
VMX
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VETERINARY MEETING & EXPO
Festival of the HeARTS
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“Test something, no, test EVERYTHING….STAT!”
Choosing and interpreting useful diagnostics in emergency patients

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VMX 2025 VETERINARY MEETING & EXPO

Conflict of Interest Disclosure:

Nancy Sanders is a full-time IDEXX employee

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.

Demonstrate prioritization of ER diagnostics by use of:

1. Assessment of patient status
2. Your raw talents
3. Determining patient and pet guardian needs
4. Your experiences
5. Case examples

Before we talk about which tests…

Let’s talk about when

Never delay necessary treatment to run diagnostics

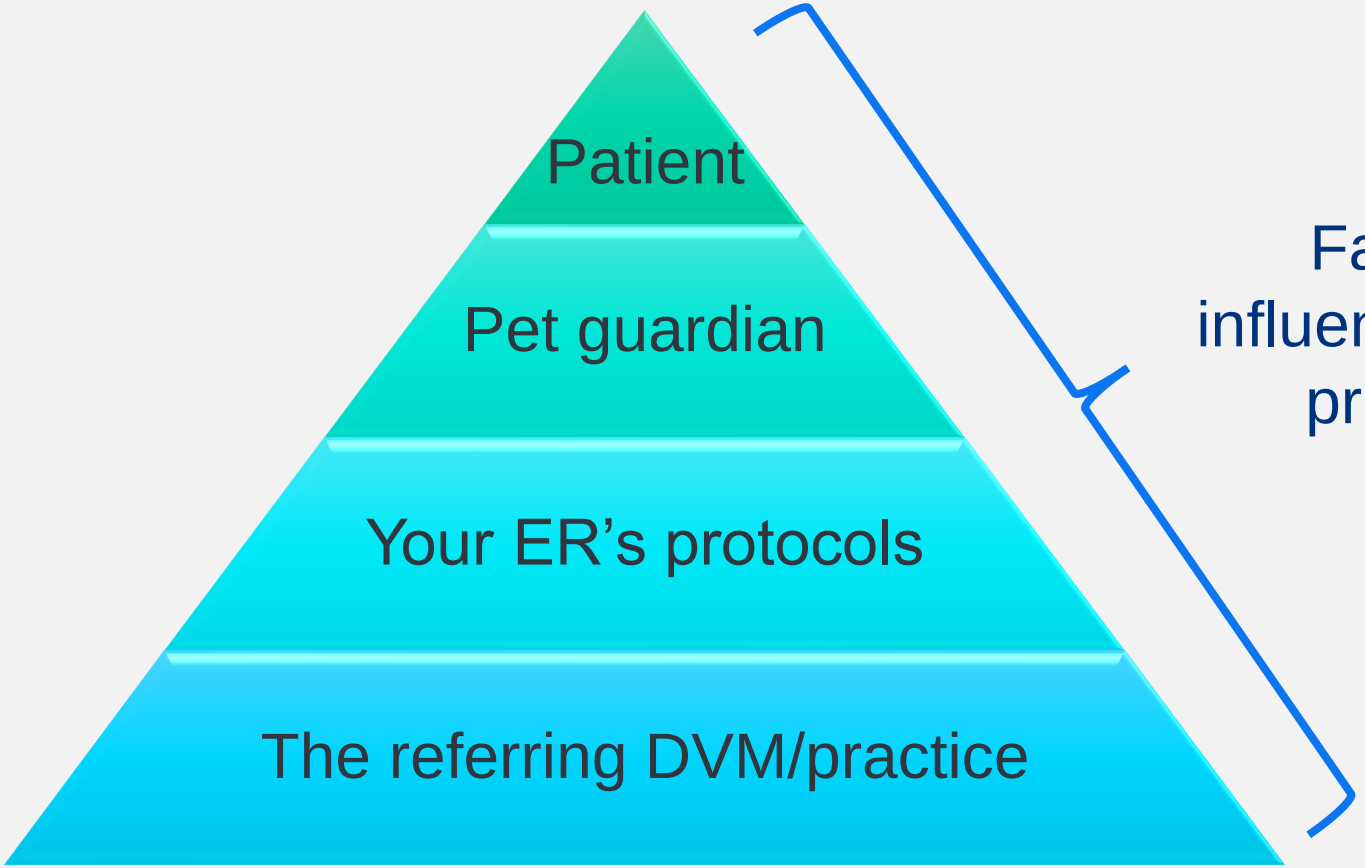
- Stabilize respiratory status
  - Ensure patent airway
  - Oxygen by least stressful method
  - Thoracocentesis
  - Sedation if indicated
- Support cardiovascular system
  - Intravenous or intraosseous fluids
  - Medications
  - Stop bleeding, blood products
  - Pericardiocentesis
- Cover pain, anxiety, stress
  - Narcotic analgesics
  - Acepromazine (low dose, cautious)

Airway

Breathing

Cardiovascular

Diagnostics for who?



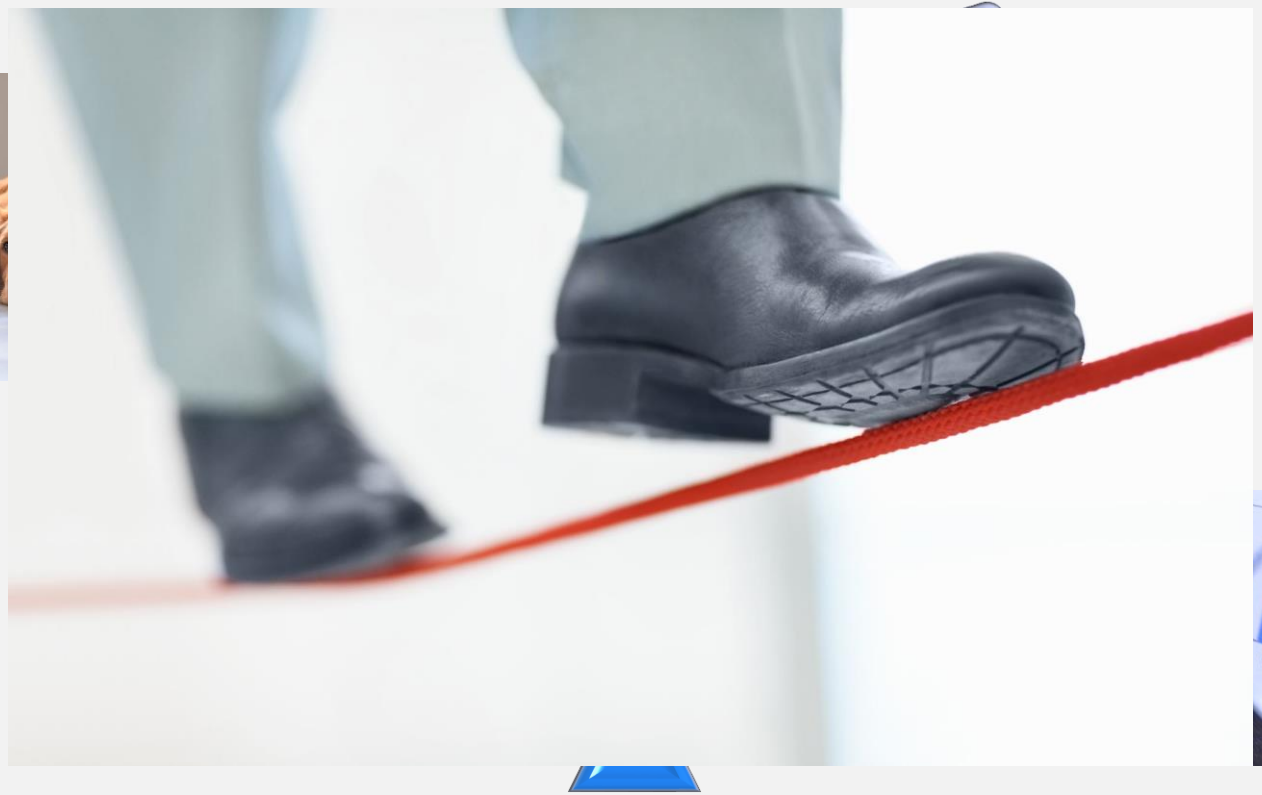
Factors that influence diagnostic prioritization

Define the purpose of your emergency room

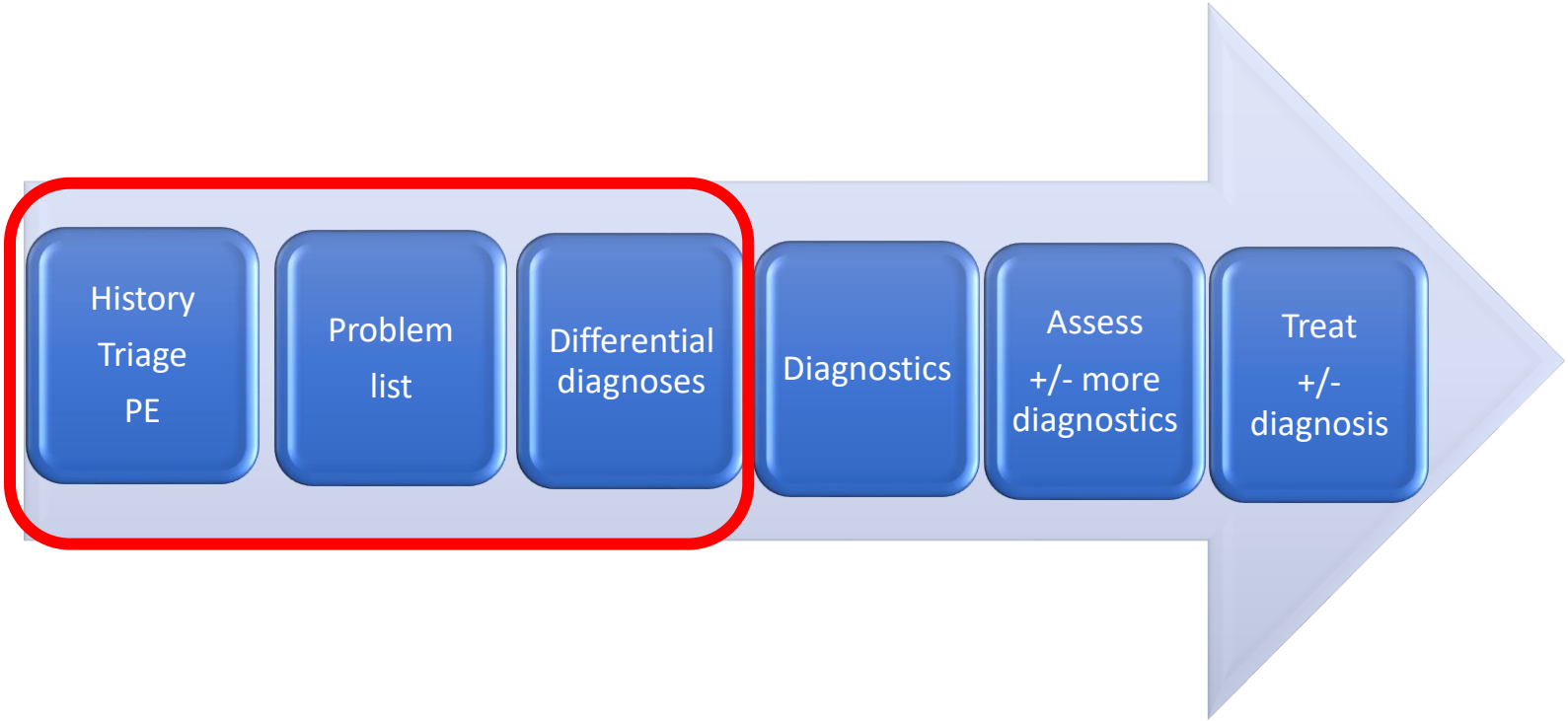
For example…

- Stabilize and send home or to referring vet
  - “Treat and street”
- Do everything
  - Full diagnosis
  - Primary vet
- Referred for specific diagnostic or overnight monitoring “only”
- Urgent vs. emergent care

The balancing act



Choosing diagnostics for the patient



What’s the client complaint?
What’s the patient’s main problem?
What’s the emergency?

FOCUS!!!

What constitutes an emergency (a.k.a. what kills rapidly?)

The BIG 3

Cardiovascular

- CHF
- Arrythmias
- Thromboembolism
- Hemorrhage
- Shock (any form)
- Hypotension
- Hypertension

Neurologic

- Seizures
- Trauma
- Stroke
- Increased intracranial pressure
- Hypertension
- Hypotension

Respiratory

- Hypoxia
  - Pulmonary infiltrates
  - Pleural space disorders
  - Thromboembolism
  - Severe hypoventilation
- Hypercapnia
  - Hypoventilation of any cause

Which diagnostics and when? (Examples only!)

Immediate – 1st tier

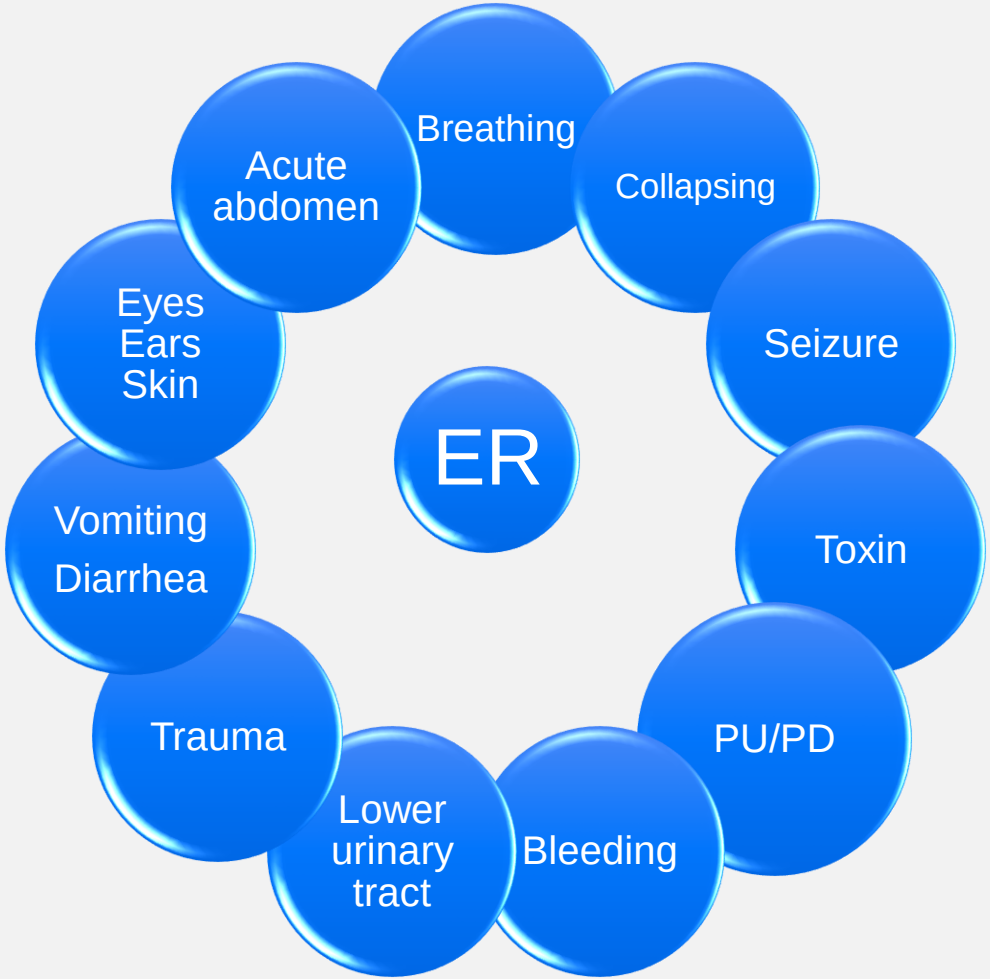
- Quick physical/ patient assessment
- PCV/TP
- Blood glucose (BG)
- Serum electrolytes
- ECG
- Systolic blood pressure (SBP)
- Pulse oximetry
- Point of care ultrasound (POCUS)

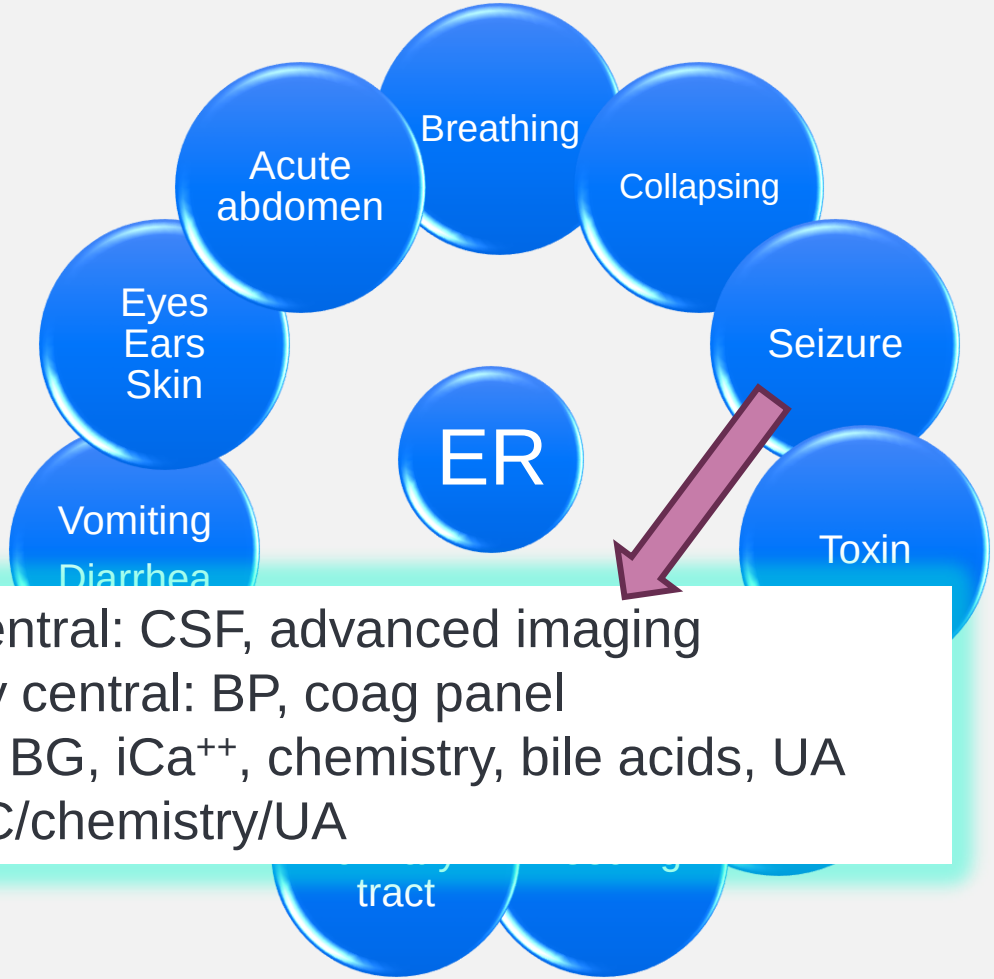
ASAP – 2nd tier

- CBC/chemistry/urinalysis
- Lactate
- Arterial or venous blood gas
- Coagulation profile
- SNAP® proBNP
- Imaging
- Fluid samples/analysis/cytology

