



ASVCP

American Society for Veterinary Clinical Pathology
4300 Duraform Lane, Ste A • Windsor, WI 53598 USA
Phone: 1-608-443-2479 • Email: info@asvcp.org

ASVCP Mystery Case Histories

Please join us at the 2025 ACVP Meeting in New Orleans on Tuesday Oct. 28th from 1:30-5pm for the ASVCP Mystery Case Session chaired by Dr. Johanna Rigas. In this session, pathologists and trainees present these veterinary clinical pathology-based cases encompassing classic, unique, and/or unusual representations of pathologic entities. Case discussions may include hematologic, cytologic, endocrinologic, or clinical chemistry findings resulting from natural disease, medical treatments, or research/toxicologic studies.

Access to the 2025 digital case material and full case summaries is \$50 for ASVCP members and \$75 for non-ASVCP members. Access to the digital slides will be available starting **October 6, 2025**. Instructions will be sent 1-2 business days after purchase. To purchase the digital scans of slides that correspond to the cases presented in New Orleans, visit https://www.asvcp.org/page/2025_mysteryslide.

If you have any questions, please reach out to info@asvcp.org.

2025 Case Index:

Case	Presenter- Institution	Species	Material/Data
<u>1</u>	Maša Vilfan- Univ. of Edinburgh	Feline	Fluid Preparation-Pericardial
<u>2</u>	Madison Knight- Univ. of Missouri	Canine	Fluid Preparation-Urine
<u>3</u>	Diya Sharma-LaHue- Charles River Laboratories	Primate	Blood Smear
<u>4</u>	Em Adam- Purdue Univ.	Canine	Blood Smear
<u>5</u>	Kimia Alizadeh- Univ. of Illinois	Canine	Aspirate-Liver
<u>6</u>	Alison Vancouver- Purdue Univ.	Other- Hedgehog	Aspirate-Kidney
<u>7</u>	Latifat Adekunle- Oregon State Univ.	Canine	Fluid Preparation-Peritoneal
<u>8</u>	Kelli Chan- North Carolina State Univ.	Canine	Fluid Preparation-Peritoneal
<u>9</u>	Lina Crespo Bilhalva- Tufts Univ.	Caprine	Fecal Smear
<u>10</u>	Will Patterson- North Carolina State Univ.	Bovine	Chemistry Case
<u>11</u>	Jasmine Hsin Yeh- Virginia-Maryland	Feline	Aspirate-Cutaneous
<u>12</u>	Jacqui Nunnolley- Univ. of Missouri	Equine	Fluid Preparation-Peritoneal
<u>13</u>	Kathleen Hu- Texas A&M Univ.	Canine	Blood Smear
<u>14</u>	Basant Ahmed- Ohio State Univ.	Canine	Aspirate-Penis
<u>15</u>	Sarah Jacobson- Texas A&M Univ.	Canine	Aspirate-Liver
<u>16</u>	Elyssa Armstrong- Tufts Univ.	Feline	Blood Smear
<u>17</u>	Jeremy Bessett- Univ. of Wisconsin	Canine	Blood Smear



MYSTERY CASE SESSION
CASE HISTORIES
CASE #1

CONTRIBUTOR NAME*	Maša Vilfan
CONTRIBUTOR EMAIL*	m.vilfan@sms.ed.ac.uk
COAUTHORS	Liam Wilson, Anais Allen-Deal, Paola Cazzini
COMPANY OR UNIVERSITY	Royal (Dick) School of Veterinary Studies, University of Edinburgh

* Corresponding contributor

SPECIMEN: Direct smear from pericardial fluid

SIGNALMENT: 2-year-old, male neutered, cross-breed cat

HISTORY AND CLINICAL FINDINGS: The cat was referred to the Emergency and Critical Care service at the Hospital for Small Animals, Royal (Dick) School of Veterinary Studies, University of Edinburgh (HfSA) due to increased respiratory rate and effort, elevated temperature, decreased appetite and lethargy. It was an indoor cat and shared a household with one other cat. Six months prior the cat presented at the referring practice with pyrexia of unknown origin that responded to treatment with non-steroidal anti-inflammatory drugs (NSAIDs). Three days and one day prior to referral, a large volume of hemopurulent pleural effusion was removed at the referring veterinarian via thoracocentesis. At the same time, the patient was treated with an injection of dexamethasone (dose not specified, DEXA-JECT 2mg/ml, Bimeda, UK), an antibiotic (dose not specified, Convenia 80 mg/ml, Zoetis, USA) and continuous treatment with NSAIDs (dose for 4kg cat SID, LOXICOM CAT 0.5 mg/ml oral 5ml, UK) was prescribed.

On presentation at the HfSA, the cat was calm, alert and responsive. It had a body condition score of 4/9, moderately increased expiratory effort with reduced ventral lung sounds, muffled heart sounds and normal body temperature. Peripheral pulses were symmetrical but attenuated, and the gums were pale pink and slightly dry but with a normal capillary refill time. Hematological and biochemical abnormalities on presentation included mild lymphopenia ($1.00 \times 10^9/L$; reference interval (RI) 1.50 – 7.00), mild hypoalbuminaemia (27.20 g/L; RI 28.00 – 39.00), mild azotemia (urea 14.20 mmol/L; RI 2.80 – 9.80), mild total hypocalcemia (2.08 mmol/L; RI 2.10 – 2.90), hyponatremia (140.00 mmol/L; RI 145.00 – 156.00), hypochloremia (109.00 mmol/L; RI 119.00 – 143.00) and low total T4 (<13.00 ; RI 13.00 – 48.00). Thoracic point of care ultrasound revealed a pericardial effusion with mild tamponade and moderate volume of pleural effusion. A subsequent CT showed thickening of the pleura and pericardium as well as sternal and mediastinal lymphadenopathy. The pericardial fluid was sent for cytological examination.

LABORATORY DATA:

Table 1. Pericardial effusion fluid analysis results

TEST	RESULT	UNITS
Macroscopic appearance	Blood-stained	n/a
TNCC	117.8	$\times 10^9/L$
TP	64.2	g/L
Triglycerides	0.43	mmol/L

TNCC total nucleated cell count, TP total protein, n/a not applicable

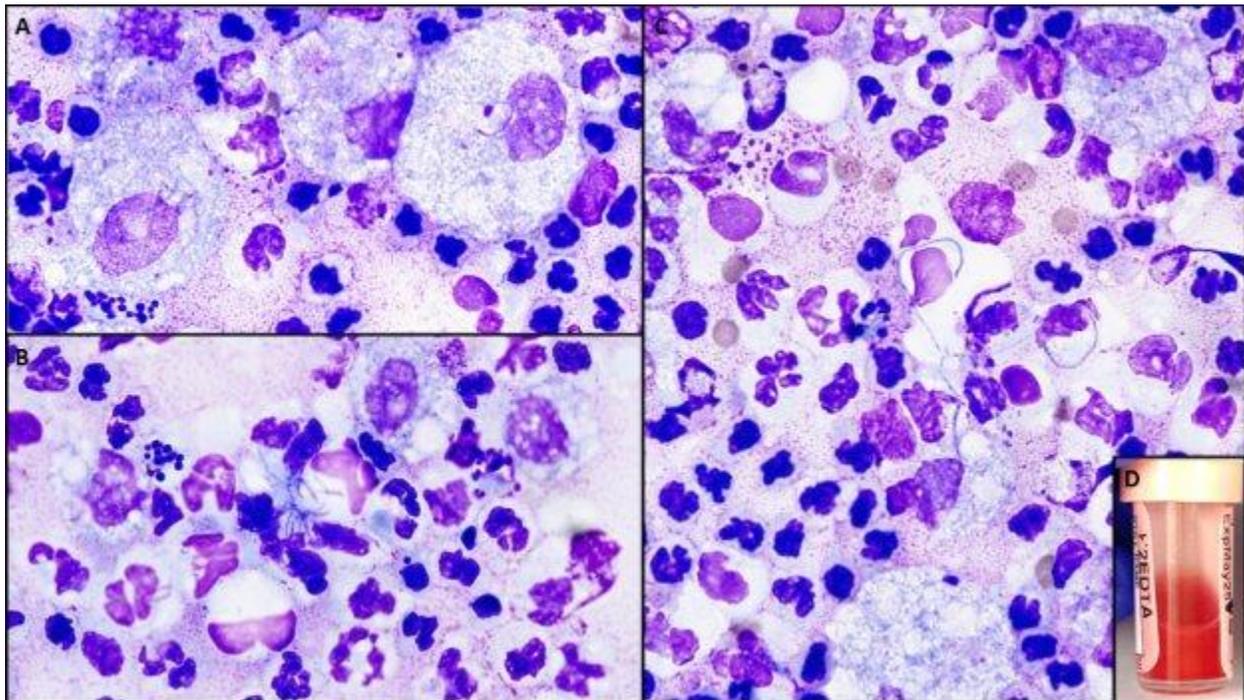


Figure 1 Photomicrographs of pericardial fluid cytology and macroscopic appearance of the pericardial fluid from a cat. (A), (B), and (C) Representative fields from direct smear cytologic preparations of pericardial fluid, May-Grünwald-Giemsa stain, 100 \times objective. (D): Macroscopic appearance of the pericardial effusion at the time of submission to the laboratory.

