders

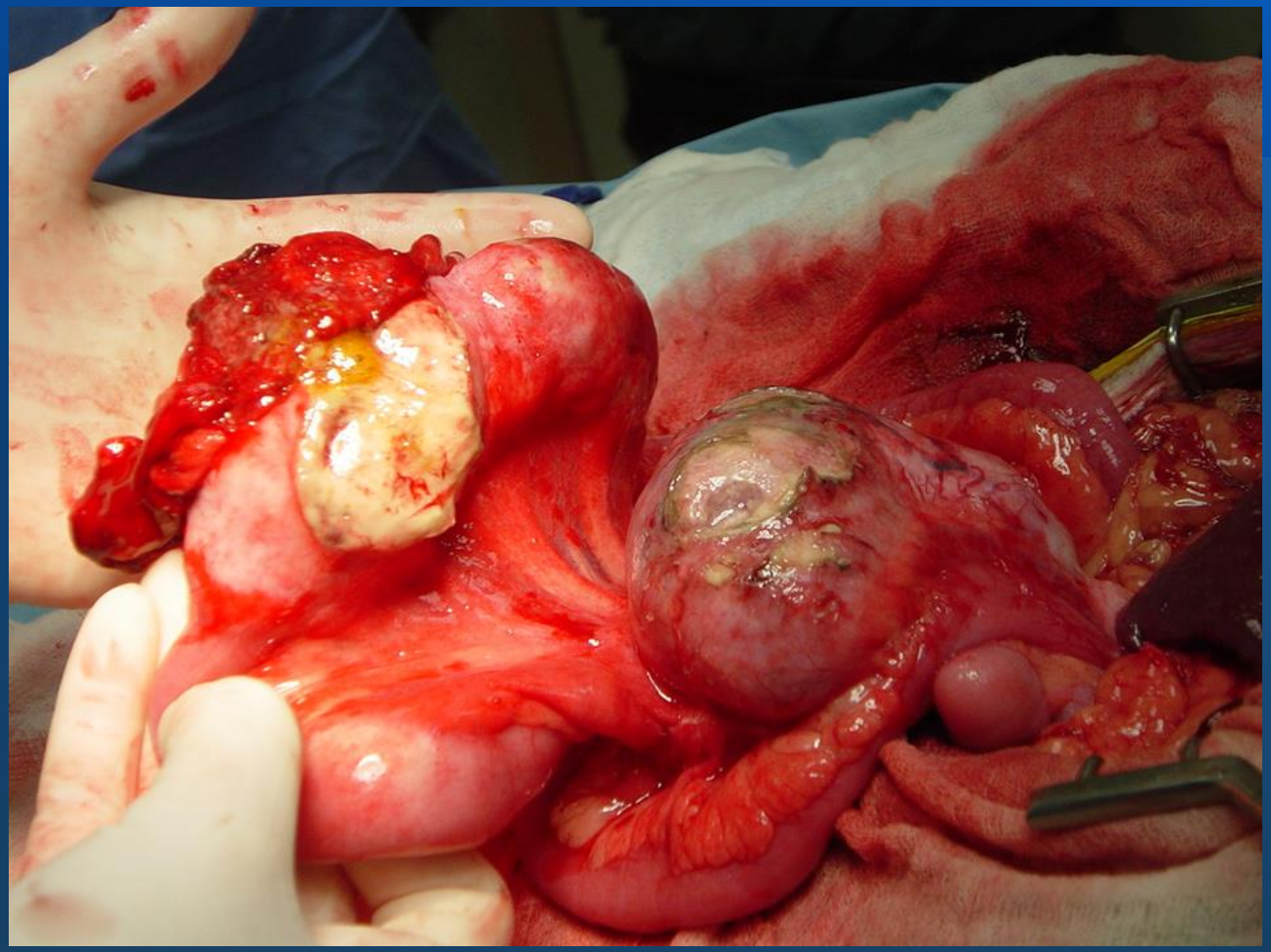
Decreased abdominal contrast = ?