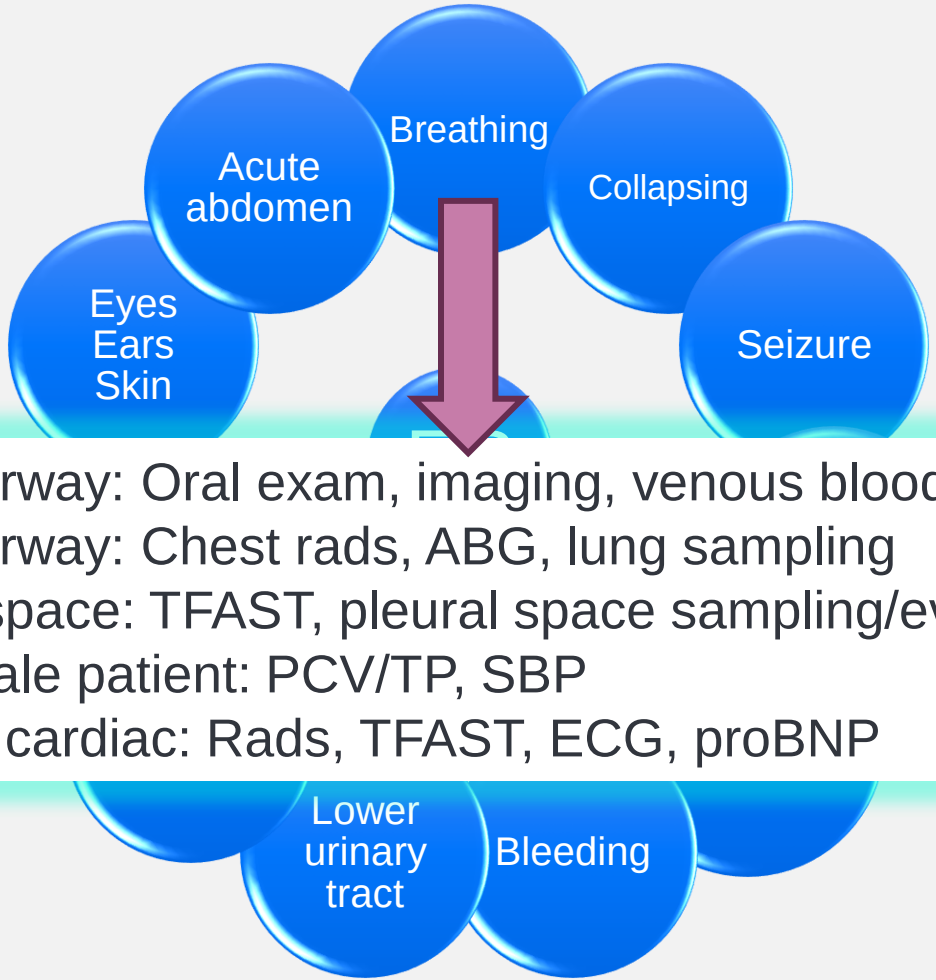
When appropriate - 3rd tier

- Quant PL/ Snap® cPL/fPL
- Infectious disease screening
- C-reactive protein
- Cystatin B
- Blood type/cross-match
- Blood smear
- Slide agglutination
- Serum cortisol
- Advanced imaging
- ProBNP

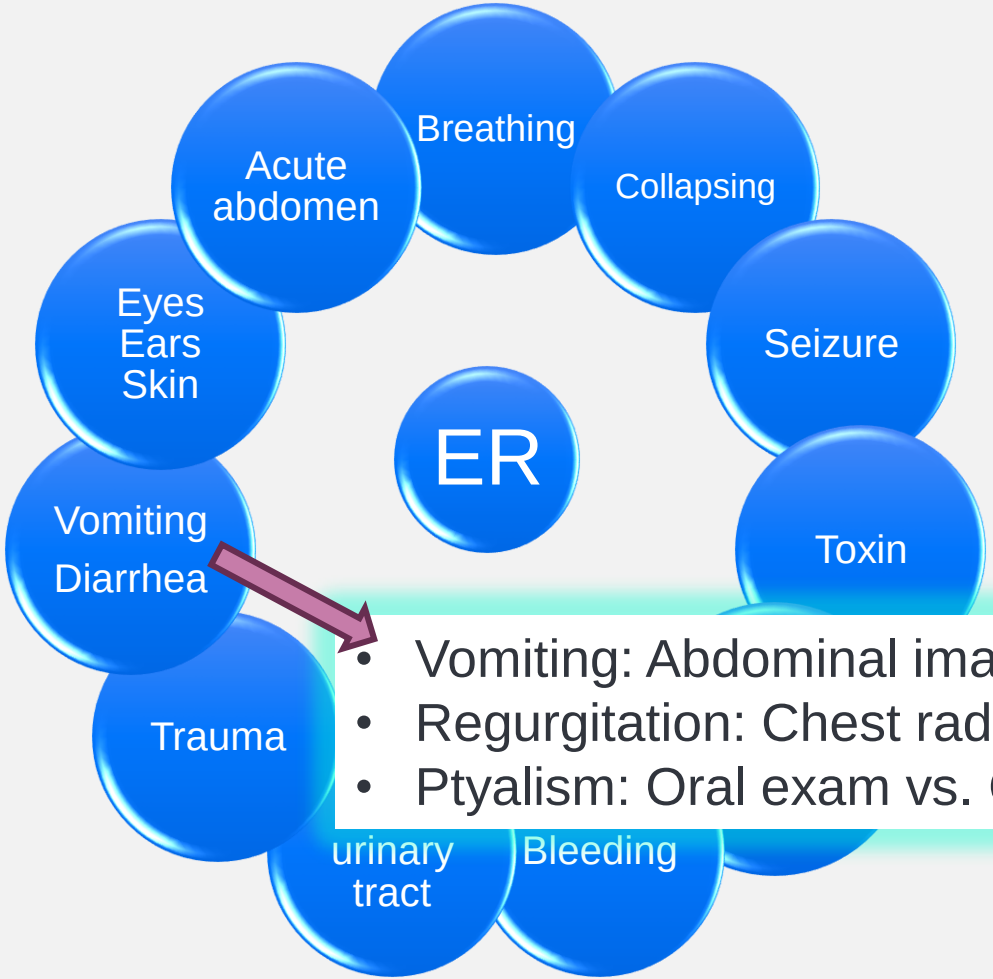


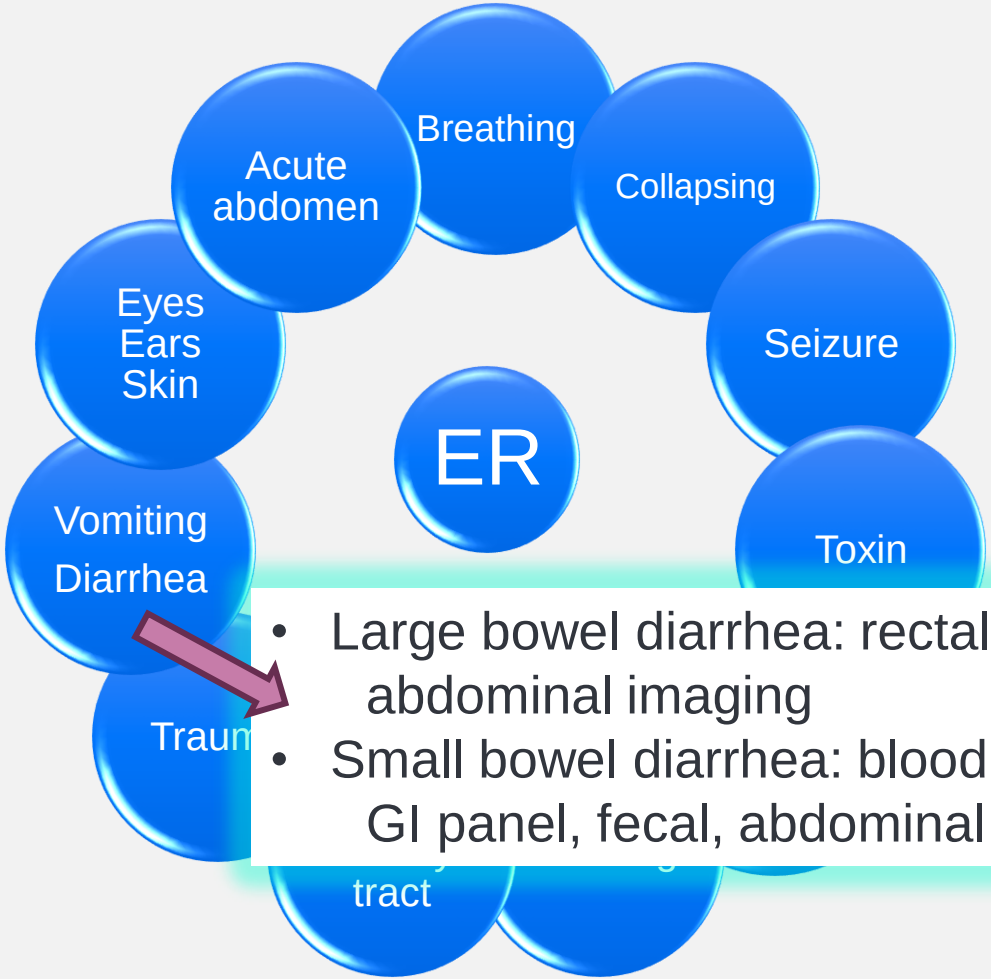


- Primary central: CSF, advanced imaging
- Secondary central: BP, coag panel
- Metabolic: BG, iCa^{++}, chemistry, bile acids, UA
- Toxic: CBC/chemistry/UA



- Upper airway: Oral exam, imaging, venous blood gas (VBG)
- Lower airway: Chest rads, ABG, lung sampling
- Pleural space: TFAST, pleural space sampling/evacuation
- Really pale patient: PCV/TP, SBP
- Suspect cardiac: Rads, TFAST, ECG, proBNP



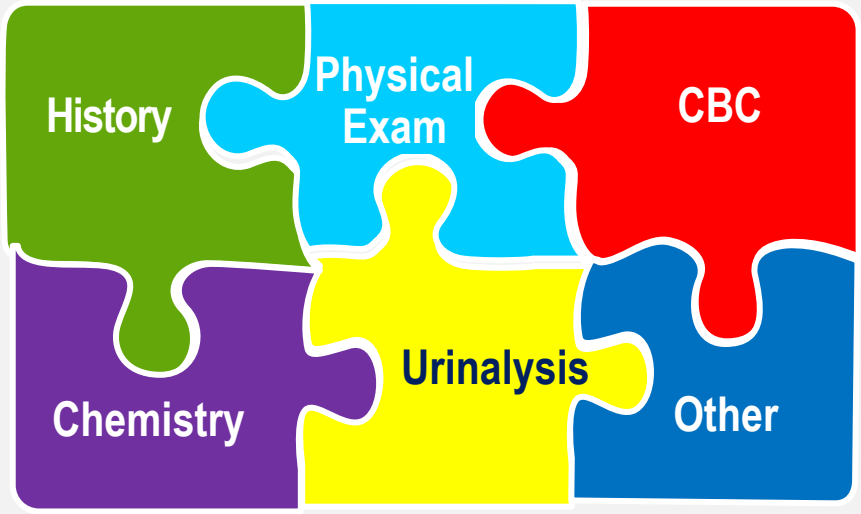


- Large bowel diarrhea: rectal, fecal, abdominal imaging
- Small bowel diarrhea: blood work including GI panel, fecal, abdominal imaging

When considering diagnostics, a little forward-thinking can go a LONG way

- What question(s) am I trying to answer?
- What do results of this test tell me?
- Will results of this test change what I do?
- What might happen to the patient if treatment is withheld?
- What might happen if treatment is administered without full investigation?
- How might current treatments interfere with future diagnostics?
- What future/additional samples might I need?
- If saving samples, how should they be stored?

General “minimum database”

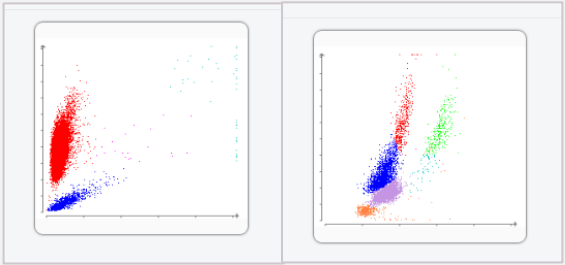


Hematology consists of 3 parts

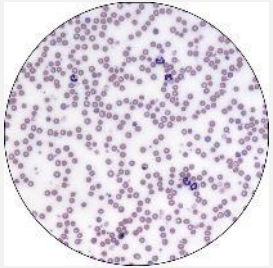
CBC

Hematology	5/13/20 11:25 AM	
Click to view Differentials		
RBC	6.33	6.54 - 12.20 M/µL
Hematocrit	29.2	30.3 - 52.3 %
Hemoglobin	9.7	9.8 - 16.2 g/dL
MCV	46.1	35.9 - 53.1 fL
MCH	15.3	11.8 - 17.3 pg
MCHC	33.2	28.1 - 35.8 g/dL
RDW	20.9	15.0 - 27.0 %
% Reticulocyte	0.1	%
Reticulocytes	5.7	3.0 - 50.0 K/µL
Reticulocyte Hemoglobin	15.2	13.2 - 20.8 pg
WBC	8.91	2.87 - 17.02 K/µL
% Neutrophils	56.9	%
% Lymphocytes	33.4	%
% Monocytes	5.6	%
% Eosinophils	3.4	%
% Basophils	0.7	%
Neutrophils	5.07	2.30 - 10.29 K/µL
Lymphocytes	2.98	0.92 - 6.88 K/µL
Monocytes	0.50	0.05 - 0.67 K/µL
Eosinophils	0.30	0.17 - 1.57 K/µL
Basophils	0.06	0.01 - 0.26 K/µL
Platelets	368	151 - 600 K/µL
MPV	16.7	11.4 - 21.6 fL
Plateletcrit	0.61	0.17 - 0.86 %

Dot plots/graphics



Blood smear



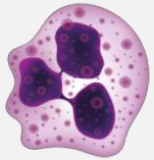
The three major sections of the CBC

Erythrogram

Hematocrit, RBC
- Anemia
- Erythrocytosis

Anemia Classification
- Reticulocytes
  - Regenerative
  - Non-regenerative

RBC Indices
- MCV
- RDW
- Retic-Hemoglobin

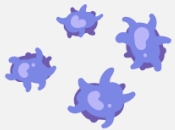


Leukogram

Total White Blood Count
- Cell Distribution

Cell Descriptions
- Left Shift
- Toxic Changes
- Precursor

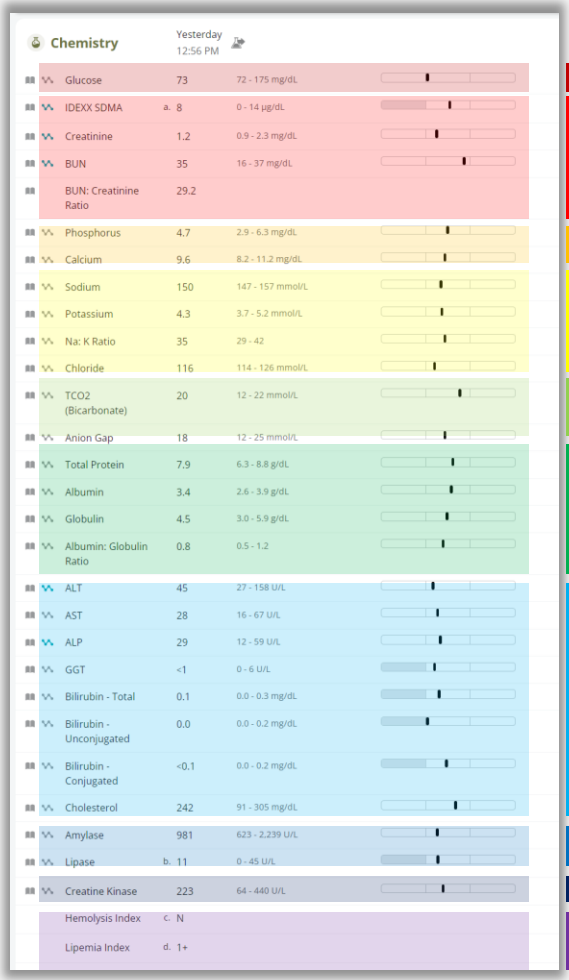
Thrombogram



Total Platelet Count
Plateletcrit
Platelet indices
- MPV

Morphology
- Megakaryocytes
- Clumping

How do I analyze the chemistry panel?