QUESTIONS:

1. Based on the cytologic appearance, which of the following is the most likely etiologic agent?
 - a. Bacterial rods
 - b. Oomycete
 - c. Filamentous bacteria
 - d. Fungal hyphae

2. Which of the following special stains panel would be the most appropriate next step to help identify the organism?
 - a. Gram stain and Ziehl-Neelsen stain
 - b. Periodic Acid-Schiff (PAS) and acid-fast stain
 - c. Ziehl-Neelsen and Fite-Faraco stains
 - d. PAS and Gomori methenamine silver (GMS) stains

CONTRIBUTOR NAME*	Madison Knight
CONTRIBUTOR EMAIL*	mekhgt@umsystem.edu
COAUTHORS	Angela Royal, Iliana Navarro, Joanna Murdoch, Jodi Matheson
COMPANY OR UNIVERSITY	University of Missouri

* Corresponding contributor

SPECIMEN: Cytocentrifuged slide of urine sediment

SIGNALMENT: 6-month-old female intact French Bulldog

HISTORY AND CLINICAL FINDINGS:

The patient was presented to the University of Missouri for suspected hermaphroditism. The patient had a history of hematuria, stranguria, and pollakiuria beginning around 7 weeks of age that improved with antimicrobial therapy. Evaluation by the referring veterinarian revealed persistent mild anemia, pyuria, and hematuria. Urine culture demonstrated heavy growth of *E. coli* at two separate times. Initial selection of Clavamox prior to each culture was switched to TMS based on susceptibility results. The patient also had intermittent vaginal tissue protrusion.

On presentation, physical examination findings included possible urethral prolapse versus hermaphroditism, and thickened uterus or urinary bladder on abdominal palpation. Hematochezia was noted after rectal exam. A cystocentesis was performed and urine was submitted for analysis.

LABORATORY DATA:

Complete blood count (ADVIA 2120i): Mild regenerative anemia, otherwise unremarkable

Biochemical profile (Beckman AU480): Unremarkable

Urinalysis results (Clinitek Status+ Analyzer, Goldberg TS Meter)

TEST	RESULT
Color	Yellow
Clarity	Cloudy
Specific Gravity	1.020
Glucose	Negative
Bilirubin	1+
Ketones	Trace

Heme	3+
pH	7.0
Protein - Dipstick	3+
Urobilinogen (E.U./dL)	0.2
WBC/hpf	9-20
RBC/hpf	> 40
Bacteria/hpf	Many rods
Urothelial Cells/lpf	1-5
Squamous Cells/lpf	Rare
Casts/lpf	None Seen
Crystals/lpf	None Seen

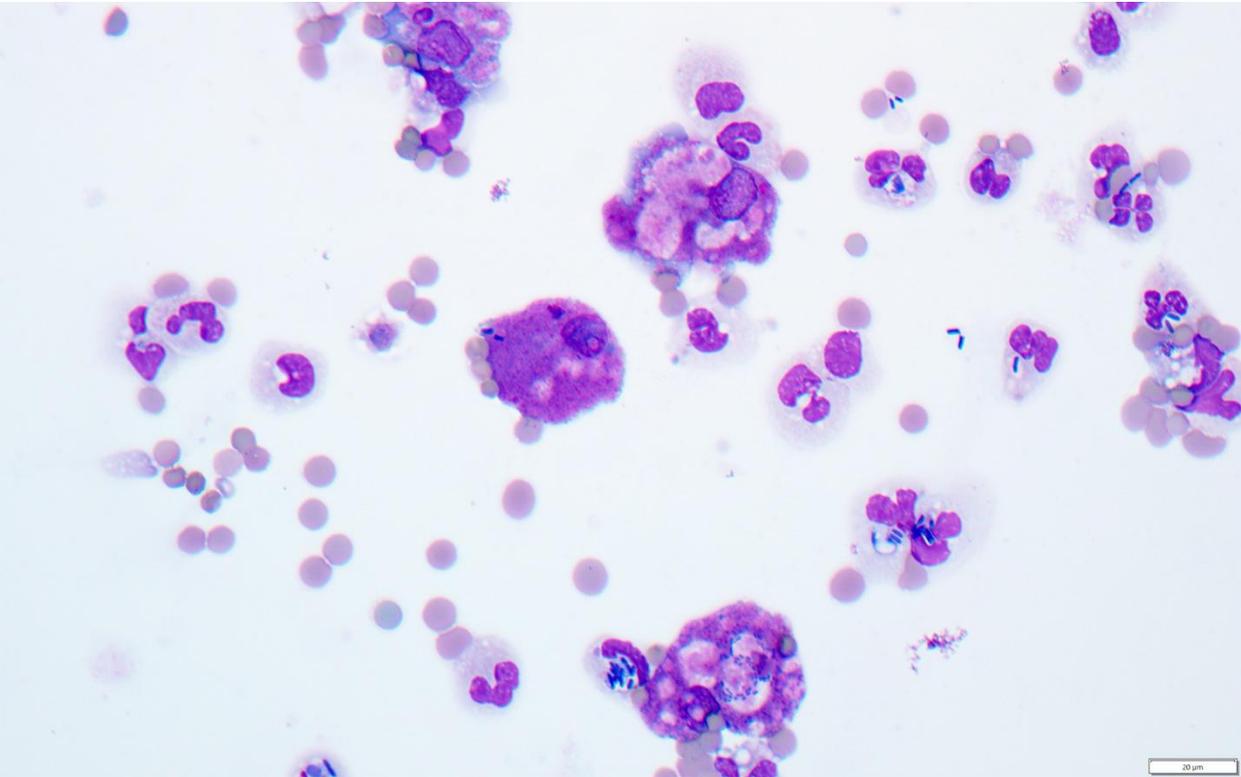


Figure 1: Cytocentrifuged preparation of urine sediment; 60x objective, Modified Wright-Giemsa