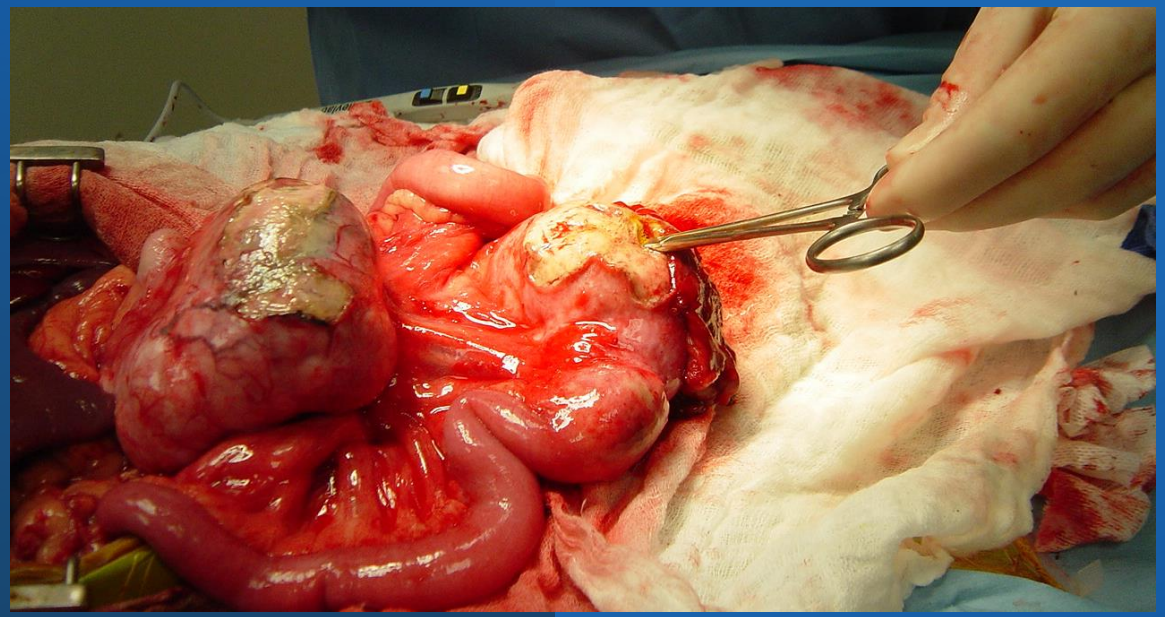
- AFAST:
- Abdominocentesis:





Images courtesy of Dr. Nancy Sanders





Images courtesy of
Dr. Nancy Sanders

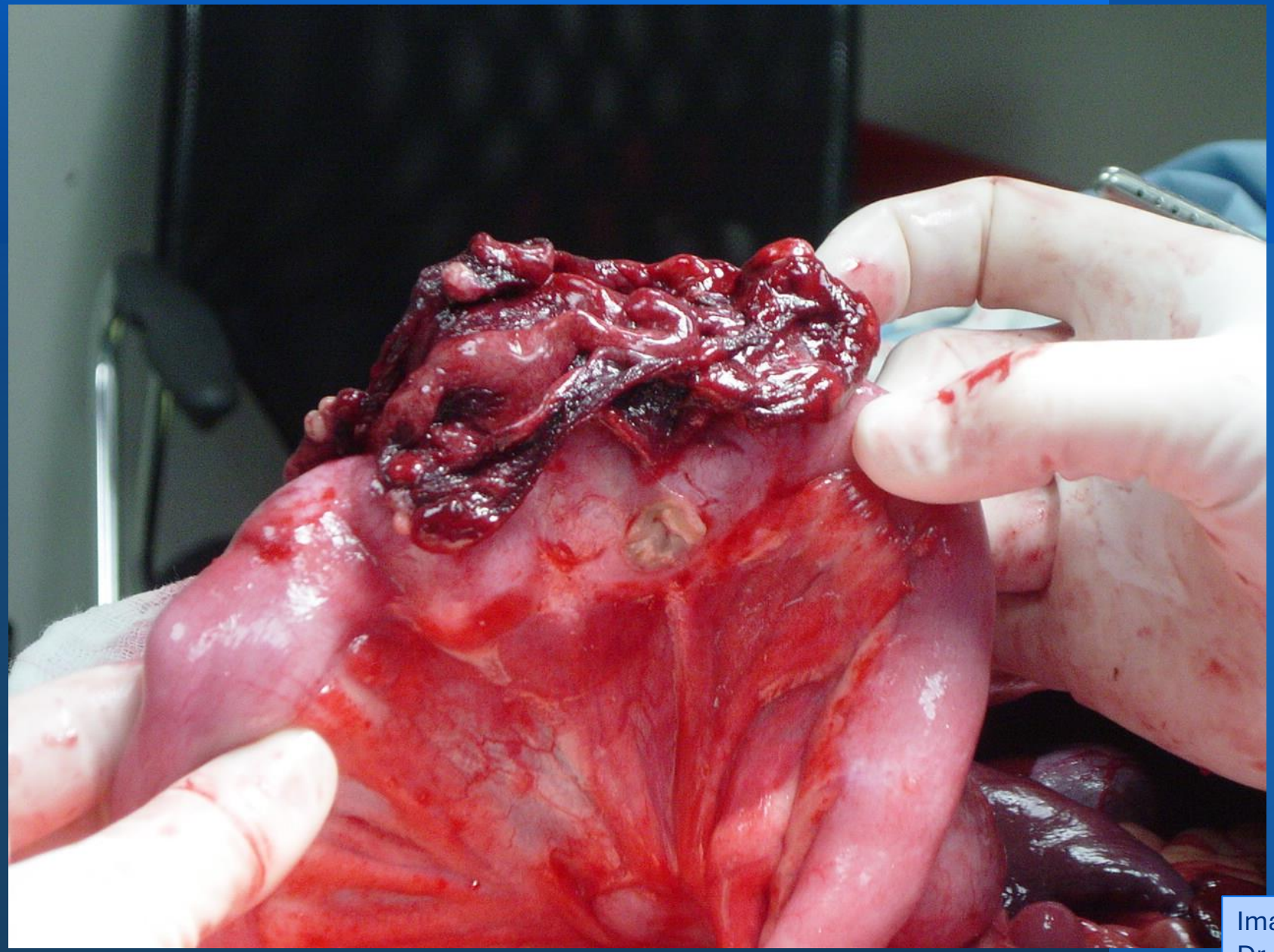


Image courtesy of
Dr. Nancy Sanders

Pulmonary hypertension

- Chronic lung disease or severe acute disease
  - Heart worm
  - PTE
  - Fibrosis
  - Chronic bronchitis
- Increased resistance in pulmonary arteries
- Right ventricular hypertrophy leads to dysfunction
- Decreased blood flow through the lungs > decreased oxygenation
- Decreased blood return to the left side of the heart
- Diagnosed via suspicion and echo
- Chest radiographs range from normal to extremely abnormal

My dog collapses and turns pale with minimal exertion

He coughs occasionally

“Gopher”

- 9 year-old male castrated Golden retriever
- PE: tachypneic, mild increase in bronchovesicular sounds, gums PALE white, pink up slightly in oxygen cage when calm, rest of PE unremarkable
- Pulse oximeter will not read
- CBC: mild neutrophilia, HCT = 58%, TP = 6.5 g/dL

Chronic lower airway disease

Take Home

- There are two major causes of pallor: anemia and poor perfusion. The subcategories are vast.
- Thorough history & PE, and simple PCV/TP can provide much insight to the pale patient
- Pallor can be an early marker of hemorrhage before anemia occurs
- Pallor is a clinical sign, not a diagnosis. There is no specific treatment for pallor.
- Don’t forget pulmonary hypertension

Questions?

Thank you!

nancy-sanders@idexx.com