Chemistry		Yesterday 12:56 PM	
Glucose		73	72 - 175 mg/dL
IDEXX SDMA	a.	8	0 - 14 µg/dL
Creatinine		1.2	0.9 - 2.3 mg/dL
BUN		35	16 - 37 mg/dL
BUN: Creatinine Ratio		29.2	
Phosphorus		4.7	2.9 - 6.3 mg/dL
Calcium		9.6	8.2 - 11.2 mg/dL
Sodium		150	147 - 157 mmol/L
Potassium		4.3	3.7 - 5.2 mmol/L
Na: K Ratio		35	29 - 42
Chloride		116	114 - 126 mmol/L
TCO2 (Bicarbonate)		20	12 - 22 mmol/L
Anion Gap		18	12 - 25 mmol/L
Total Protein		7.9	6.3 - 8.8 g/dL
Albumin		3.4	2.6 - 3.9 g/dL
Globulin		4.5	3.0 - 5.9 g/dL
Albumin: Globulin Ratio		0.8	0.5 - 1.2
ALT		45	27 - 158 U/L
AST		28	16 - 67 U/L
ALP		29	12 - 59 U/L
GGT		<1	0 - 6 U/L
Bilirubin - Total		0.1	0.0 - 0.3 mg/dL
Bilirubin - Unconjugated		0.0	0.0 - 0.2 mg/dL
Bilirubin - Conjugated		<0.1	0.0 - 0.2 mg/dL
Cholesterol		242	91 - 305 mg/dL
Amylase		981	623 - 2,239 U/L
Lipase	b.	11	0 - 45 U/L
Creatine Kinase		223	64 - 440 U/L
Hemolysis Index	c.	N	
Lipemia Index	d.	1+	

Metabolism, endocrine

Kidney

Mineral/Bone

Electrolytes

Acid-base

Proteins

Hepatobiliary

Pancreas, GI

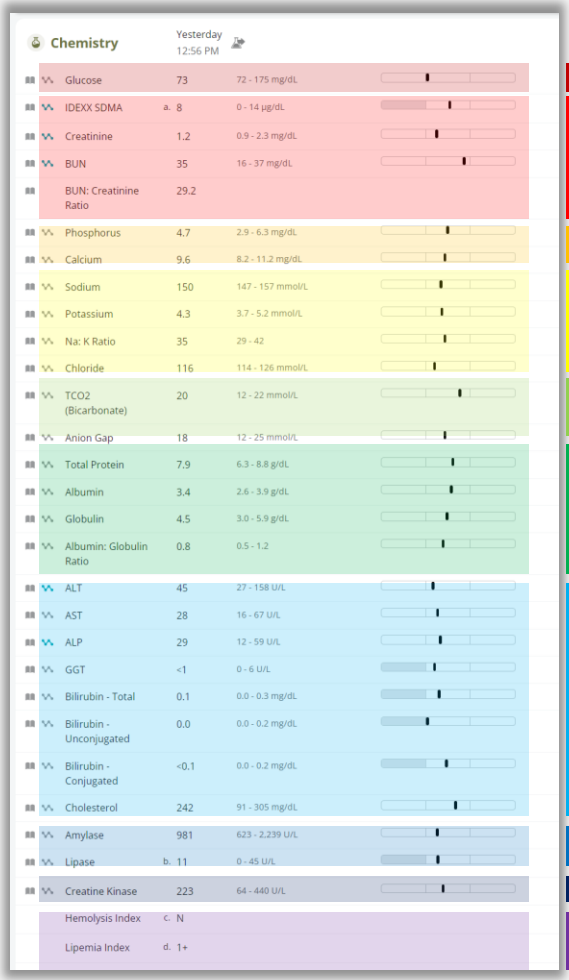
Muscle

Sample Quality

Grouped per basic categories

IDEXX

Kidney assessment is complex and is a combination of categories



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Metabolism

Kidney

Mineral/Bone

Electrolytes

Acid-base

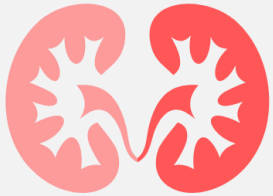
Proteins

Hepatobiliary

Pancreas, GI

Muscle

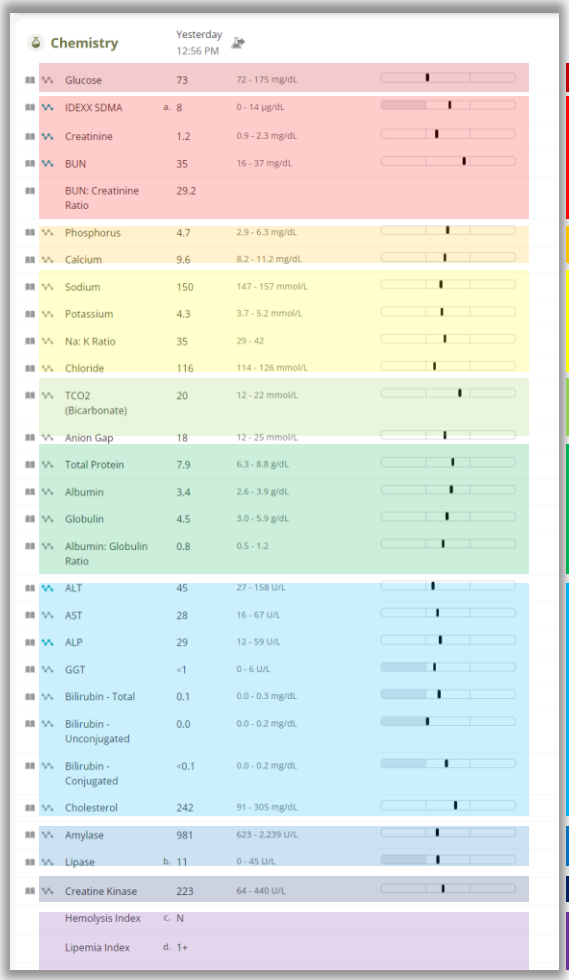
Sample Quality



Kidney Disease

- Glucose
- Kidney
- Mineral
- Electrolytes
- Acid-base
- Proteins
- Cholesterol

Liver assessment is complex and a combination of categories



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Kidney

Mineral/Bone

Electrolytes

Acid-base

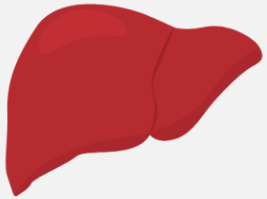
Proteins

Hepatobiliary

Pancreas, GI

Muscle

Sample Quality



Liver Disease

Glucose

Kidney

Electrolytes

Proteins

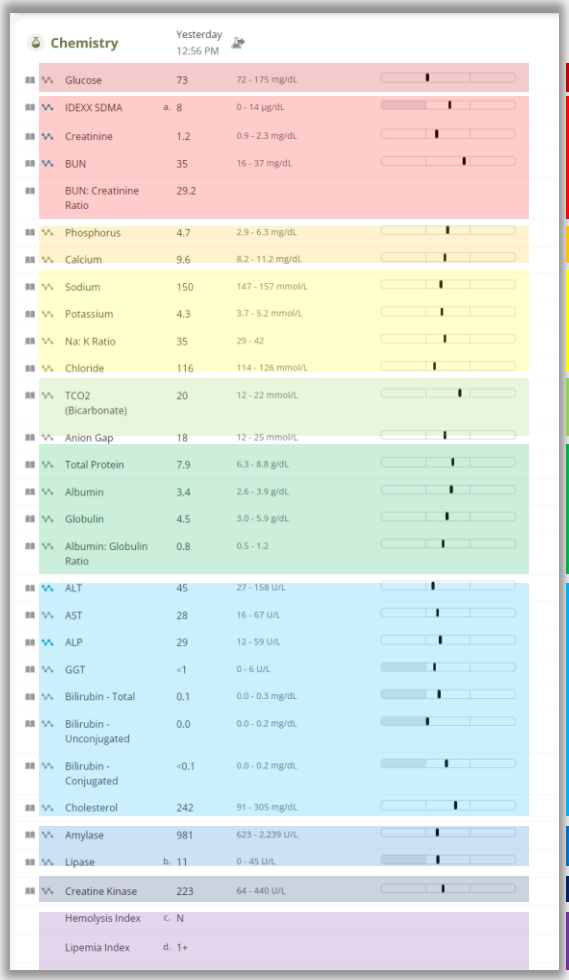
Hepatobiliary

Pancreas, GI

Sample quality

IDEXX

GI assessment is complex and often a combination of categories



Metabolism

Kidney

Mineral/Bone

Electrolytes

Acid-base

Proteins

Hepatobiliary

Pancreas, GI

Muscle

Sample Quality

GI & Pancreatic Disease

Glucose

Kidney

Mineral/Bone

Electrolytes

Acid-base

Proteins

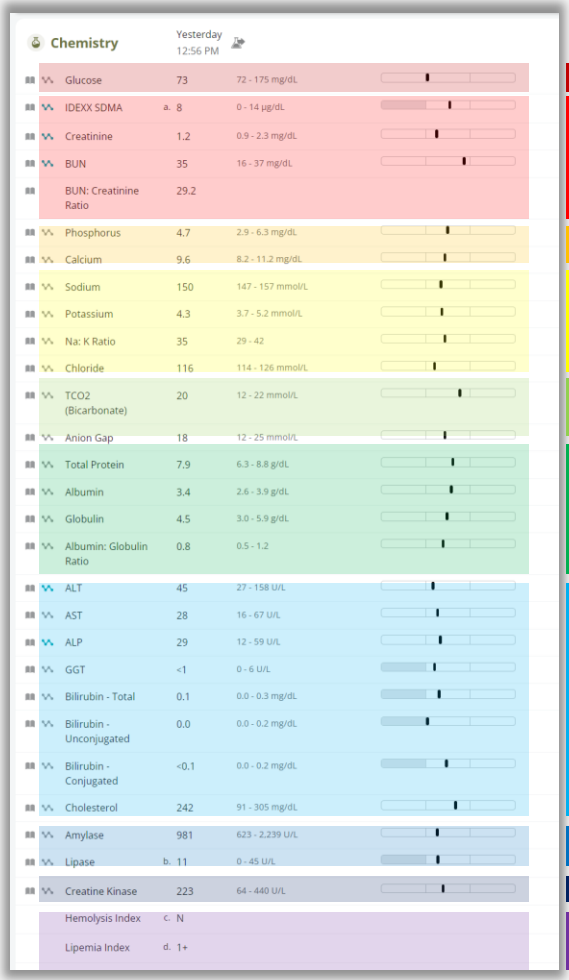
Hepatobiliary

Pancreas, GI

Sample quality

IDEXX

Endocrine assessment is complex and often a combination of categories



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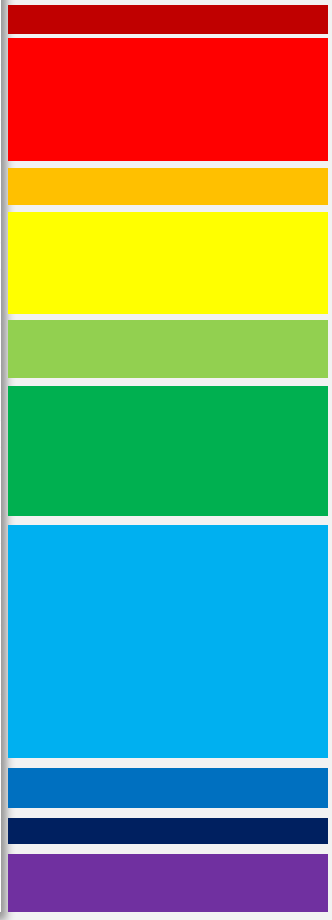
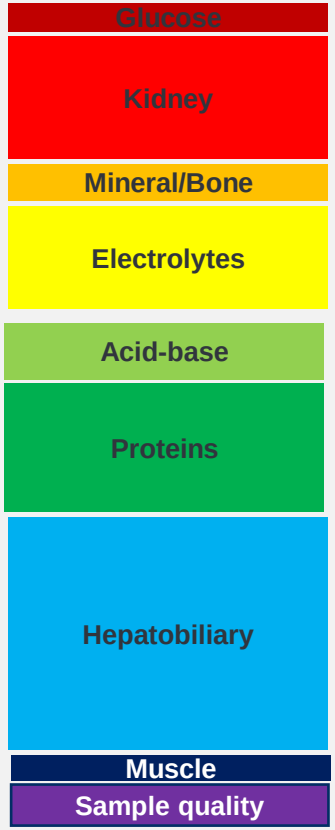


Endocrine Disease



IDEXX

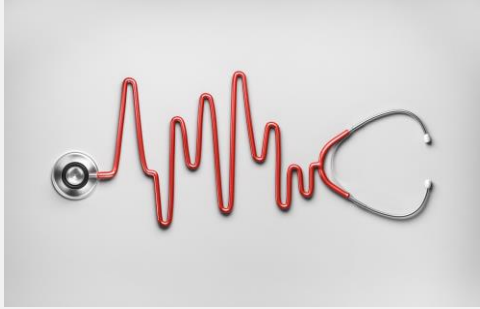

Cases!!!

My pet collapsed.

Jasper

- 15-year-old MC mixed-breed dog
- Collapsed this am
- Similar episode a few weeks ago, spontaneously resolved

Triage



- Quick PE
  - TPR = 99 F, 160 bpm, 60 bpm
  - Sternal recumbency, QAR, mentally appropriate
  - Pale, moist MM, bounding pulses
  - 2/6 systolic heart murmur, normal lung auscultation
  - Questionable abdominal fluid wave
- Quick Assessment
  - Tachycardic, tachypneic
  - Shocky, unstable
  - Ddx include: anemia, hemorrhage/hemoabdomen

What diagnostics?

- FIRST STABILIZE!!!
  - Fluids/volume replacement
  - Blood transfusion

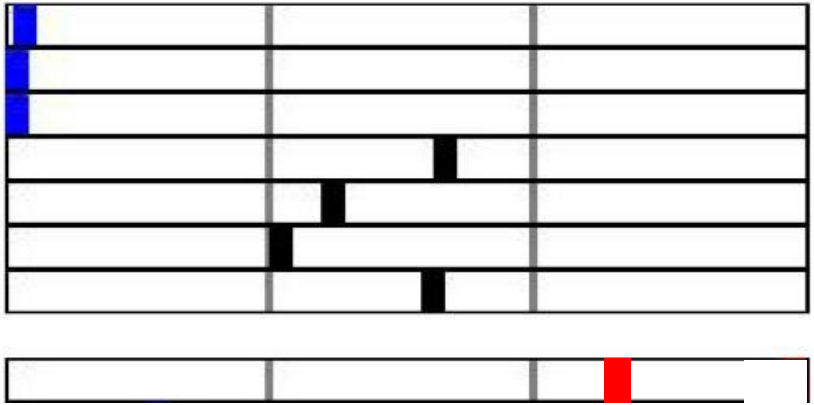
- 1st tier diagnostics: PCV/TP, SBP, AFAST vs. abdominal rads (vs. blind abdominocentesis)

- 2nd tier diagnostics:
- 3rd tier diagnostics:

Regenerative anemia…

(Note normal RBC indices)

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	
%RETIC	18.2 %		
RETIC	**153.7** K/µL	10.0 - 110.0	HIGH



PCV 19%/TS 5.2

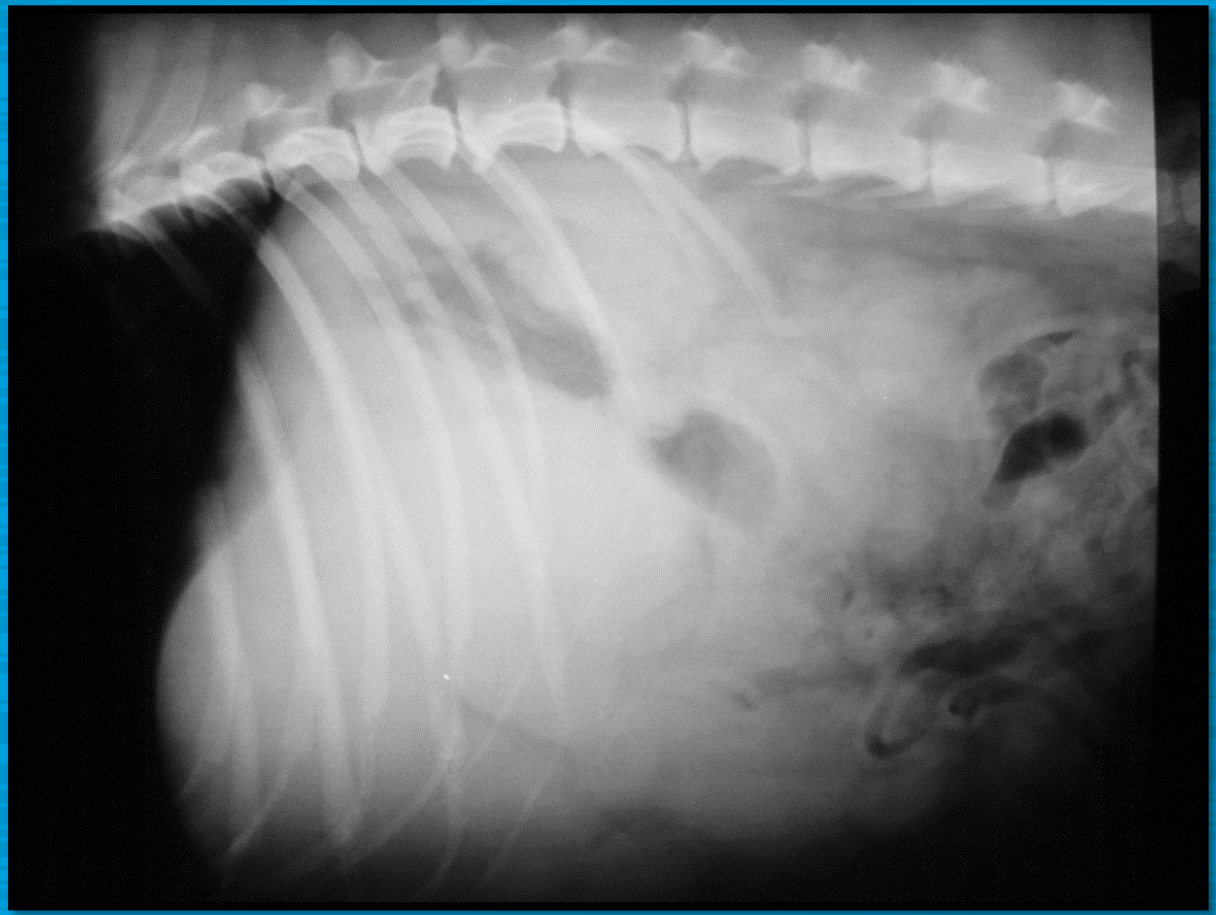
Focus

- What's the client complaint? Collapsing
- What's the main problem? Profound anemia, regenerative; hypoproteinemia
- What's the emergency? Anemia, hypovolemia, hypovolemic shock, possible surgical emergency
- Do these all fit together; are we addressing all concerns?