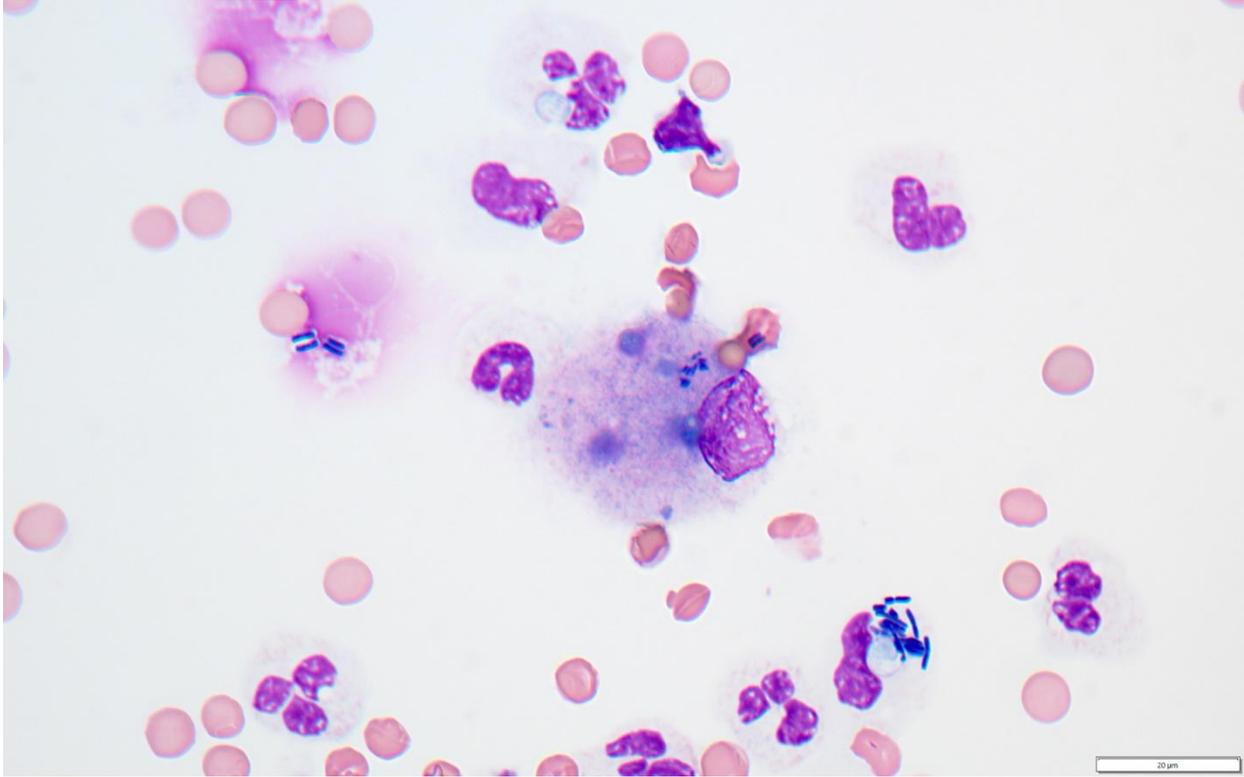


Figure 2: Cytocentrifuged preparation of urine sediment; 100x objective, Modified Wright-Giemsa

ADDITIONAL DIAGNOSTIC TESTS:

Urine Culture (cystocentesis): Heavy bacterial growth of *E. coli*, nonhemolytic

Abdominal Ultrasound: Severe urinary bladder wall and urethral thickening with multifocal smoothly marginated wall proliferations and echogenic urinary contents (Figure 3). The caudal descending colon wall is also mildly thickened.

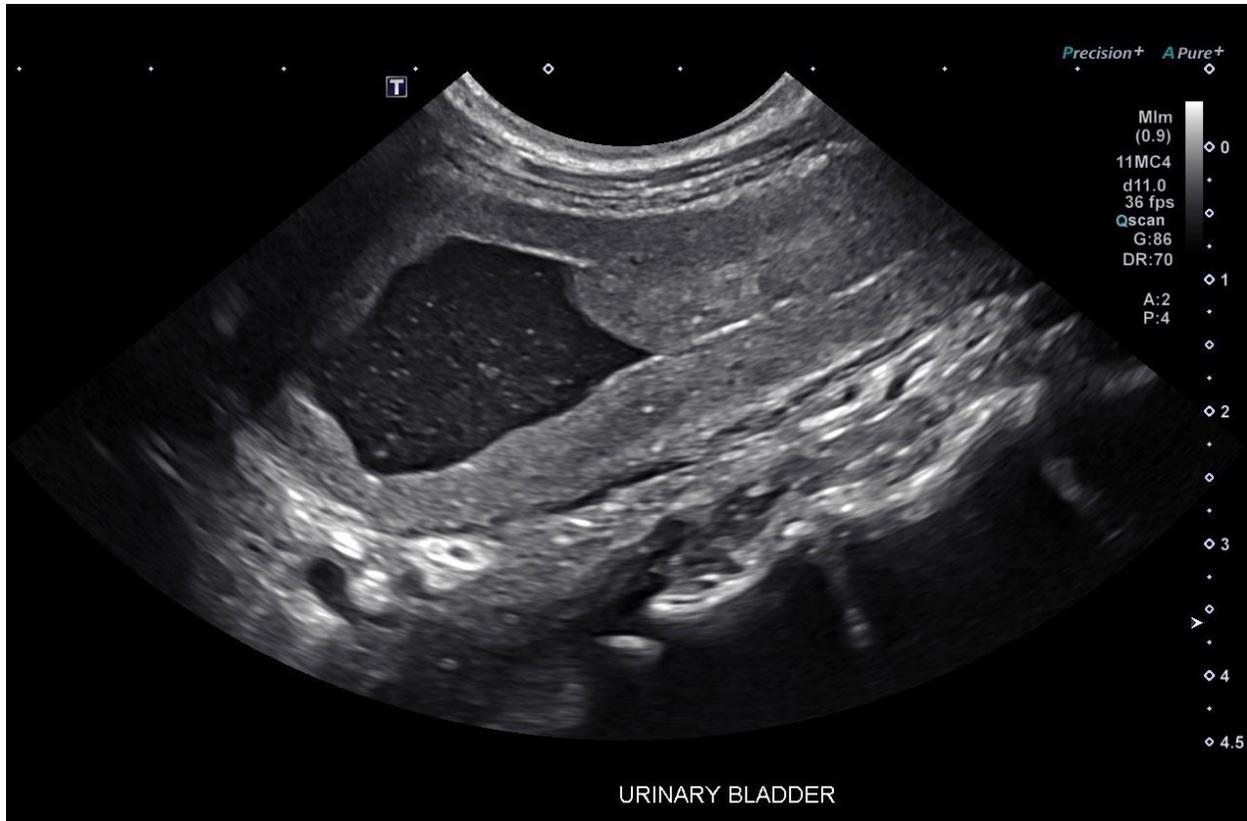


Figure 3: Sagittal view ultrasound image of the urinary bladder

QUESTIONS:

1. Based on cytological findings, what cytochemical stain would best highlight the larger round cellular inclusions (as seen in Figure 2)?
 - a. Von Kossa
 - b. Toluidine Blue
 - c. Sudan Black B
 - d. Periodic acid-Schiff
2. What other disease might have a similar pathologic mechanism to the condition depicted in this case?
 - a. Granulomatous colitis
 - b. Erosive immune-mediated polyarthritis
 - c. Cutaneous sterile granuloma syndrome

CONTRIBUTOR NAME*	Diya Sharma-LaHue
CONTRIBUTOR EMAIL*	Diya.Sharma@crl.com
COMPANY OR UNIVERSITY	Charles River Laboratories Inc.

* Corresponding contributor

SPECIMEN: Peripheral blood

SIGNALMENT: Approximately 3-year-old male purpose-bred Vietnamese cynomolgus macaque (*Macaca fascicularis*)

HISTORY AND CLINICAL FINDINGS:

The macaque was enrolled in a nonclinical toxicity study with the goal of evaluating the effects of a large molecule test article in development for the treatment of autoimmune diseases. The test article was administered to cynomolgus macaques at a low-, mid-, or high-dose level via once-weekly subcutaneous injection or at a high-dose level via once-weekly intravenous injection for 4 weeks, followed by an 8-week off-dose observation (recovery) period. The macaque highlighted in this case was assigned to the low-dose subcutaneous injection group. At the time of study enrollment, the macaque was healthy and had an unremarkable physical exam and baseline blood work (CBC, coagulation, and clinical chemistry panels) and Urinalysis.

Due to declining clinical condition and failure to respond to veterinary treatment, the macaque was euthanized on study Day 74, during the recovery period. Clinical signs prior to euthanasia consisted of weakness, decreased activity, weight loss with a low body condition score (1.5/5), liquid feces, and mild dehydration. Blood samples could not be collected from the macaque at the time of euthanasia due to the poor clinical condition. However, non-fasted blood work (CBC and Clinical Chemistry panels) were previously performed on study Day 57 as part of scheduled study collections, with results presented below.

LABORATORY DATA:

Study Day 57 Hemogram Results (ADVIA 2120 analyzer)

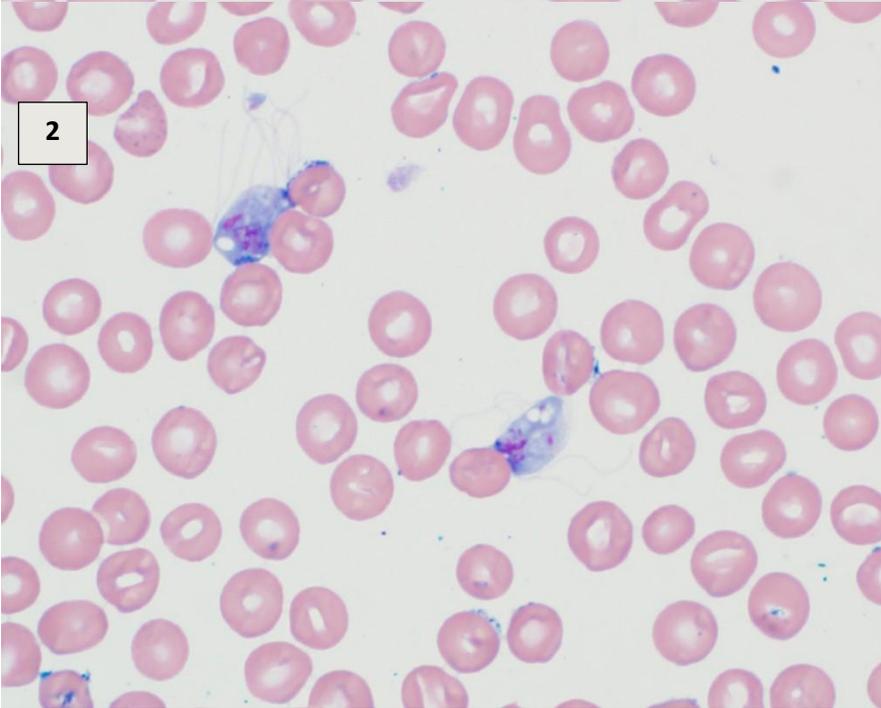
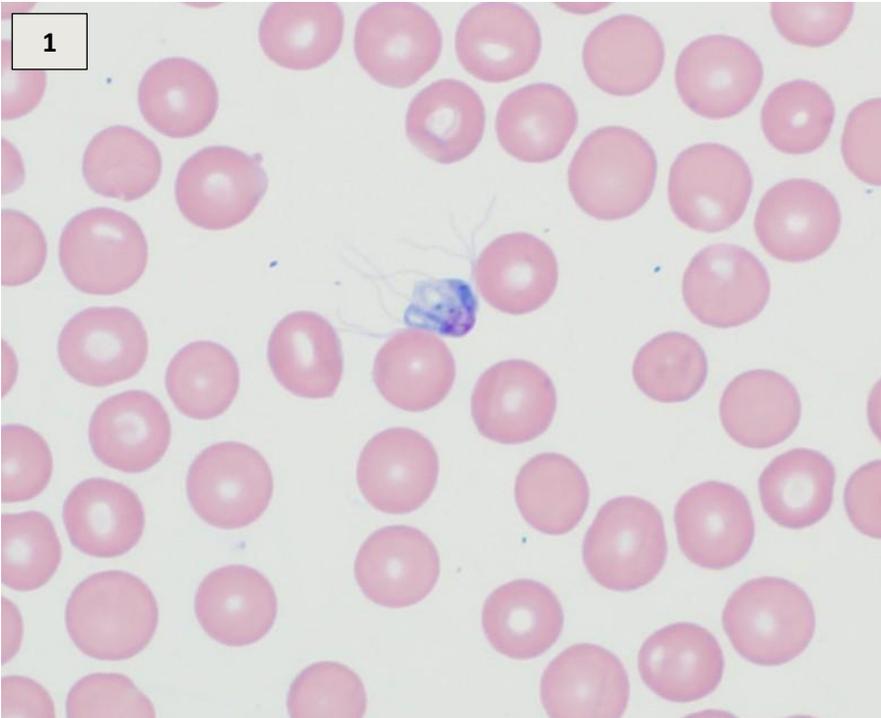
TEST	UNITS	RESULT	REFERENCE INTERVAL
HCT	%	28.6 (L)	40.2 – 50.0
HGB	g/dL	8.8 (L)	12.3 – 15.1
RBC	x 10 ⁶ /μL	4.41 (L)	5.03 – 6.69
MCV	fL	64.7 (L)	68.9 - 85.9
RDW	%	13.3	11.4 – 14.6
MCH	pg	20.0 (L)	21.6 – 25.6

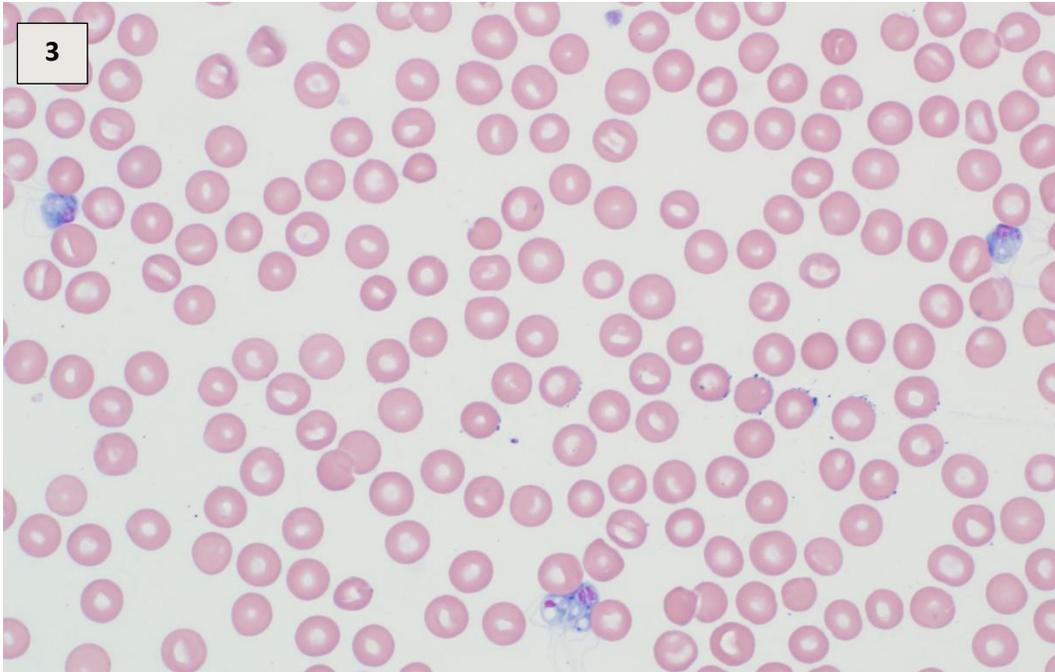
MCHC	g/dL	30.9	28.5 – 32.1
RETIC	x 10 ⁹ /L	27 (L)	30 - 114
PLT	X 10 ³ /μL	55 (L)	252 - 582
WBC	X 10 ³ /μL	8.49	7.5 – 23.9
NEUT	X 10 ³ /μL	4.16	2.22 – 16.78
LYMPH	X 10 ³ /μL	3.91	2.83 – 12.99
MONO	X 10 ³ /μL	0.34	0.17 – 0.76
EOS	X 10 ³ /μL	0.08	0.02 – 0.34
BASO	X 10 ³ /μL	0.00 (L)	0.02 – 0.15

Note: WBC differential cell counts reflect manual differential cell counts.

Study Day 57 Clinical Chemistry Results (Cobas analyzer)

TEST	UNITS	RESULT	REFERENCE INTERVAL
ALT	U/L	85 (H)	22 – 80
AST	U/L	100	25 – 125
ALP	U/L	949 (H)	85 - 732
GGT	U/L	26 (L)	33 - 194
CK	U/L	92 (L)	125 - 5537
TBIL	mg/dL	0.37	0.1 – 0.4
UREA	mg/dL	40 (H)	16 - 31
CREAT	mg/dL	0.5 (L)	0.6 – 1.4
CA	mg/dL	8.1 (L)	9.2 – 11.4
PHOS	mg/dL	4.5	3.6 – 7.3
TP	g/dL	3.9 (L)	6.5 – 8.2
ALB	g/dL	1.9 (L)	3.7 – 5.0
GLOB	g/dL	2.0 (L)	2.3 – 3.9
GLUC	mg/dL	70	56 – 123
CHOL	mg/dL	99	82 - 187
TRIG	mg/dL	109 (H)	26 - 97
NA	mEq/L	145	143 - 155
K	mEq/L	4.2	3.8 – 6.6
CL	mEq/L	105	101 - 113
C-reactive protein	mg/dL	22.60 (H)	0.03 – 1.88





Images 1 to 3: peripheral blood smear from a male cynomolgus macaque. Sample collected on study Day 57. 100x objective, Wright-Giemsa stain.