- What now?
  - Treat shock and anemia: transfusion and fluid therapy

What now (continued)?

- 2nd tier diagnostics: determine cause of regenerative anemia> hemorrhage or hemolysis; assess any consequences of shock (CBC, chemistry, UA, lactate, cystatin B)
- 3rd tier diagnostics: If hemorrhage, determine surgical vs. non-surgical (imaging), coags
- Assess response to ER treatment
- IF surgical case, determine if surgery an option: serial SBP/PCV/TP/lactate, ECG, thoracic radiographs/met check

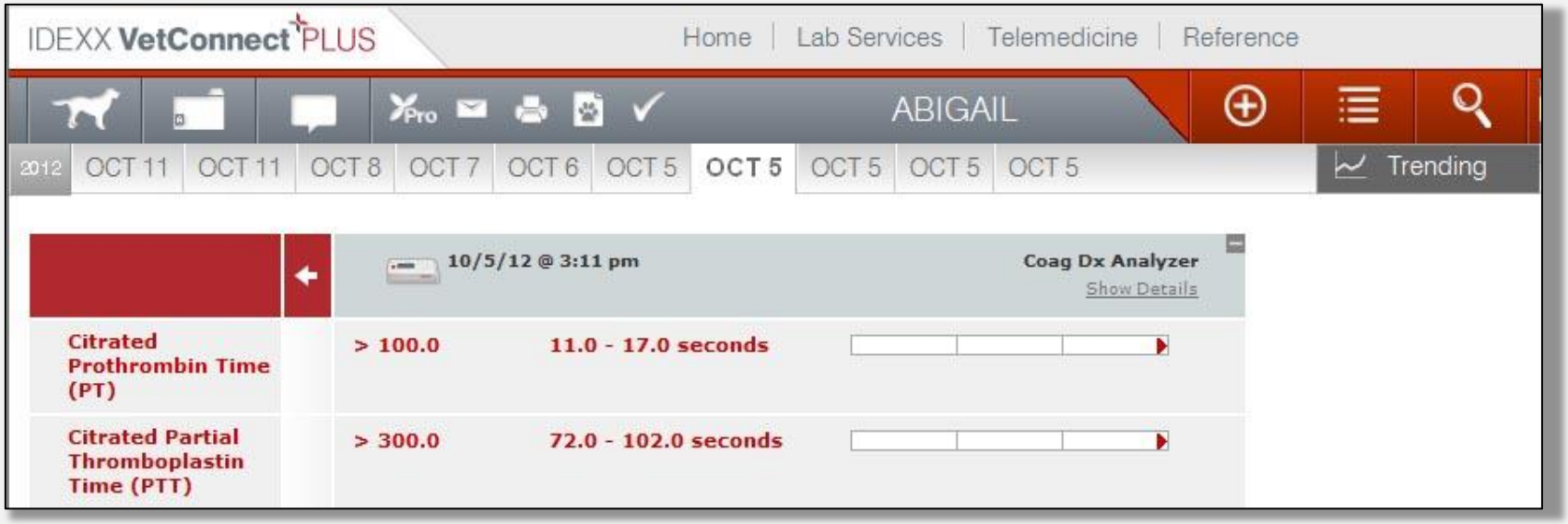


Next diagnostic steps

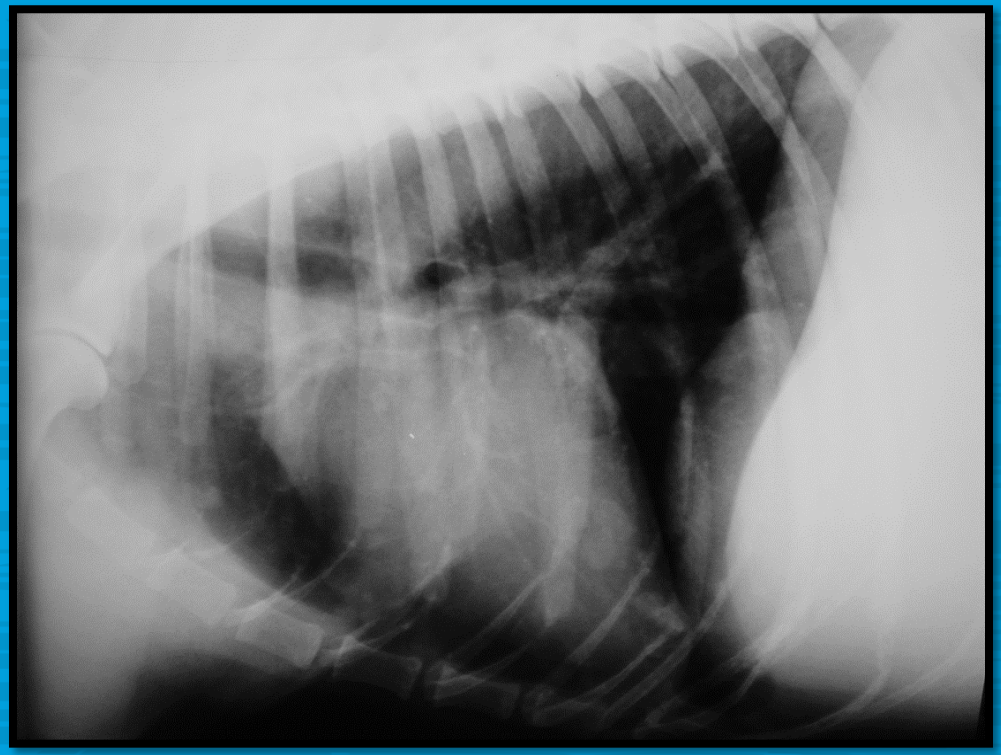
+ Additional imaging vs. blind abdominocentesis
+ Fluid analysis: PCV/TP, see if clots, +/- cytology or other diagnostics

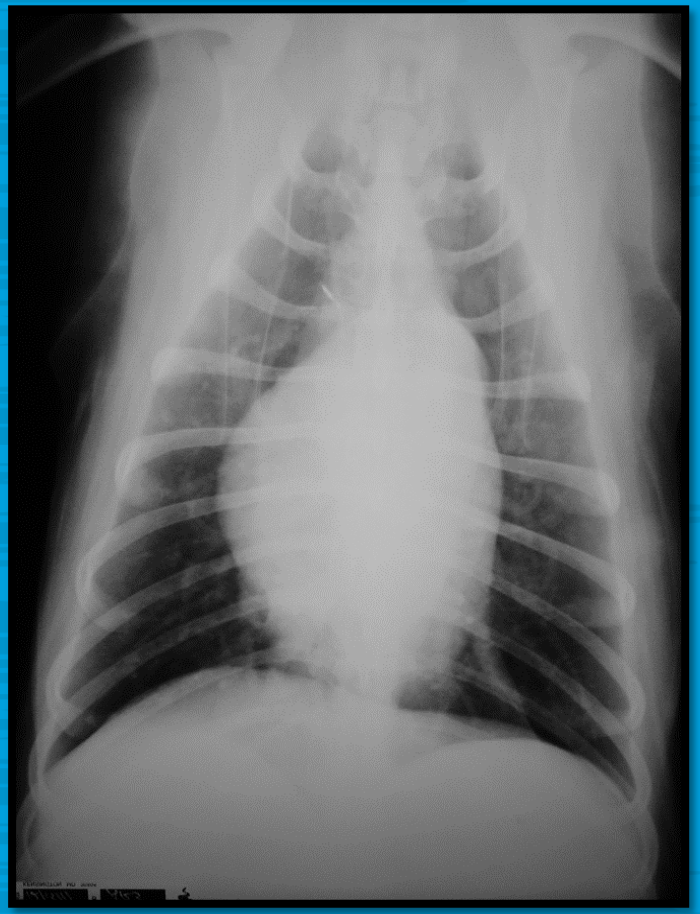
Abd. fluid
PCV 29%/TS 4.7
Does not clot

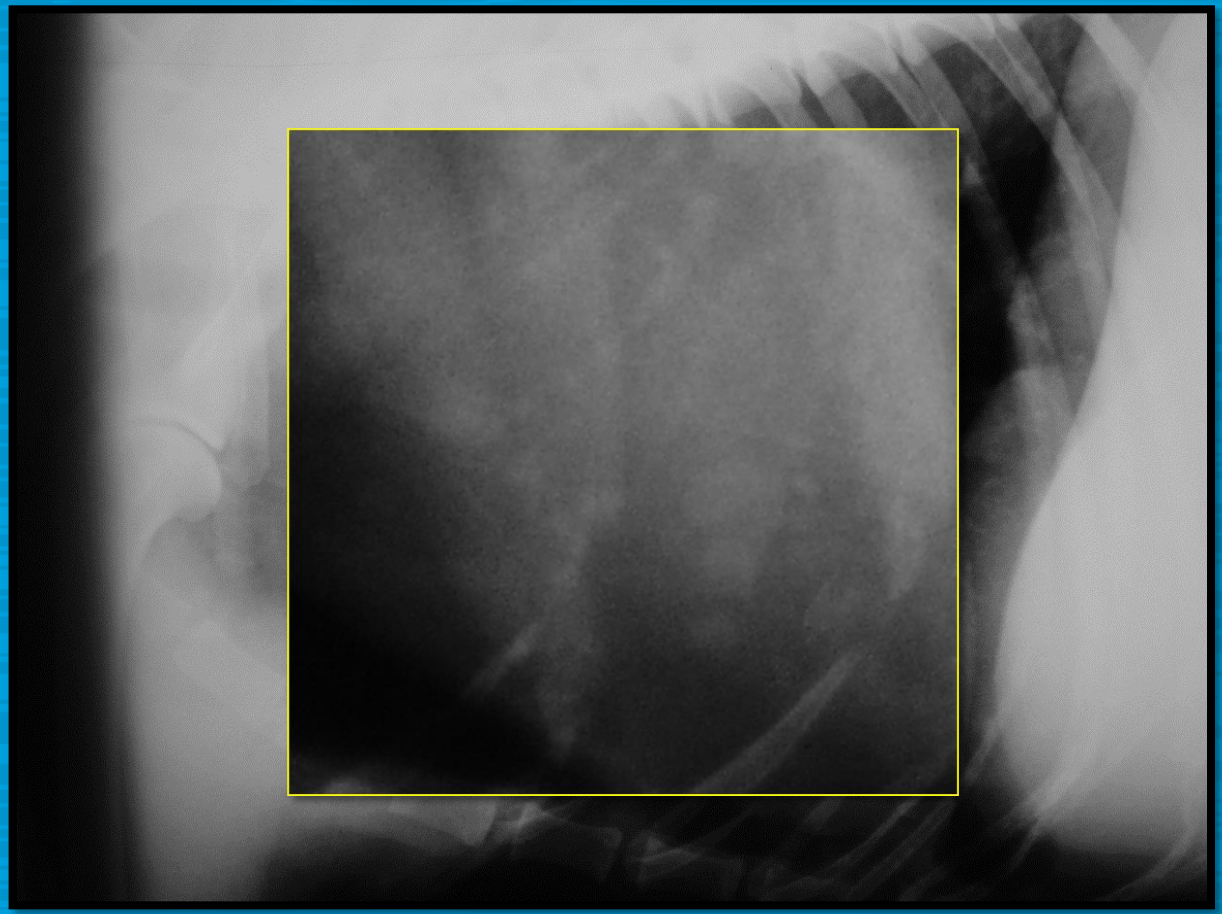
Not all causes of hemorrhage are surgical…



Don’t forget your coags!

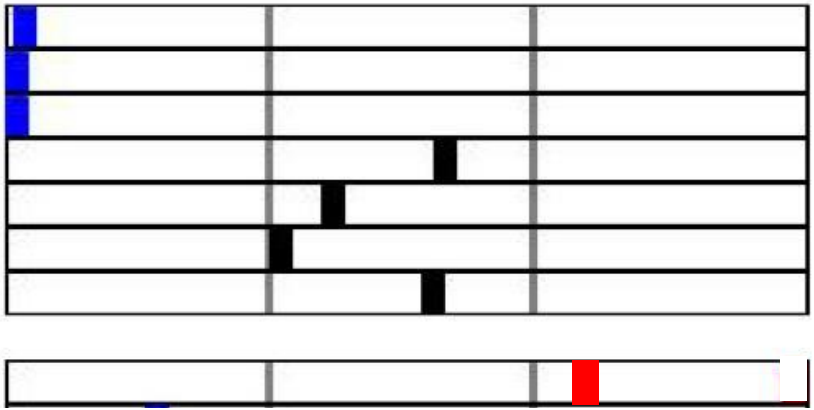






What IF…

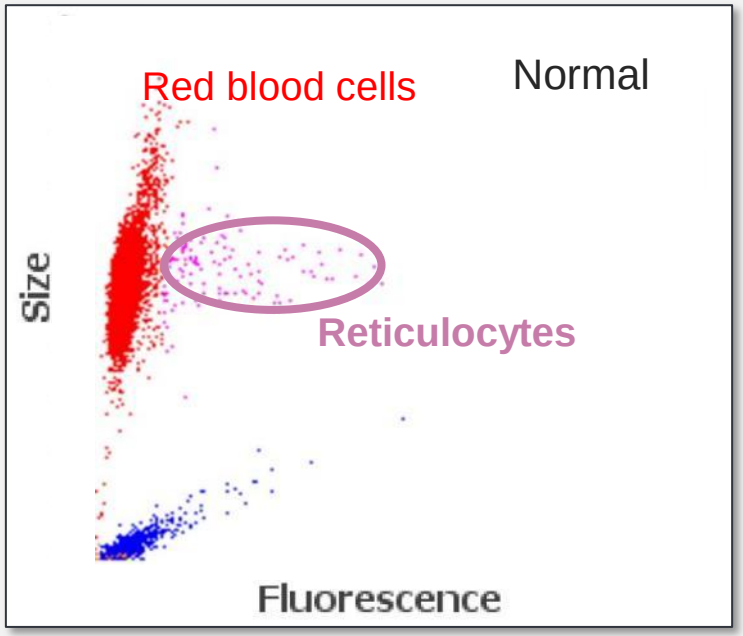
Test	Results	Reference Interval	LOW / NORMAL / HIGH
ProCyte Dx (May 13, 2019 2:41 AM)			
RBC	2.28 M/µL	5.65 - 8.87	LOW
HCT	15.9 %	37.3 - 61.7	LOW
HGB	5.1 g/dL	13.1 - 20.5	LOW
MCV	69.7 fL	61.6 - 73.5	
MCH	22.4 pg	21.2 - 25.9	
MCHC	32.1 g/dL	32.0 - 37.9	
RDW	18.7 %	13.6 - 21.7	
%RETIC	18.2 %		
RETIC	**153.7** K/µL	10.0 - 110.0	HIGH

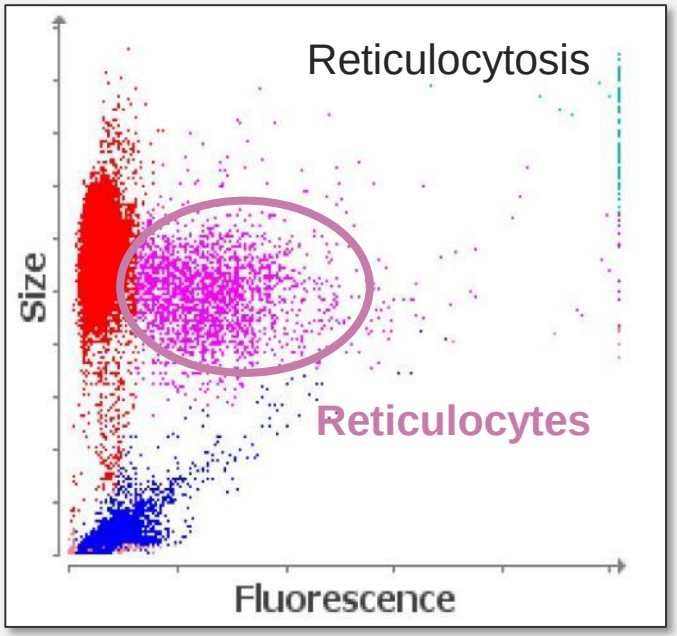


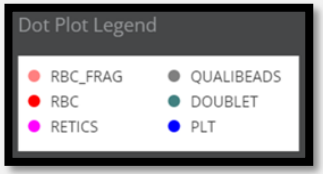
PCV 19%/TS 8.2

IDEXX

Reticulocytosis:
From where can we get more information?