QUESTIONS:

1. How are the depicted organisms likely transmitted?
 - a. Fecal-orally
 - b. Mosquito vector
 - c. Reproductively
 - d. Tick vector

2. In what animal species does infection with this organism more commonly occur?
 - a. Bovine
 - b. Canine
 - c. Feline
 - d. Fish

CONTRIBUTOR NAME*	Em Adam
CONTRIBUTOR EMAIL*	adam21@purdue.edu
COAUTHORS	Dr. Craig Thompson, Dr. Joanne Messick, Dr, Andrea Pires dos Santos
COMPANY OR UNIVERSITY	Purdue University

* Corresponding contributor

SPECIMEN: Peripheral blood, Modified-Wright’s stain, glass slide

SIGNALMENT: 7-year and 6-month-old, female-spayed mixed breed dog

HISTORY AND CLINICAL FINDINGS:

The dog presented to the referring veterinarian in early January 2023 for a two- to three-week history of mild left forelimb lameness. Later that month, the owners noted a painful, firm swelling over the distal left fourth metacarpal bone. Radiographs revealed an expansile lesion confined to that bone along with mild hepatomegaly likely due to fat accumulation. In February, the affected metacarpal was amputated due to progression of the swelling and lameness.

Histopathology confirmed an intramedullary plasma cell tumor. However, in the absence of staging (e.g., assessment for lytic bone lesions or hyperglobulinemia), it remained unclear whether the lesion represented a solitary osseous plasmacytoma or multiple myeloma.

Two months after amputation (April 2023), multiple new subcutaneous masses developed, including on the right caudal abdomen, left cranial and caudal thigh, and right ventral thorax. Cytology of one mass confirmed a plasma cell tumor. Due to disease progression, the dog was started on cyclophosphamide and furosemide. While on cyclophosphamide, the masses remained stable. Prednisone was also initiated and tapered over three weeks. In June, due to financial constraints, treatment was switched to melphalan with continued prednisone. The dog remained clinically stable, but the masses slowly increased in number and size.

In June 2024, the dog was evaluated by the rDVM for coughing and wheezing. Thoracic radiographs were unremarkable, and clinical signs improved within weeks. However, a new subcutaneous mass near the right thyroid was noted. With continued mass progression and recurrence of coughing accompanied by neck mass enlargement, the dog was referred to the Purdue University Oncology Service in July 2024. Diagnostics included serial bloodwork, PARR, flow cytometry, and cytology.

LABORATORY DATA:

Table 1. CBC results with blood smear review at Purdue University (Siemens Advia 2120i)

TEST	8/28/24	10/18/24	12/4/24	Reference Interval
HCT	42.9	40.6	40.6	37-55%
RBC	6.2	6.2	6.6	5.5-8.5 M/ μ L
Hgb	13.8	13.1	13.2	12-18 g/dL
MCV	69.2	65.7	61.7	60-75 fL
MCHC	32.2	32.3	32.6	32-36 g/dL
Reticulocytes	34.3	29.6	127.2 (H)	<100 K/ μ L
WBC	11.5	10	6.3	6-17 K/ μ L
Seg Neutrophils	10.7	9	3.8	3-12 K/ μ L
Lymphocytes	0.5 (L)	0.3 (L)	1.8	1-5 K/ μ L
Monocytes	0.35	0.6	0.44	0.15-1.35 K/ μ L
Eosinophils	0 (L)	0.1	0.13	0.10-1.25 K/ μ L
Platelets (PLTs)	200	100 (L)	26 (L)	200-500 K/ μ L
Comments	- Clumped PLTs - Enlarged PLTs - 2+ poikilocytes	- Clumped PLTs - 1+ poikilocytes - Noted keratocytes	- Enlarged PLTs - Increased rouleaux - 1+ anisocytosis - Rare keratocytes, poikilocytes, polychromasia, & schistocytes - Low number of atypical lymphocytes	

Table 2. Serum chemistry analysis at Purdue University (VITROS 4600 Chemistry System)

TEST	8/28/24	10/18/24	12/4/24	Reference Interval
Glucose	97	97	90	67-132 mg/dL
BUN	20	17	26	7-32 mg/dL
Creatinine	0.6	0.7	1.3	0.50-1.50 mg/dL
Phosphorus	4.5	5.1	4.7	2.2-7.9 mg/dL
Calcium	10.7	10.7	15.1 (H)	9.7-12.3 mg/dL
Sodium	144	142	141	138-148 mmol/L
Potassium	4.2	4.6	5.7 (H)	3.5-5.0 mmol/L
Chloride	119 (H)	108	103 (L)	105-117 mmol/L
CO2	18	20	25 (H)	13-24 mmol/L
Anion Gap	11.2	18.6 (H)	18.7 (H)	9-18 mmol/L
Total Protein	6.9	6.4	8.2 (H)	4.8-6.9 g/dL
Albumin	4.2 (H)	3.9	3.6	2.3-3.9 g/dL
Globulin	2.7	2.5	4.6 (H)	1.7-3.8 g/dL
ALT	62	203 (H)	463 (H)	3-69 IU/L
ALP	434 (H)	831 (H)	969 (H)	20-157 IU/L
GGT	<10	<10	11	5-16 IU/L

Total Bilirubin	0.7	0.2	0.3	0.10-0.80 mg/dL
Cholesterol	217	246	183	125-301 mg/dL
Amylase	443	489	578	378-1033 IU/L
Lipase	1174	2552 (H)	1870 (H)	104-1753 IU/L

Peripheral Blood Results:

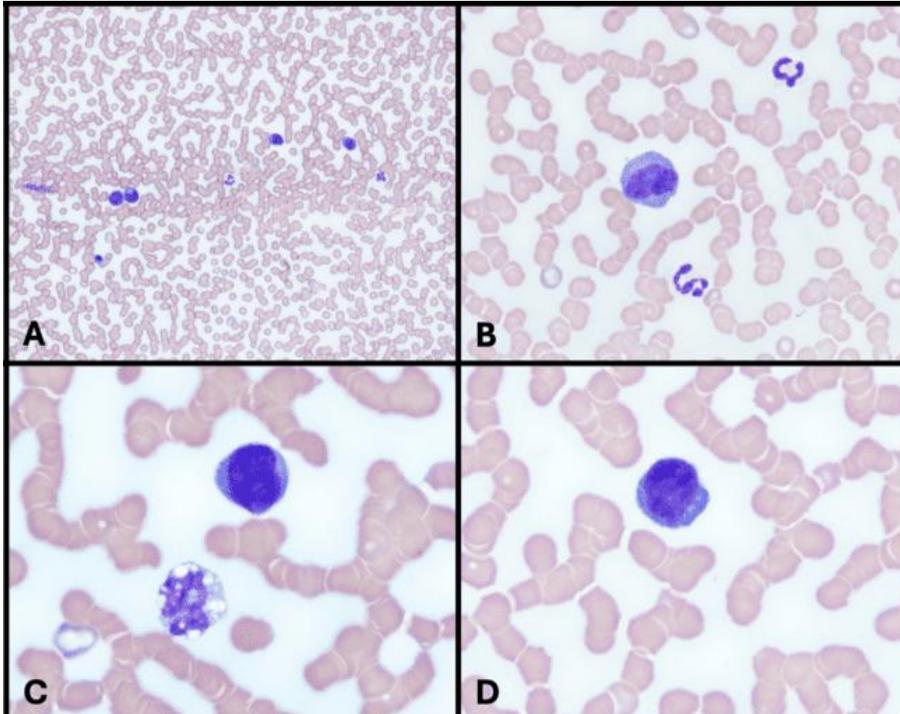


Figure 1. Peripheral blood. (December 2024) (A) 20x, (B) 60x, and (C, D) 100x. Modified-Wright's stain.