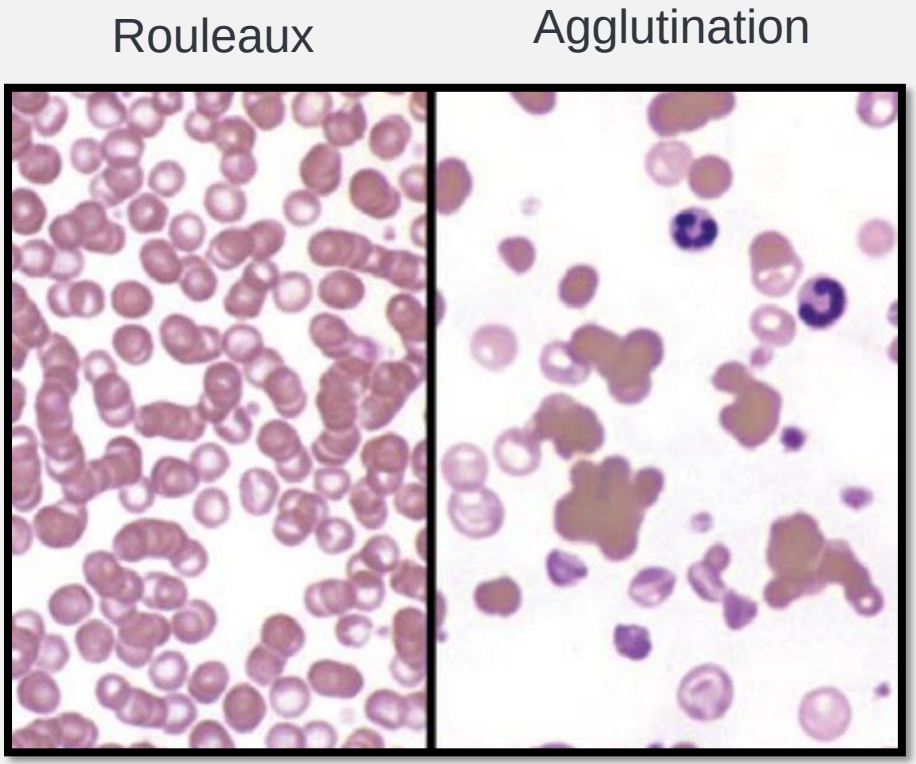






If hemolysis is suspected, diagnostics should include:

+ Blood smear review
+ Slide agglutination
+ Chest and abdominal imaging
+ +/- Infectious disease testing
+ +/- Coomb’s test



Options for rapid evaluation of blood smears are numerous

- In-house microscopy, self-reviewed
- Digital cytology, remote evaluation
- In-house automated analyzer (artificial intelligence)

Sample Selection

Options for screening for infectious diseases can be overwhelming

Antibody (Ab), serology

- **Indicates:**
  - Exposure
- **Limitations**
  - Current infx not confirmed
  - May need paired titer

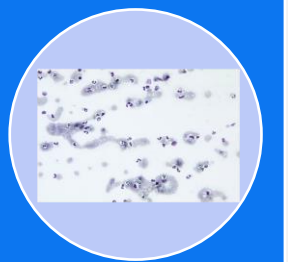
Antigen (Ag)

- **Indicates:**
  - Organism present
- **Limitations**
  - Does not confirm organism viability

PCR

- **Indicates:**
  - Organism present
- **Limitations**
  - Does not confirm organism viability
  - TAT

Cytology Histopathology

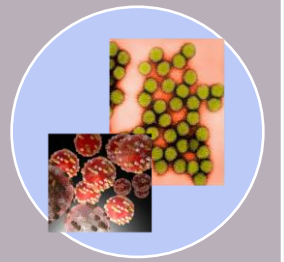


- **Indicates:**
  - Organism present
- **Limitations**
  - Specific ID
  - $

Culture

- **Indicates**
  - ***Viable*** organism
- **Limitations**
  - Sample handling
  - $
  - TAT

Other advanced diagnostics

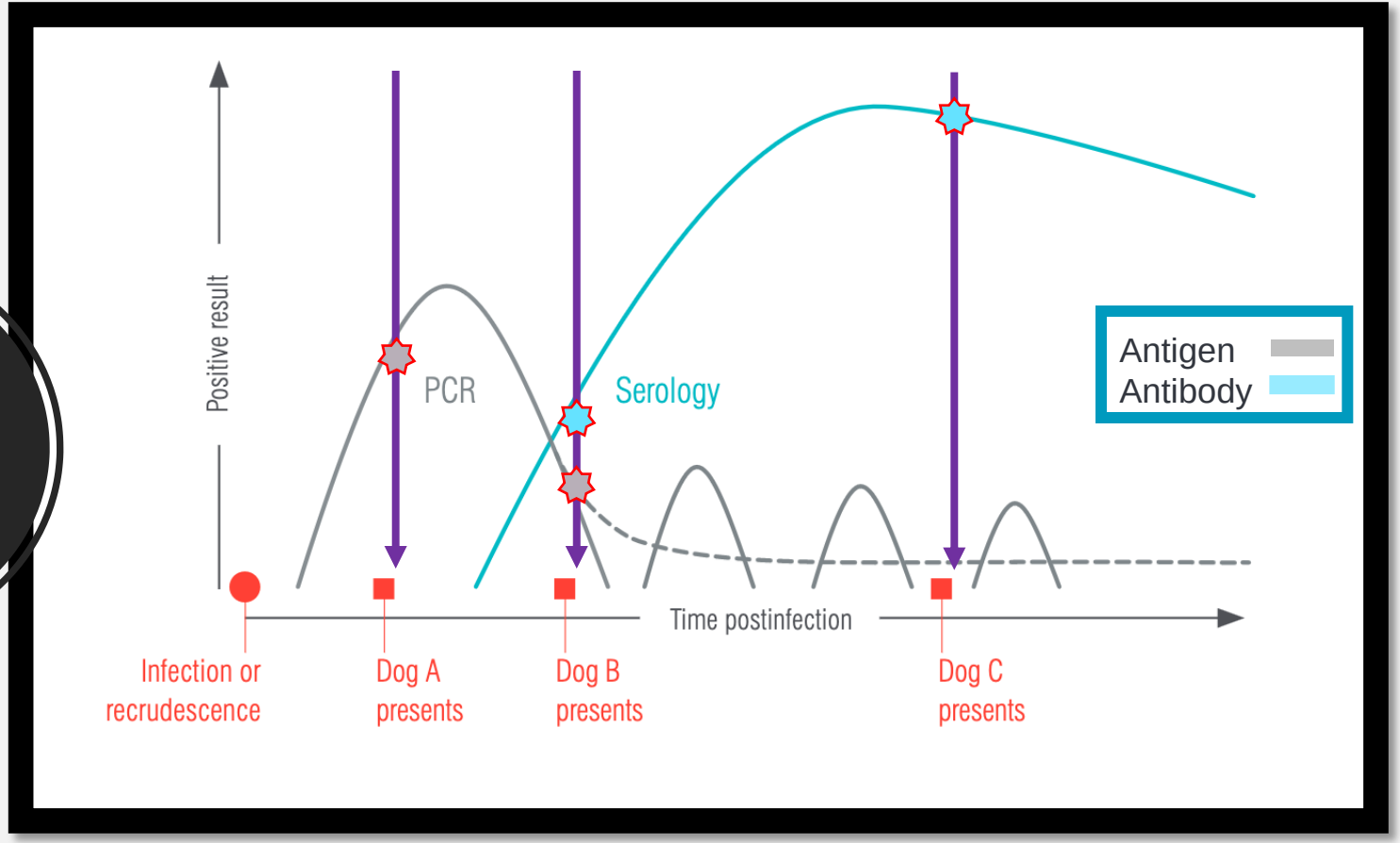


- **Indicates:**
  - Organism present
- **Limitations**
  - TAT
  - $
  - Availability

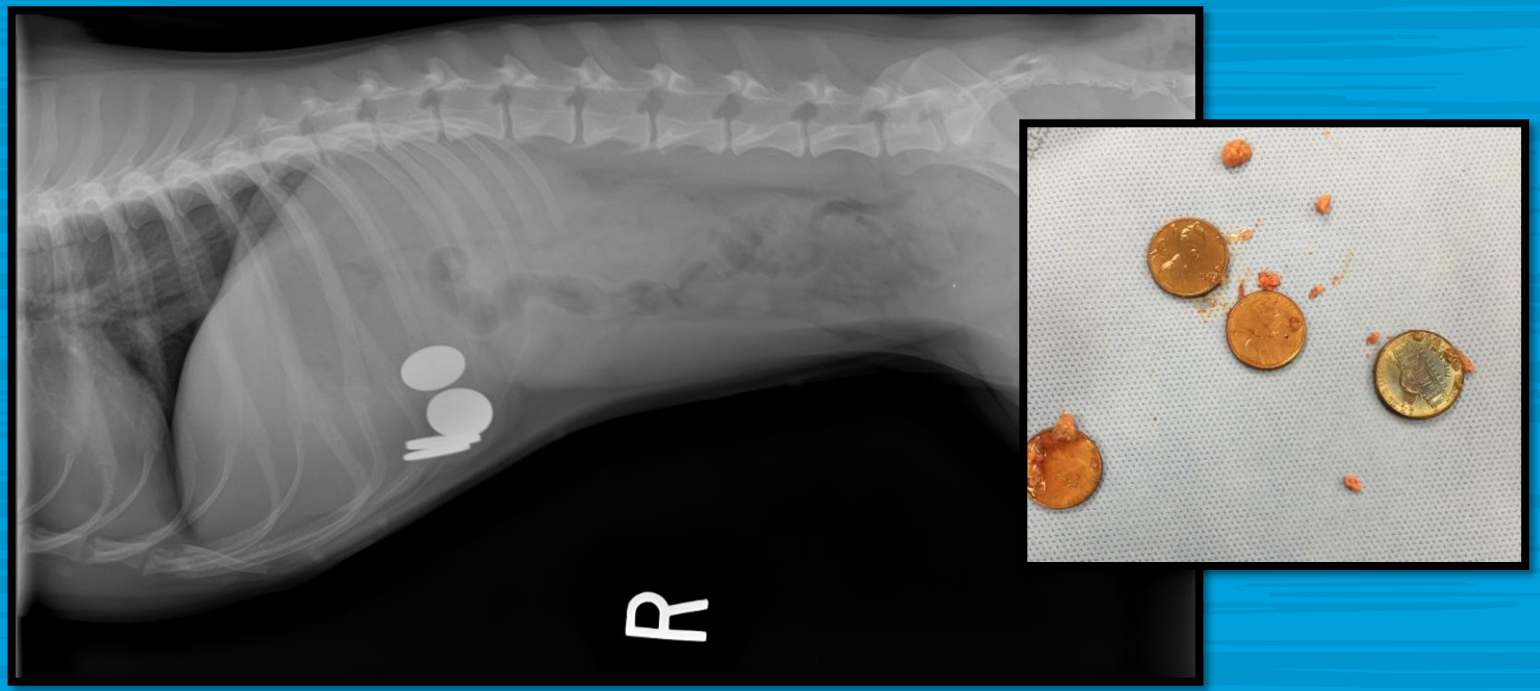
More than one test method and/or repeat testing maybe be necessary for a diagnosis

IDEXX

Clinical picture influences test choice



Not all hemolytic anemias are immune-mediated…



Hemolysis

Hemolytic anemia (HA) (NOT immune-mediated)

- Intravascular (hemoglobinemia/uria)
- No agglutination & Coomb's -
- Ddx
  - Onion, propylene glycol (cats), water intox
  - Heavy metal
  - PFK/PK deficiency
  - Hypophosphatemia
  - Microangiopathy
  - Infectious
  - Massive envenomation, sprayed by skunk

Immune-mediated hemolytic anemia (IMHA)

- Extravascular (bilirubinemia/uria);
  - Rarely intravascular or at level of bone marrow
- Often autoagglutination & Coomb's +
- Ddx
  - "Triggered"
    - Infectious disease
    - Drugs
    - Vaccinations
    - Neoplasia
  - Primary/autoimmune

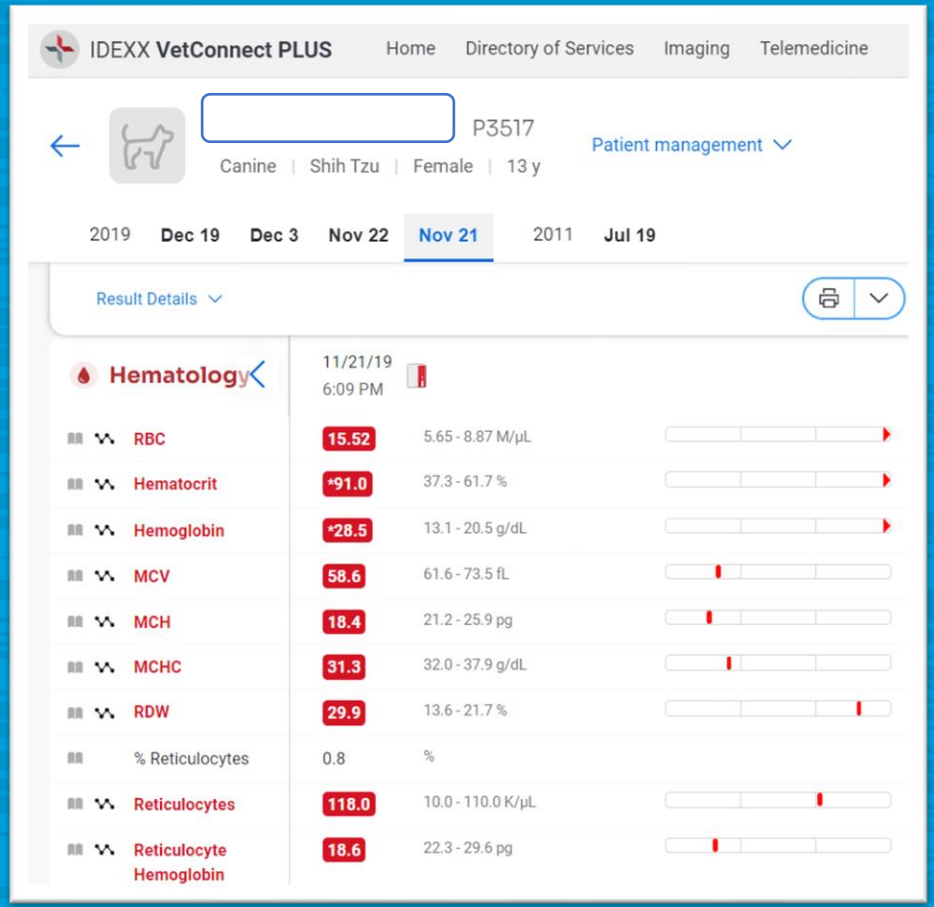
Weis DJ, Tvedten H. Erythrocyte disorders. In: Willard MD, Tvedten H, ed. Small Animal Clinical Diagnosis by Laboratory Methods. St. Louis MO: Elsevier, 2012: 48-55.

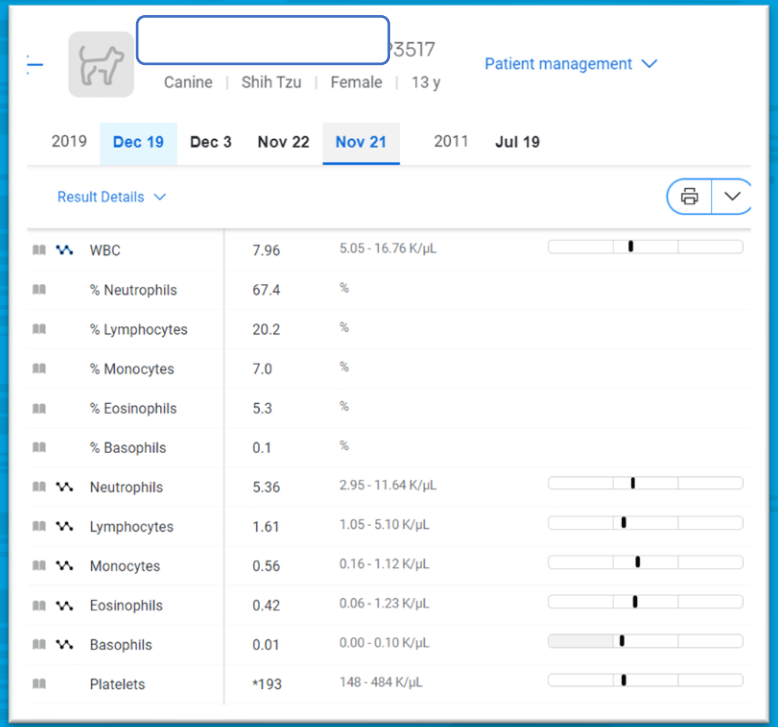
Missy

- 13-year-old fs Shih Tzu
- Occasionally collapses with exercise

Triage

- Quick PE
  - TPR = 101 F, 120 bpm, 20 bpm
  - BARH
  - Pink, moist MM, injected sclera
  - Normal pulses and chest auscultation
- Assessment
  - Unremarkable PE, currently stable dog
  - History of occasional exercise-induced collapsing
- Diagnostics
  - 1st tier: PCV/TP, BG, electrolytes? Full CBC/chem/UA? ECG?
    - Consider exercise the patient and perform pre/post exercise diagnostics such as BG, lactate, K+, BP, ECG





Confirm Hct!
PCV/TP = 92%/7.6 g/dL

Focus

- What's the client complaint? Collapsing
- What's the main problem? Erythrocytosis, likely polycythemia
- What's the emergency? Poor perfusion
- Do these all fit together; are we addressing all issues?

Sludge Vectors by Vecteezy

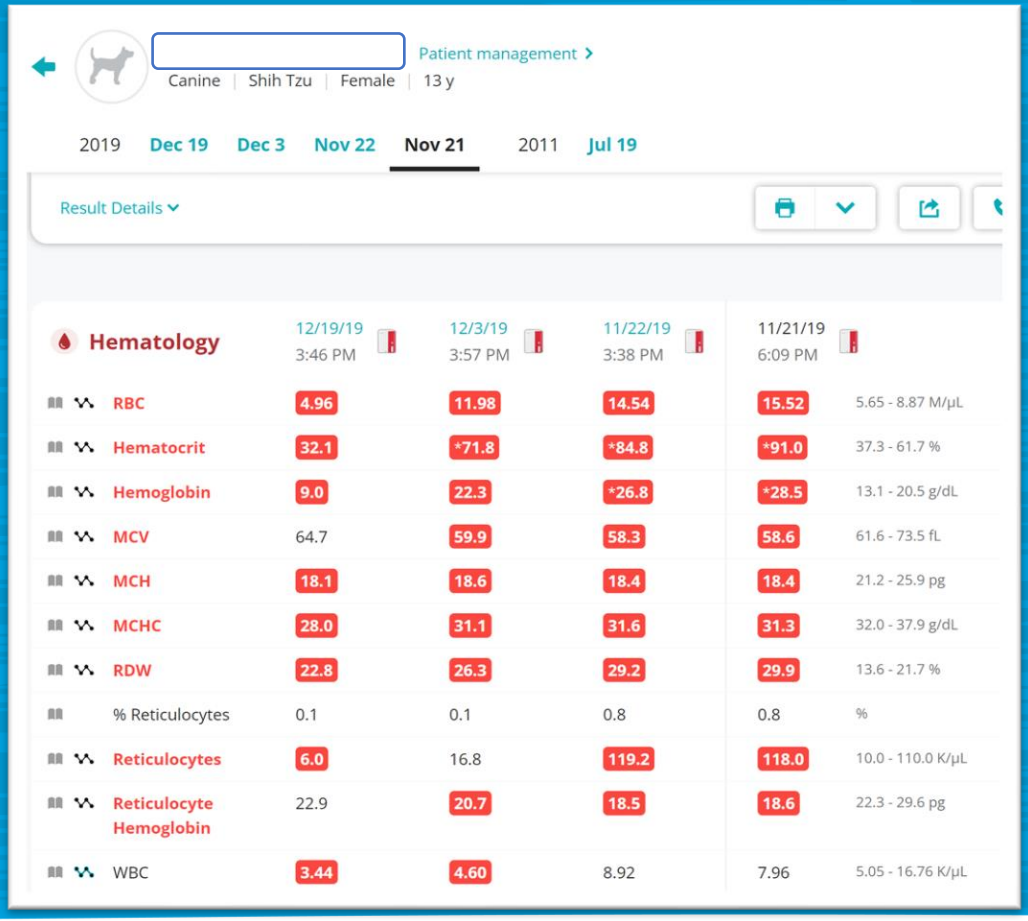
- What now?
  - Restore perfusion> phlebotomy
  - 4th tier diagnostics: thoracic radiographs/met check, abdominal imaging, +/- blood gas, erythropoietin concentration, echo

Treatment of erythrocytosis

- Relative
  - Fluid therapy
  - Treat the cause of dehydration

- Absolute
  - ER treatment = phlebotomy
    - Dogs: 20 ml/kg, replace with same volume fluid, goal is to get PCV ≤ 65%, may need to repeat
    - Cats: 10 ml/kg, same protocol, target PCV ≤ about 50%
  - All cases may need long-term, occasional phlebotomy
  - IDEALLY, treat the underlying disease if there is a treatment
    - Polycythemia vera: hydroxyurea
    - Renal tumors > surgery if an option
    - Other cancers, appropriate medical and/or surgical management as guided by an oncologist

Giger U: Polycythemia—Diagnostics and Management of a High Hematocrit. World Small Animal Veterinary Association Congress Proceedings 2018.


Patient management
Canine | Shih Tzu | Female | 13 y
2019 Dec 19 Dec 3 Nov 22 Nov 21 2011 Jul 19
Result Details
Hematology
12/19/19 3:46 PM
12/3/19 3:57 PM
11/22/19 3:38 PM
11/21/19 6:09 PM
RBC 4.96 11.98 14.54 15.52 5.65 - 8.87 M/µL
Hematocrit 32.1 *71.8 *84.8 *91.0 37.3 - 61.7 %
Hemoglobin 9.0 22.3 *26.8 *28.5 13.1 - 20.5 g/dL
MCV 64.7 59.9 58.3 58.6 61.6 - 73.5 fL
MCH 18.1 18.6 18.4 18.4 21.2 - 25.9 pg
MCHC 28.0 31.1 31.6 31.3 32.0 - 37.9 g/dL
RDW 22.8 26.3 29.2 29.9 13.6 - 21.7 %
% Reticulocytes 0.1 0.1 0.8 0.8 %
Reticulocytes 6.0 16.8 119.2 118.0 10.0 - 110.0 K/µL
Reticulocyte Hemoglobin 22.9 20.7 18.5 18.6 22.3 - 29.6 pg
WBC 3.44 4.60 8.92 7.96 5.05 - 16.76 K/µL

Henry

- 5-year-old m/c German Shorthaired Pointer
- Collapsing and heavy breathing with exercise
- Occasional cough

Triage

- Quick PE
  - TPR = 101 F, 180 bpm, 48bpm
  - Irregularly irregular heart rate, 2/6 systolic murmur
  - Pale to muddy, moist MM
  - RR and effort increase with minimal stress
  - Mild increase in bronchovesicular lung sounds
  - Moderate pulses
- Quick assessment
  - Tachyarrhythmia
  - Probable lower airway issues, CHF?
  - Anemia?
  - Bordering not stable

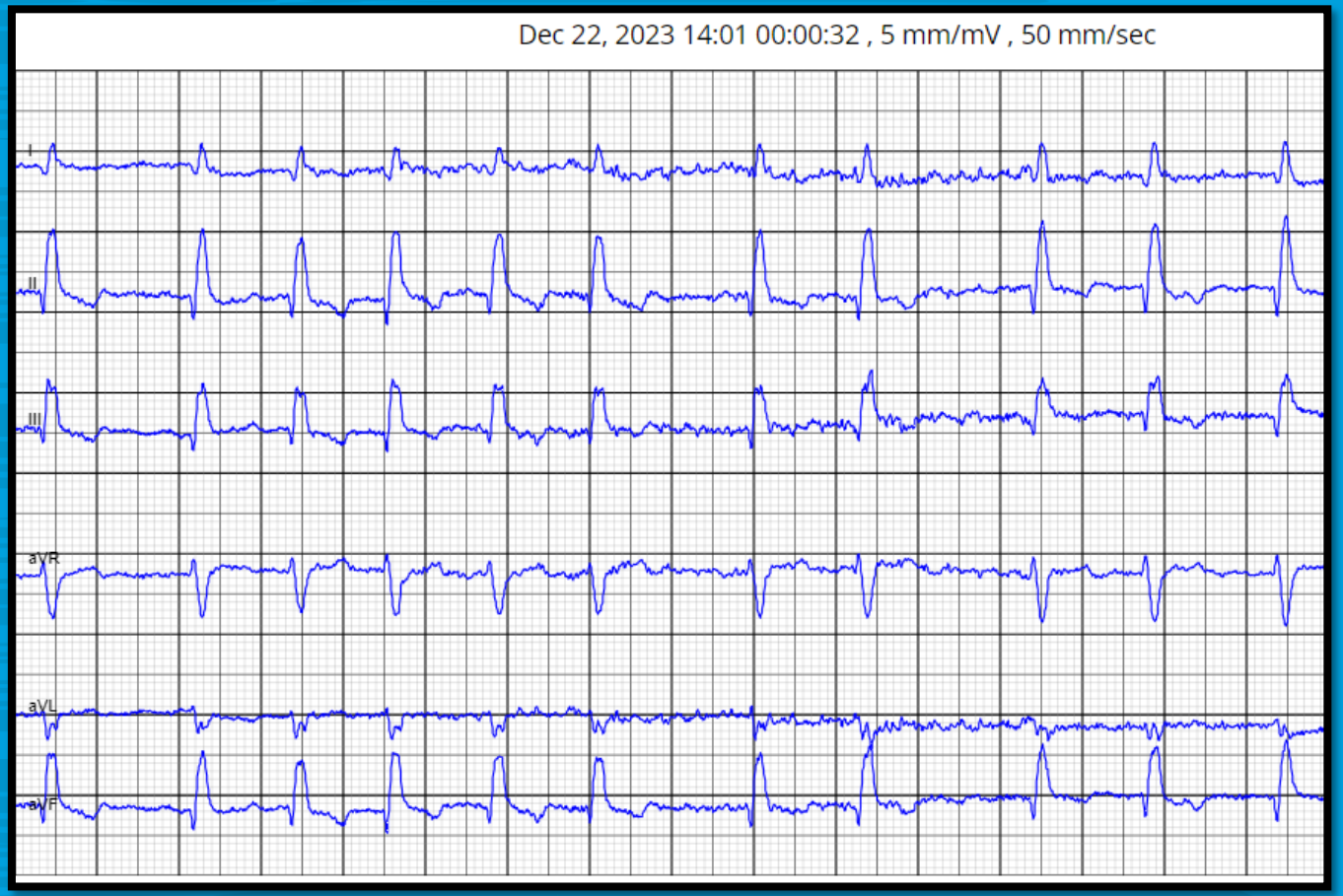
What diagnostics?

- FIRST STABILIZE!!!
  - Oxygen
  - Consider light sedation
  - Consider diuretic such as furosemide

- 1st tier diagnostics: ECG!!!, pulse oximetry, SBP, +/ PCV/TP/BG (CBC/chemistry/UA)
- 2nd tier diagnostics: Thoracic rads or TFAST
- 3rd tier diagnostics: Echo, proBNP, +/- refer to cardiologist

ECG = A-fib

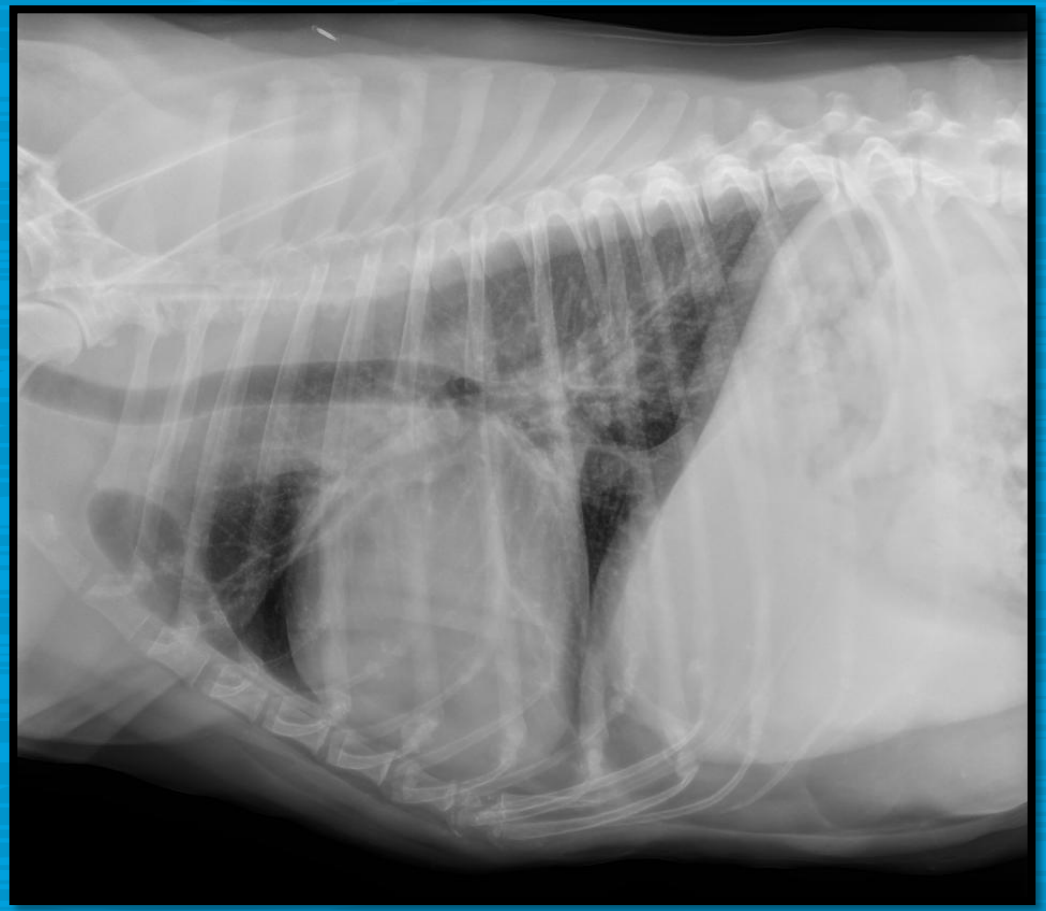
Pulse ox = 93%
PCV/TP= 42%/6.8 g/dL
SBP = 90 mmHg



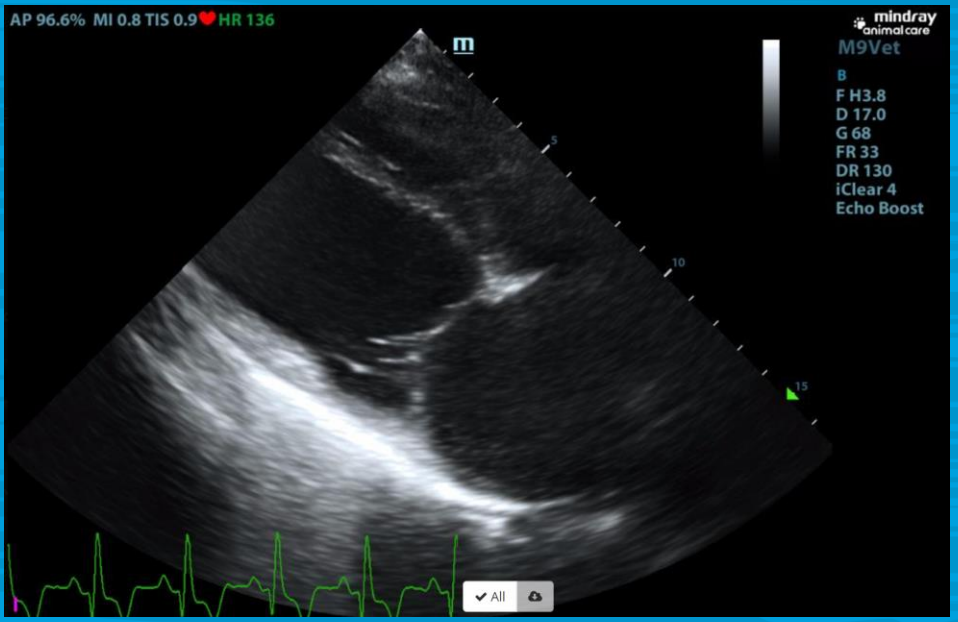
Focus

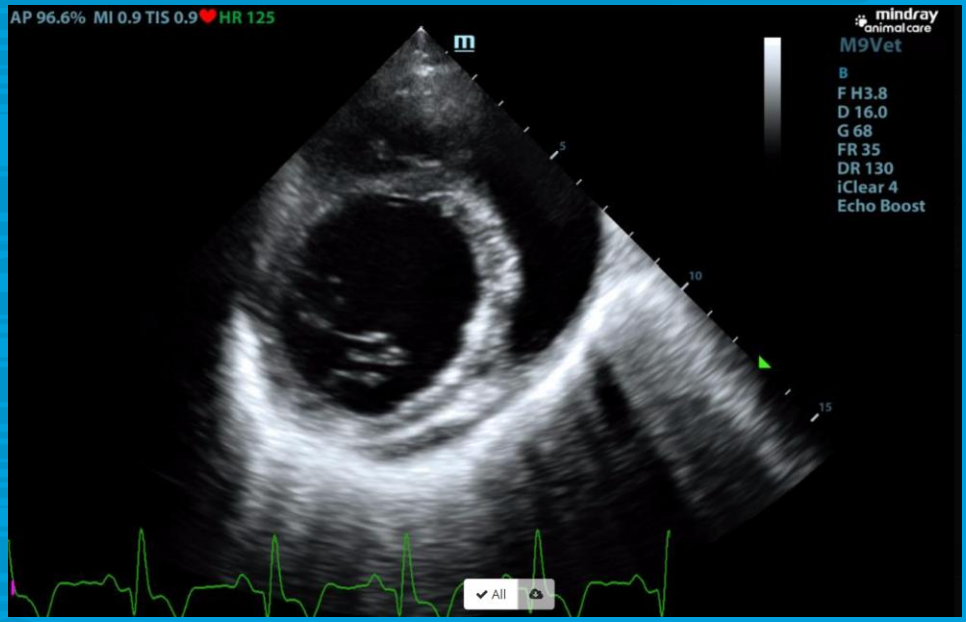
- What's the client complaint? collapsing, coughing
- What's the main problem? Cardiac disease, +/- lower airway issue (including CHF)
- What's the emergency? Poor perfusion, possibly oxygenation
- Does this all fit together/are we addressing all issues/concerns?