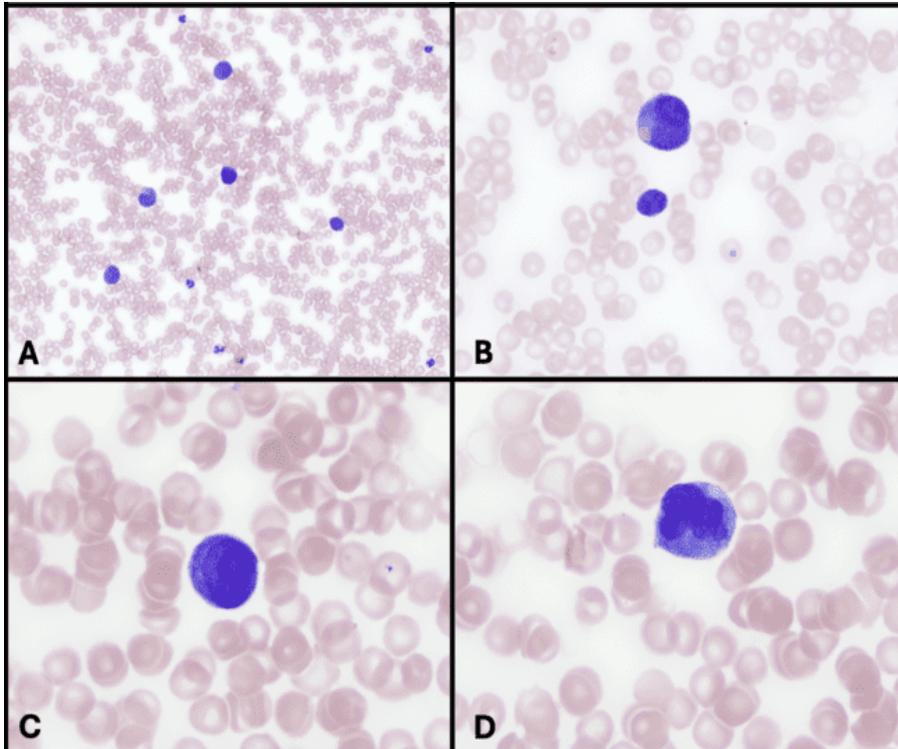


Figure 2. Ventral abdominal skin mass. (August 2024) (A) 20x, (B) 60x, and (C, D) 100x. Modified-Wright's stain.

ADDITIONAL DIAGNOSTIC TESTS:

1. Cytology Fine Needle Aspirate Submission (Purdue University)
 - a. Ventral abdominal skin mass
 - i. Interpretation: Round cell tumor
 - ii. Comment: Cell morphology shows overlapping characteristics of plasma cells and lymphocytes.
 - b. Spleen
 - i. Interpretation: Minimal extramedullary hematopoiesis
 - ii. Comment: No overt neoplasia seen
 - c. Liver
 - i. Interpretation: No significant abnormal findings
2. PARR and flow cytometry (Colorado State University)
 - a. Ventral abdominal skin mass (8/28/24)
 - i. Clonal immunoglobulin gene, Polyclonal T cell receptor (TCR) gene
 - ii. Large cells express CD45 with no other antigens detected
 1. Interpretation: Neoplasia
 - b. Peripheral blood (12/4/24)
 - i. Clonal immunoglobulin gene, Clonal TCR gene
 - ii. Large cells express CD45 with no other antigens detected
 1. Comment: PCR product size and phenotype are same as neoplastic cells from cutaneous aspirate

- iii. Minor population of small T cells with aberrant phenotype
 - 1. Express CD5 and normal class II MHC and lack CD4, CD8, and CD3 expression
 - 2. PCR product below the threshold for definitive diagnosis of neoplasia
- 3. Serum Protein Electrophoresis (Antech)
 - a. Large monoclonal peak in the beta region
 - b. Differential diagnoses include multiple myeloma, macroglobulinemia, lymphoma, or canine ehrlichiosis
- 4. Snap 4Dx Plus Test (IDEXX)
 - a. *Anaplasma* sp., *Ehrlichia* sp., and *Borrelia burgdorferi* antibodies: Negative
 - b. *Dirofilaria immitis* antigen: Negative

QUESTIONS:

- 1. Which immunohistochemical stain(s) would you have selected if histopathology had been performed on the ventral abdominal skin mass? (Select all that apply)
 - a. CD3/CD4
 - b. CD21/CD79
 - c. MUM1
 - d. Iba1
- 2. What are potential explanations for identifying clonal rearrangements in both immunoglobulin and TCR genes? (Select all that apply)
 - a. Two separate neoplasms
 - b. Myeloid neoplasm
 - c. NK cell neoplasm
 - d. Precursor neoplasm

CONTRIBUTOR NAME*	Kimia Alizadeh
CONTRIBUTOR EMAIL*	kimdvm@illinois.edu
COAUTHORS	Dr. Michael Rosser, Dr. Joseph Bruner and Dr. Denzel Adam
COMPANY OR UNIVERSITY	University of Illinois Urbana-Champaign

* Corresponding contributor

SPECIMEN: Liver aspirate cytology slide (digital)

SIGNALMENT: 2-year-old, Female Spayed, German Shorthair Pointer

HISTORY AND CLINICAL FINDINGS: Jodie presented to the University of Illinois Veterinary Teaching Hospital on 11/02/2024 for hypercalcemia and a 3 day history of hyporexia. Jodie initially visited her primary veterinarian on 11/06/2024 for lethargy and hyporexia when blood work revealed hypercalcemia. No history of coughing, sneezing, vomiting or diarrhea was reported. The owner did not report any polydipsia or polyuria either. Jodie is an outdoor dog and was on a hunting trip in Alabama in November and March of 2024 where she was used for quail hunting.

Upon presentation to the U of I Emergency Service on 11/8/24, Jodie's vitals were within normal limits. On physical exam, she had severe generalized muscle wasting with a body condition score of 3/9 and enlarged prescapular lymph nodes. Thoracic radiographs and CBC were unremarkable. Chemistry findings are mentioned in Table 1. Baseline cortisol was mildly increased (136.0 nmol/L, Reference Interval: 57.0 - 114.0). No vitamin D supplement consumption or known toxin exposure were reported.

LABORATORY DATA:

Table 1. Serum chemistry panel (Beckman Coulter DxC 700 AU)

TEST	UNITS	RESULT (FLAG-H/L)	REFERENCE INTERVAL
Creatinine	mg/dL	0.6	0.5-1.5
BUN	mg/dL	19	6-30
Total Protein	g/dL	8.3 (H)	5.1-7
Albumin	g/dL	3.1	2.5-3.8
Globulins	g/dL	5.2 (H)	2.7-4.4
Albumin/Globulin Ratio		0.6	0.6-1.1
Total Calcium	mg/dL	15.4 (H)	7.6-11.4

Phosphorus	mg/dL	3.7	2.7-5.2
Sodium	mmol/L	152	141-152
Potassium	mmol/L	4.3	3.9-5.5
Sodium/Potassium Ratio		35	28-36
Chloride	mmol/L	114	107-118
Glucose	mg/dL	98	68-126
ALP total	U/L	33	7-92
CIALP	U/L	1	0-40
ALT (SGPT)	U/L	33	11-74
AST (SGOT)	U/L	58	11-74
GGT	U/L	4	0-7
Total Bilirubin	mg/dL	0.2	0.1-0.3
CPK (CK)	U/L	234	26-310
Cholesterol total	mg/dL	160	129-297
Triglyceride	mg/dL	68	32-154
Bicarbonate	mmol/L	27 (H)	16-24
Anion Gap		15	8-25

IMAGING: Abdominal and thoracic ultrasound were performed on 11/11/2024. No free fluid or masses were noted in the abdomen or chest. The liver was mildly enlarged with rounded margins and mildly heterogeneous echotexture without discrete nodules or masses. The ileocolic lymph nodes were mildly enlarged, rounded, and peripherally hypoechoic. Ultrasound guided fine needle aspirates of the liver and spleen as well as the prescapular lymph node were obtained.

CYTOLOGY: Cytology of the left prescapular lymph node aspirate showed mild reactivity. The splenic aspirate showed evidence of mild extra medullary hematopoiesis. Cytology images from multiple locations of the liver are presented below (Figures 1-4).

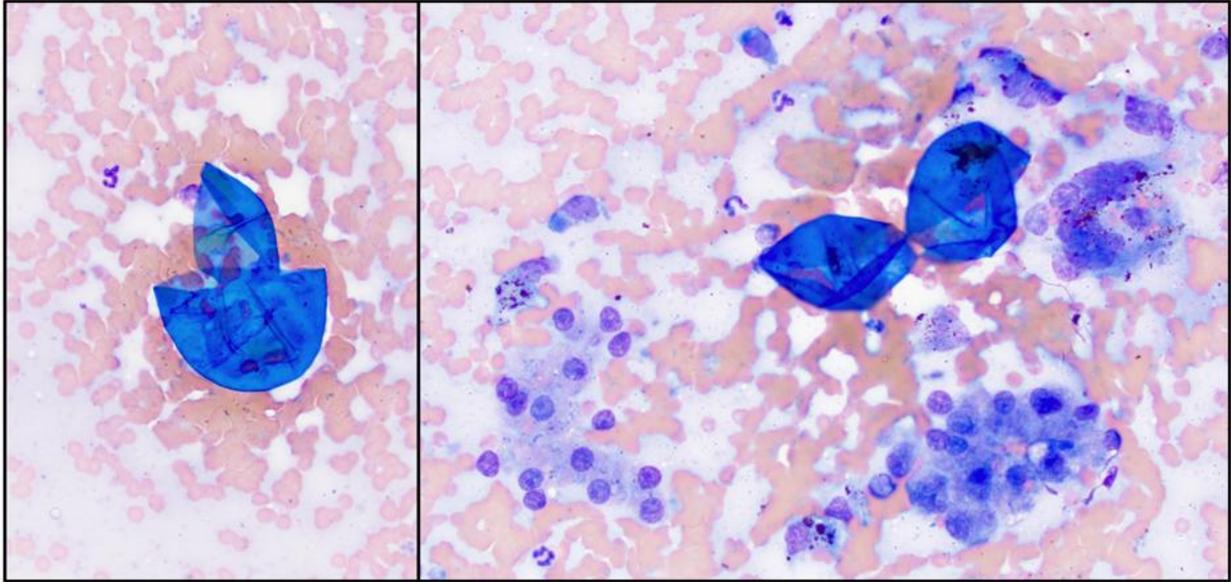


Figure 1. Liver aspirate, 50x objective. Wright Giemsa

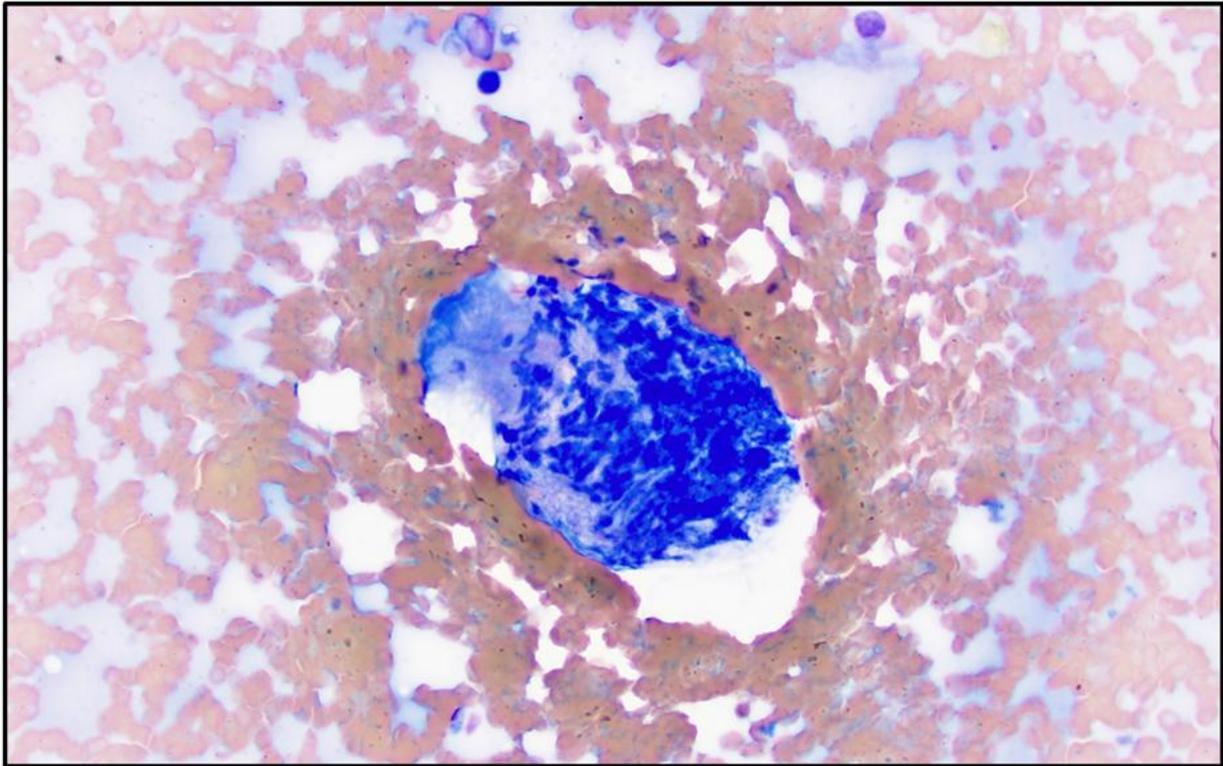


Figure 2. Liver aspirate, 50x objective. Wright Giemsa

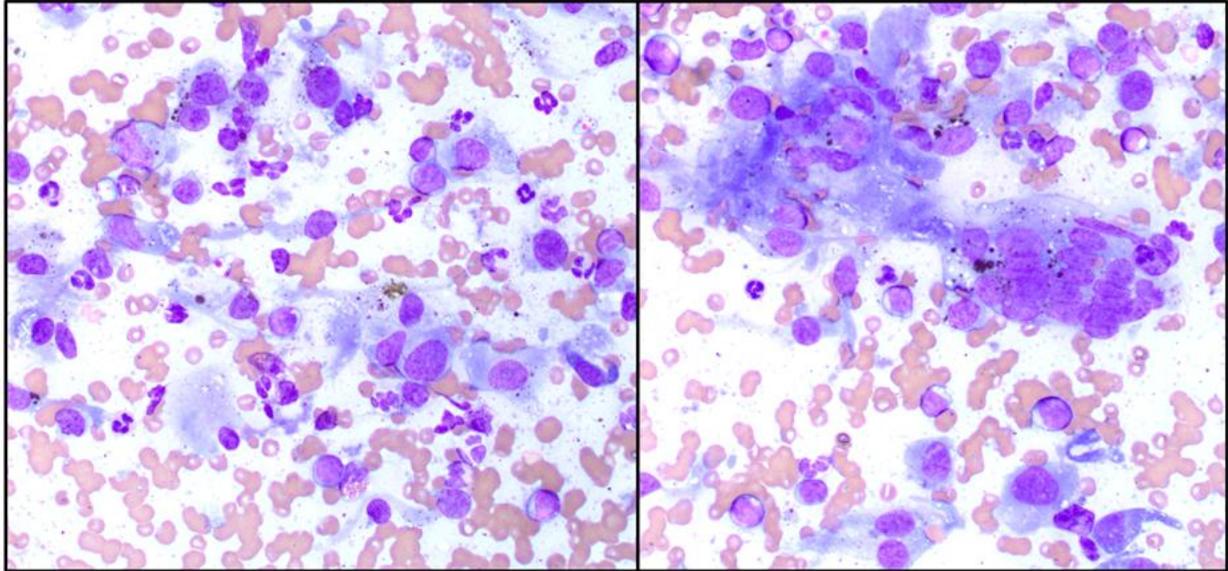


Figure 3. Liver aspirate, 50x objective. Wright Giemsa

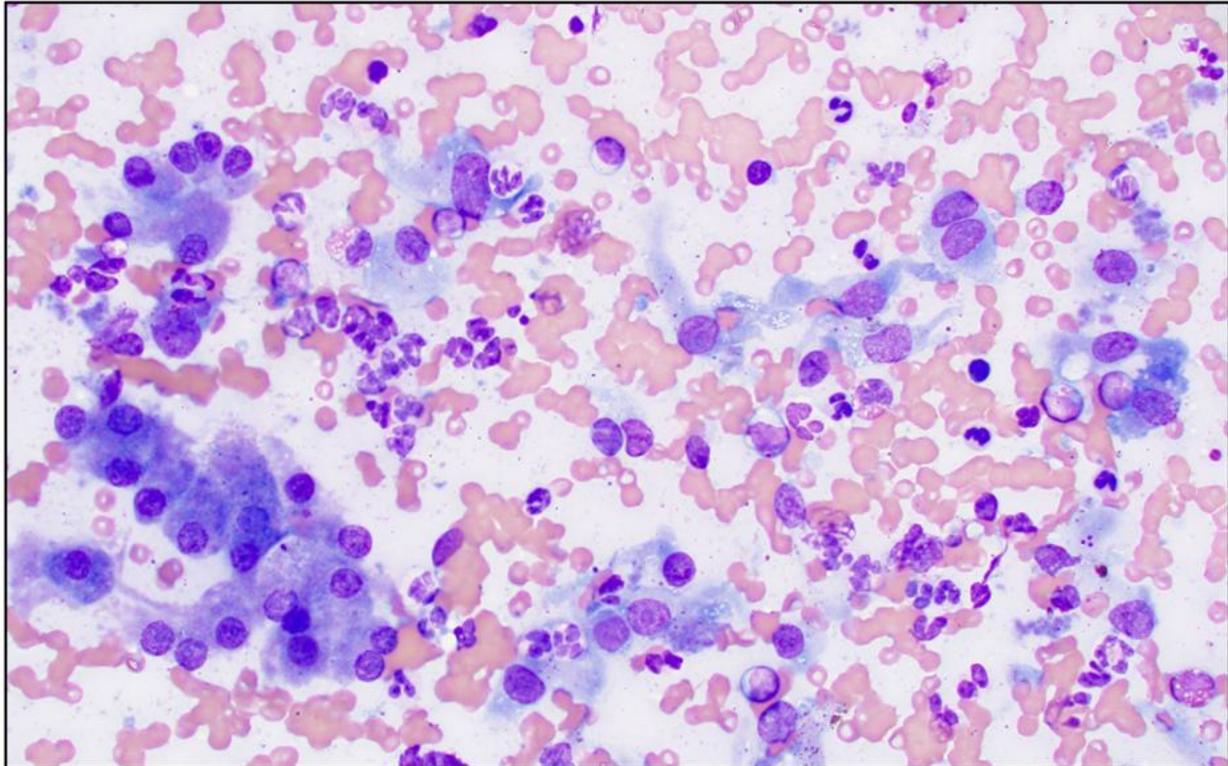


Figure 4. Liver aspirate, 50x objective. Wright Giemsa

ADDITIONAL DIAGNOSTIC TESTS: Malignancy profile and calcitriol measurements were performed on 11/13/2024 at Michigan State University. Results are summarized in Table 2.

Table 2. Malignancy profile and calcitriol

TEST	UNITS	RESULT (FLAG-H/L)	REFERENCE INTERVAL
Parathyroid Hormone (CLIA)	pmol/L	<0.50 (L)	1.10-10.601
Ionized Calcium (ISE)	mmol/L	2.06 (H)	1.25-1.45
Parathormone Related Protein (RIA)	pmol/L	0.0	0.0-1.0
Calcitriol (RIA)	pmol/L	337	164-523

QUESTIONS:

1. Which of the following histopathological changes have been described with this organism?
 - a. Granulomatous inflammation
 - b. Fibrosis
 - c. Pigments in macrophages
 - d. All of the above

2. Which method is the most helpful for detection of the parasite ova in the feces?
 - a. Centrifugal floatation
 - b. Passive floatation
 - c. Sodium chloride sedimentation
 - d. Direct fecal smear exam

CONTRIBUTOR NAME*	Alison Vancouver
CONTRIBUTOR EMAIL*	avancouv@purdue.edu
COAUTHORS	Camila Mello, Cassandra Powers, Craig Thompson, Joanne B. Messick, Andrea Pires dos Santos
COMPANY OR UNIVERSITY	Purdue University

* Corresponding contributor

SPECIMEN: Fine needle aspirate, kidney mass, Modified-Wright stain, digital scanned slide

SIGNALMENT: 4-year-old female intact Hedgehog

HISTORY AND CLINICAL FINDINGS:

A 4-year-old female hedgehog presented to Purdue University Veterinary Hospital (PUVH) primary care service after her owner observed weight loss, mild polydipsia, and increased dander. Over the 6 weeks prior to presentation, the hedgehog gained approximately 30-40 grams, and the polydipsia appeared to resolve after the owner began monitoring her weight and supplementing her ad libitum dry diet with moistened chow. Normally she was a very active and petite hedgehog with no history of illness. She was acquired from a USDA-registered breeder shortly after weaning and had no known exposure to infectious diseases.