- What next?



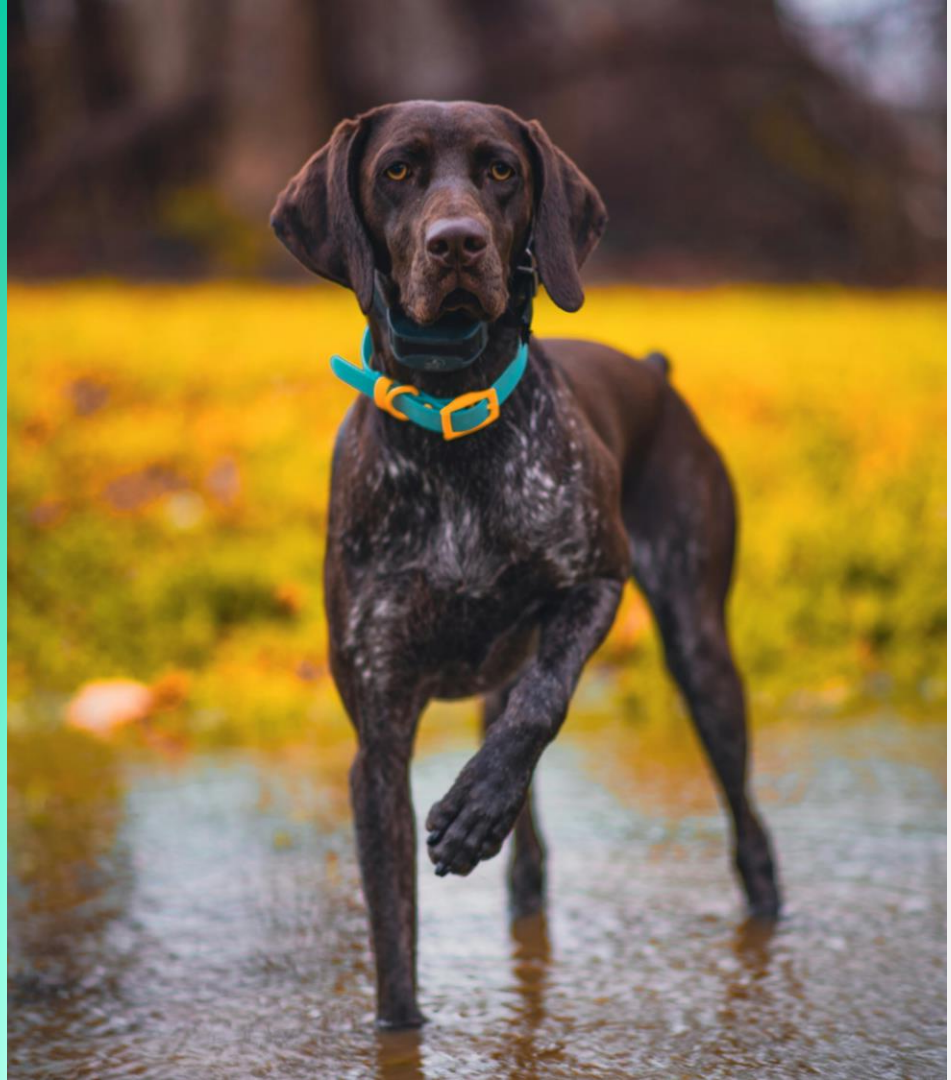
Echo





Treatment

- Oxygen
- Diuretic: e.g., furosemide
- Negative chronotrope: e.g., diltiazem, beta blocker, digoxin
- Positive inotrope: e.g., pimobendan, digoxin
- Longer term treatment: +/- decrease afterload, e.g., ACEI, ARB



Follow-up?

- Monitor:
  - Hydration
  - Renal chemistries and electrolytes
  - SBP, ECG, RR & effort, rads, echo, +/- proBNP
- ** Check for grain-free diet!!!**

IDEXX

Brutus

- 10-year-old MC Rottweiler
- Snoring more than usual for months, progressively worse
- Anxious this am and collapsed

Triage

- Quick PE
  - TPR 103.5 F, 130 bpm, marked stertor
  - Paradoxical chest movement
  - Muddy/greyish MM, moist
  - Normal pulses, marked referred upper airway noise
  - Panicked b/c can barely breathe
- Assessment
  - Unstable, can barely breathe, panics with any handling
  - Cardiovascularly stable for the moment

Diagnostics

- STABILIZE THE PATIENT
  - Sedation
  - Rest, minimal stress
  - +/- Tracheostomy?
  - +/- Oxygen

- 1st tier: Sedated oral exam – **BE PREPARED**, pulse oximetry
- 2nd tier: ?
- 3rd tier: ?

Sedated upper airway exam!!!

Focus

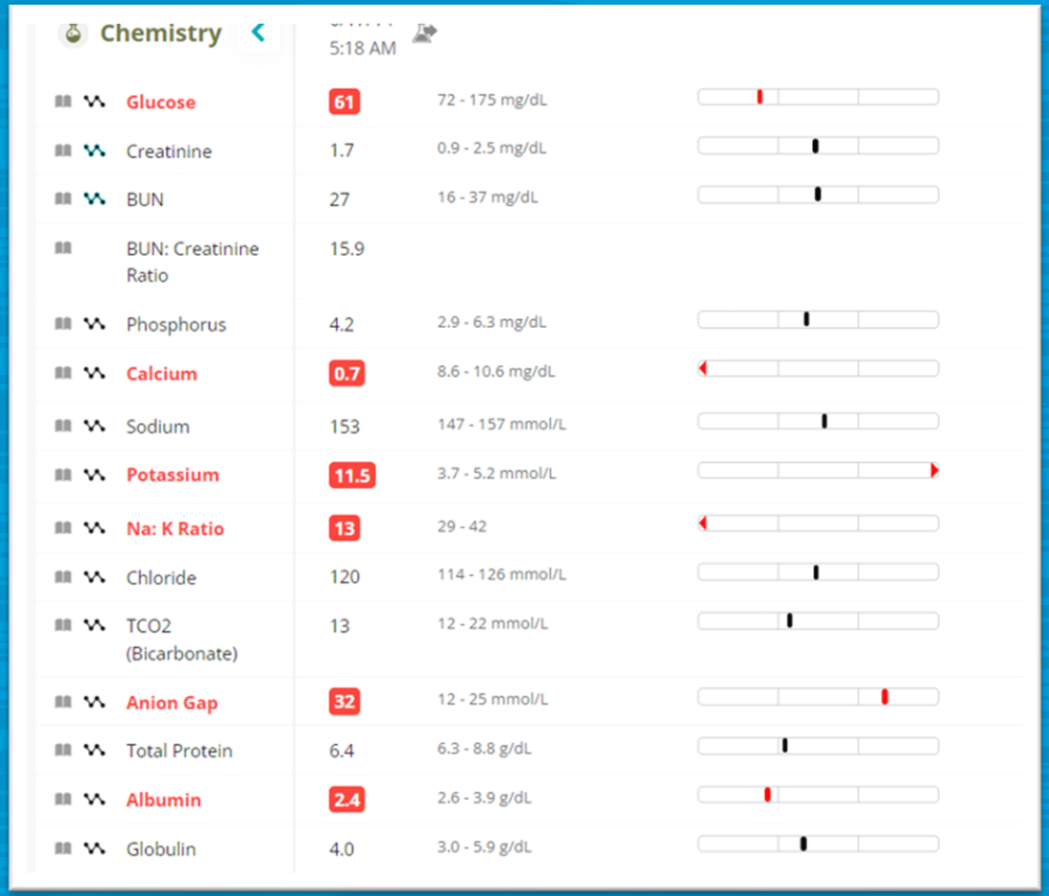
- What's the client complaint? Can't breathe
- What's the main problem? Soft palate mass obstructing airway
- What's the emergency? At risk of respiratory arrest
- Do these all fit together; are we addressing all issues?

- What now?
  - SECURE AN AIRWAY!!!

Stridor - Respiratory – upper airway

Max

- 2-year-old MI Standard Poodle
- Pre-neuter labs
- No complaints



Chemistry

5:18 AM

Glucose	61	72 - 175 mg/dL
Creatinine	1.7	0.9 - 2.5 mg/dL
BUN	27	16 - 37 mg/dL
BUN: Creatinine Ratio	15.9	
Phosphorus	4.2	2.9 - 6.3 mg/dL
Calcium	0.7	8.6 - 10.6 mg/dL
Sodium	153	147 - 157 mmol/L
Potassium	11.5	3.7 - 5.2 mmol/L
Na: K Ratio	13	29 - 42
Chloride	120	114 - 126 mmol/L
TCO2 (Bicarbonate)	13	12 - 22 mmol/L
Anion Gap	32	12 - 25 mmol/L
Total Protein	6.4	6.3 - 8.8 g/dL
Albumin	2.4	2.6 - 3.9 g/dL
Globulin	4.0	3.0 - 5.9 g/dL

Triage

- Quick PE
  - Completely normal

- Assessment
  - Very abnormal, scary labs
  - Clinically stable patient ?

Diagnostics

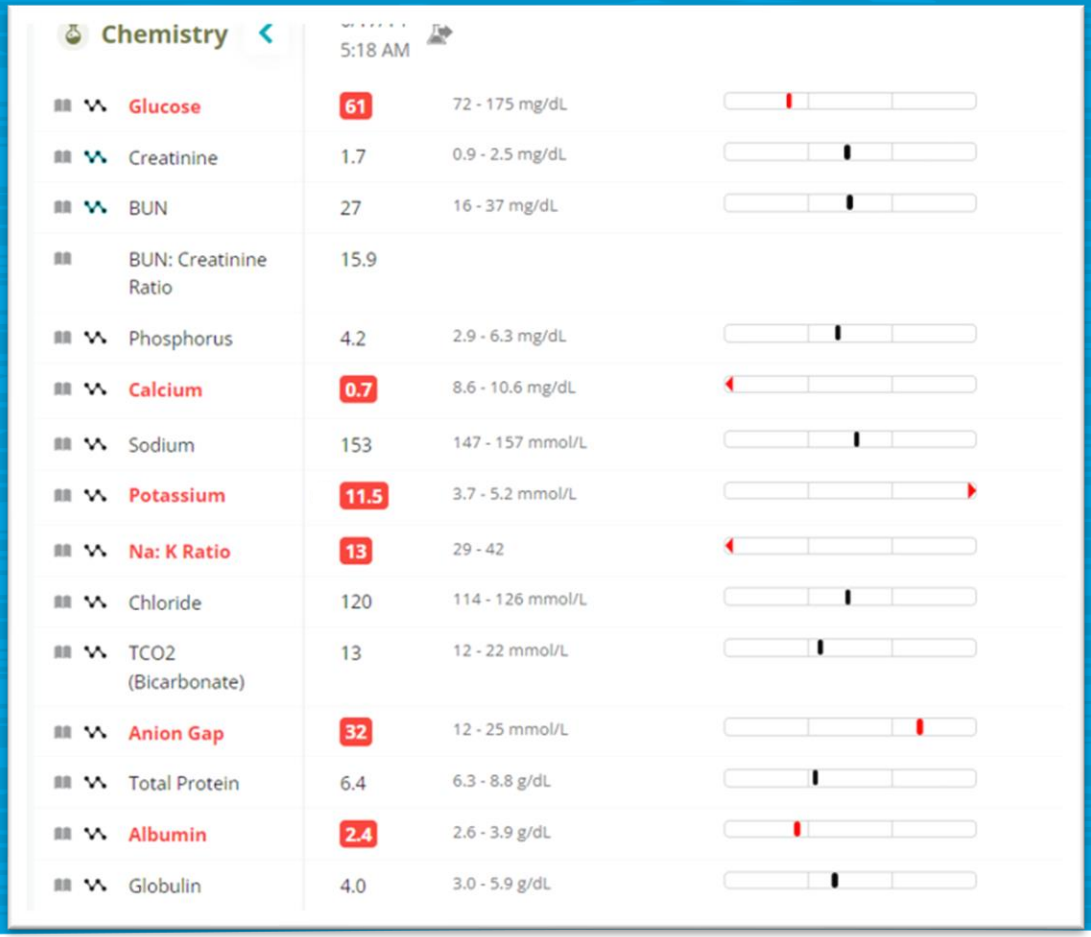
- STABILIZE THE PATIENT
  - ?

- Next diagnostics
  - 1st tier: Confirm results, NEW blood sample
  - 2nd tier: ?
  - 3rd tier: ?

Focus

- What's the client complaint? Routine surgery
- What's the main problem? Potentially something major
- What's the emergency? If real, complications of profound hypocalcemia and hyperkalemia
- Do these all fit together; are we addressing all issues?

- What now?

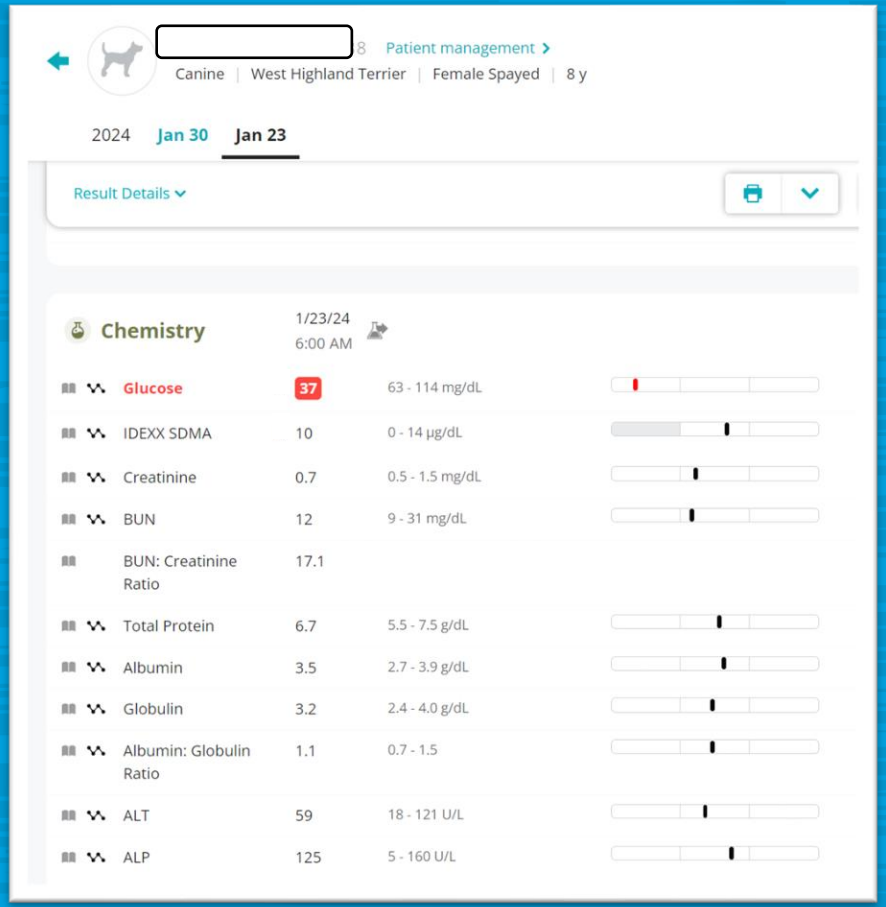


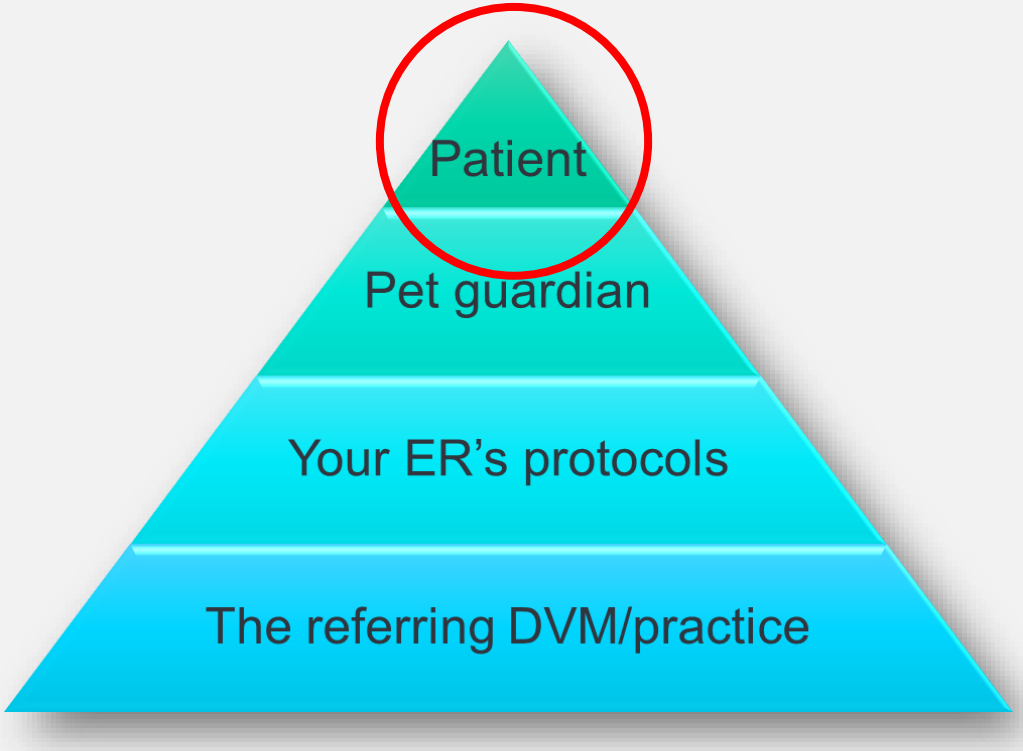
EDTA Contamination

Precious

- 8-year-old FS Westie
- Referred for sedated ear cleaning
- History of chronic allergies and skin issues
- “FYI, collapse and quick recovery recently
- Generally healthy, “normal lab work”

- You note hypoglycemia on RDVM pre-anesthetic labs


[redacted] Patient management
Canine | West Highland Terrier | Female Spayed | 8 y
2024 Jan 30 Jan 23
Result Details
Chemistry
1/23/24
6:00 AM
Glucose 37 63 - 114 mg/dL
IDEXX SDMA 10 0 - 14 µg/dL
Creatinine 0.7 0.5 - 1.5 mg/dL
BUN 12 9 - 31 mg/dL
BUN: Creatinine Ratio 17.1
Total Protein 6.7 5.5 - 7.5 g/dL
Albumin 3.5 2.7 - 3.9 g/dL
Globulin 3.2 2.4 - 4.0 g/dL
Albumin: Globulin Ratio 1.1 0.7 - 1.5
ALT 59 18 - 121 U/L
ALP 125 5 - 160 U/L



Triage

- Quick PE
  - TPR 101 F/120 bpm/20 bpm
  - BARH, downright rambunctious
  - Pink, moist MM
  - Normal pulses and chest auscultation
- Assessment
  - Completely stable vs. on the edge of crashing

Diagnostics

- STABILIZE THE PATIENT
  - Does this patient require treatment for profound hypoglycemia?

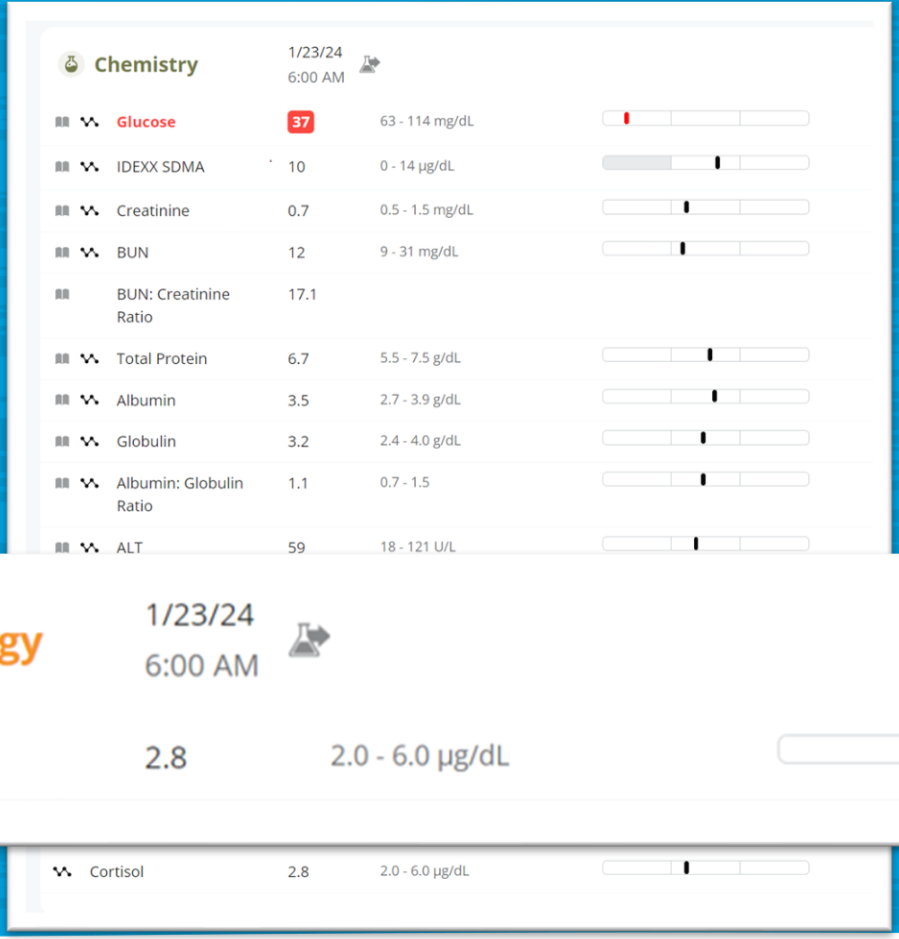
- Next diagnostics
  - 1st tier: Repeat/confirm BG on glucometer = 27 mg/dL
  - 2nd tier: Consider cortisol, bile acids, insulin panel, thoracic rads, abdominal imaging
  - 3rd tier: Thoracic rads, advanced abdominal imaging

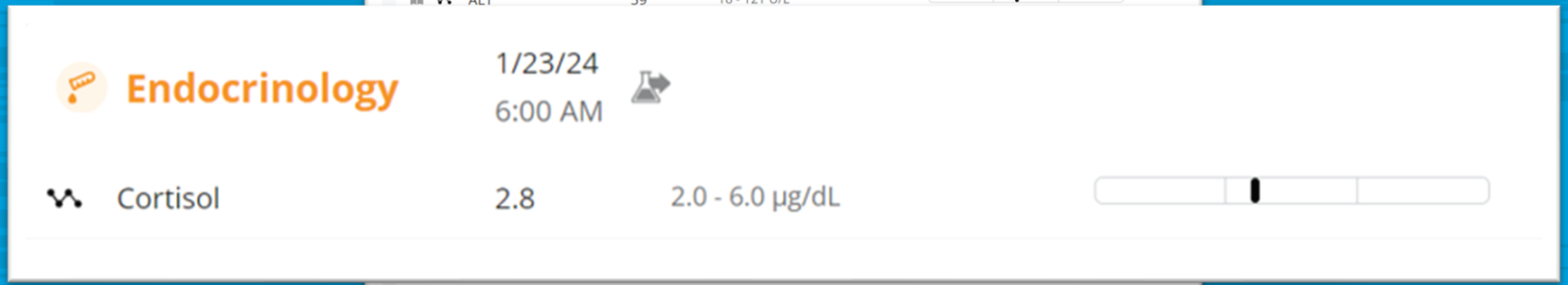
Switching gears…

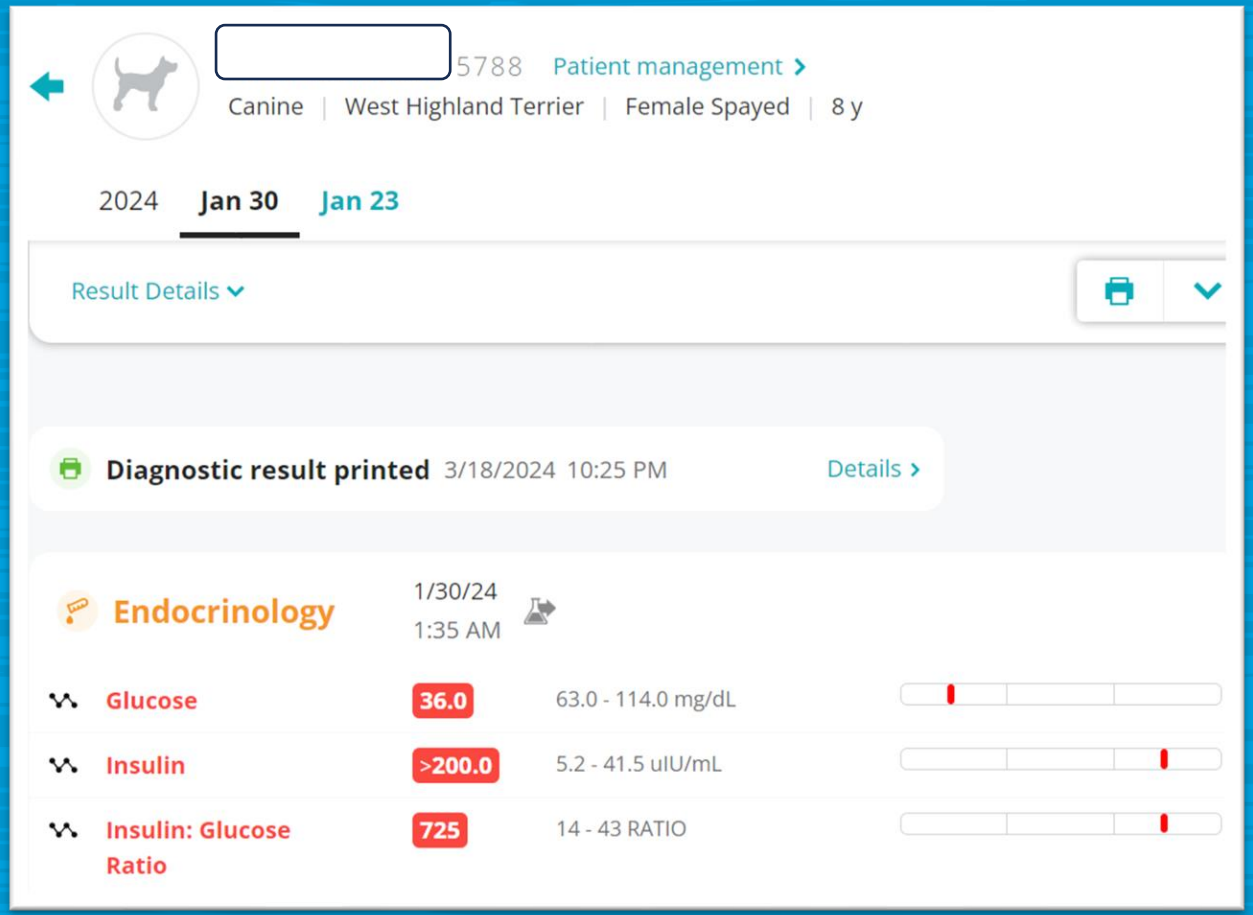
Focus

- What's the client complaint? Referral for sedated ear cleaning
- What's the main problem? Possibly hypoglycemic
- What's the emergency? None at the moment; risk of seizures and other complications of profound hypoglycemia
- Do these all fit together; are we addressing all issues?

- What now?
  - Treat hypoglycemia?: diet, +/- drugs, +/- glucose CRI?
  - Ddx for asymptomatic, profound hypoglycemia?


Chemistry
1/23/24
6:00 AM
Glucose 37 63 - 114 mg/dL
IDEXX SDMA 10 0 - 14 µg/dL
Creatinine 0.7 0.5 - 1.5 mg/dL
BUN 12 9 - 31 mg/dL
BUN: Creatinine Ratio 17.1
Total Protein 6.7 5.5 - 7.5 g/dL
Albumin 3.5 2.7 - 3.9 g/dL
Globulin 3.2 2.4 - 4.0 g/dL
Albumin: Globulin Ratio 1.1 0.7 - 1.5
ALT 59 18 - 121 U/L
Cortisol 2.8 2.0 - 6.0 µg/dL


Endocrinology
1/23/24
6:00 AM
Cortisol 2.8 2.0 - 6.0 µg/dL


5788
Patient management
Canine | West Highland Terrier | Female Spayed | 8 y
2024
Jan 30
Jan 23
Result Details
Diagnostic result printed 3/18/2024 10:25 PM
Details
Endocrinology
1/30/24
1:35 AM
Glucose
36.0
63.0 - 114.0 mg/dL
Insulin
>200.0
5.2 - 41.5 uIU/mL
Insulin: Glucose Ratio
725
14 - 43 RATIO

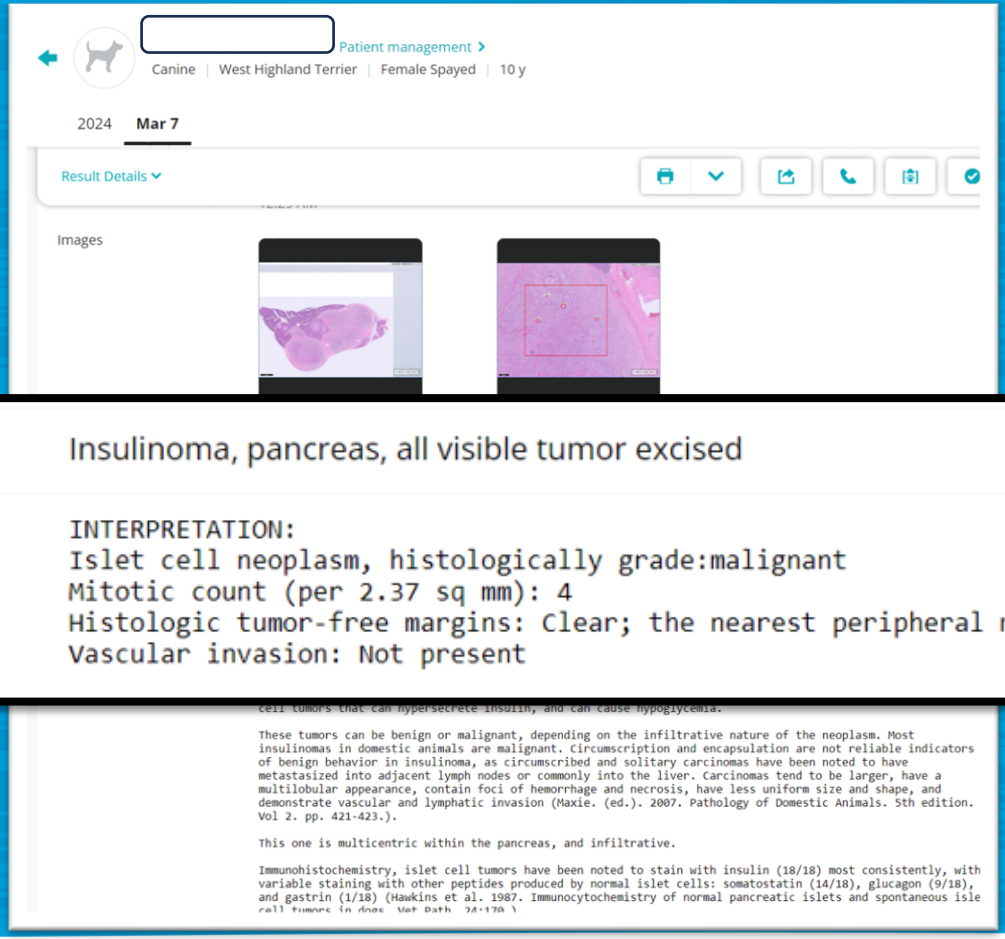
Pet Name:		**Appt. Date:**	02/15/2024 01:00 PM
Species:	Canine	**Report Date:**	02/15/2024 - Update: 02/15/2024
Breed:	West Highland White Terrier	**Presenting Complaint:**	
Sex:	Female - Spayed		Met check, insulinoma
Weight:	17.6 lbs/ 8 kg		
Patient DOB:	01/29/2014 (10 years old)		

Abdominal Ultrasound Report

Interpretation:
Liver: nodule may be benign nodular regeneration, but metastatic neoplasia is not fully ruled out.
Kidneys: consistent with chronic degenerative kidney disease with dystrophic mineralization vs. urolithiasis.
Pancreas: nodule most likely insulinoma given high insulin:glucose ratio, although other neoplasia (carcinoma) vs. nodular hyperplasia are not fully ruled out.
Lymph nodes: consider inflammation vs. reactive lymphoid hyperplasia vs. metastatic neoplasia.

Bladder: Normal wall, two discrete stones (8.3mm, 4.3 mm) as well as a few small calculi near the bladder neck.

Interpretation:
Liver: nodule may be benign nodular regeneration, but metastatic neoplasia is not fully ruled out.
Kidneys: consistent with chronic degenerative kidney disease with dystrophic mineralization vs. urolithiasis.
Pancreas: nodule most likely insulinoma given high insulin:glucose ratio, although other neoplasia (carcinoma) vs. nodular hyperplasia are not fully ruled out.
Lymph nodes: consider inflammation vs. reactive lymphoid hyperplasia vs. metastatic neoplasia.
Bladder: stones as noted, consider calcium oxalate vs. struvite vs. other.



Clinical History:	Insulinoma, pancreas, all visible tumor excised
Pathologist's Report	INTERPRETATION: Islet cell neoplasm, histologically grade:malignant Mitotic count (per 2.37 sq mm): 4 Histologic tumor-free margins: Clear; the nearest peripheral margin is only 0.11 mm. Vascular invasion: Not present

cell tumors that can hypersecrete insulin, and can cause hypoglycemia.

These tumors can be benign or malignant, depending on the infiltrative nature of the neoplasm. Most insulinomas in domestic animals are malignant. Circumscription and encapsulation are not reliable indicators of benign behavior in insulinoma, as circumscribed and solitary carcinomas have been noted to have metastasized into adjacent lymph nodes or commonly into the liver. Carcinomas tend to be larger, have a multilobular appearance, contain foci of hemorrhage and necrosis, have less uniform size and shape, and demonstrate vascular and lymphatic invasion (Maxie. (ed.). 2007. Pathology of Domestic Animals. 5th edition. Vol 2. pp. 421-423.).

This one is multicentric within the pancreas, and infiltrative.

Immunohistochemistry, islet cell tumors have been noted to stain with insulin (18/18) most consistently, with variable staining with other peptides produced by normal islet cells: somatostatin (14/18), glucagon (9/18), and gastrin (1/18) (Hawkins et al. 1987. Immunocytochemistry of normal pancreatic islets and spontaneous isle cell tumors in dogs. Vet Path. 24:170.).

Take Home

- Symptoms are often non-specific
  - Your choice of diagnostics in the heat of an emergency should be based on science AND art
- Do not skip the basics
- If it doesn’t make sense, slow down before you act
- Think forward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