On initial physical examination, the hedgehog was mildly underconditioned (body condition score 4/9) with moderately flaky skin, severe dental calculus, and a possible swelling above the left eye. Cytologic evaluation of the swelling was non-diagnostic, showing peripheral blood contamination. A complete blood count (CBC), serum chemistry mini-panel, and urinalysis were performed. Results of the CBC and urinalysis are presented in Tables 1 and 2. The most notable finding on the chemistry panel was a possible minimal hyperglycemia of 130 mg/dL (Reference interval: 60-125 mg/dL).

An abdominal ultrasound performed at a recheck visit three days later identified a 4mm nodule in the right kidney, a scant amount of peritoneal fluid, and cystic structures containing echogenic material within the uterus. Empiric treatment for suspected pyometra was initiated with amoxicillin (5 mg PO BID for 10 days), and the patient was gradually transitioned to a prescription renal diet due to concerns about declining renal function. An ultrasound-guided fine-needle aspirate biopsy (FNAB) of the renal nodule was performed (Figure 1).

LABORATORY DATA (day of presentation):

Table 1. Complete blood count results including manual differential based on blood smear evaluation (Siemens Advia 2120i)

TEST	RESULT (FLAG-H/L)	Reference Interval
Total Protein (plasma)	7.3 g/dL	N/A
HCT	31.8 % (L)	33.5-47 %
RBC	4.74 M/uL	4.3-6.0 x 10 ⁶ /uL
Hgb	10.7 g/dL	10.7-14.9 g/dL
MCV	67.1 fL (L)	76.3-99.8 fL
MCHC	33.6 g/dL	27.7-35.2 g/dL
Reticulocytes	775.4 K/uL (H)	
nRBC	3 /100 WBC	
WBC	9.6 K/uL (L)	11.5-21.7 x10 ³ /uL
Seg Neutrophils	3.7 K/uL (L)	6.1-14.6 K/uL
Lymphocytes	2.9 K/uL (L)	3.3-8.9 K/uL
Monocytes	0.76 K/uL	0.0-0.8 K/uL
Eosinophils	2.1 K/uL (H)	0.0-0.3 K/uL
Platelets	44 *clumped* (L)	*226 K/uL (33-560)
Comments:	2+ anisocytosis, 3+ polychromasia, adequate platelets, enlarged platelets noted. Eosinophils are mature. Reactive lymphs noted.	

Table 2: Urinalysis with microscopic review

TEST	RESULT	REFERENCE INTERVAL
Source	Off floor	
Color	Pale Yellow, Hazy	
Turbidity	Hazy	
Specific Gravity	1.037	1.010-1.030
pH	6.0	5-8
Protein	2+	Negative
Glucose	3+	Negative
Ketones	1+	Negative
Bilirubin	Negative	
Blood	3+	Negative
WBC	0-2/hpf	
Epithelial Cells	0-2/hpf	
Bacteria	1+	

Fat Globules	Few	
--------------	-----	--

Reference intervals for CBC and chemistry: Grayson A. Doss, James W. Carpenter, Chapter 8 - Hedgehogs, Editor(s): James Carpenter, Craig Harms, Carpenter's Exotic Animal Formulary (Sixth Edition), W.B. Saunders, 2023, Pages 511-52

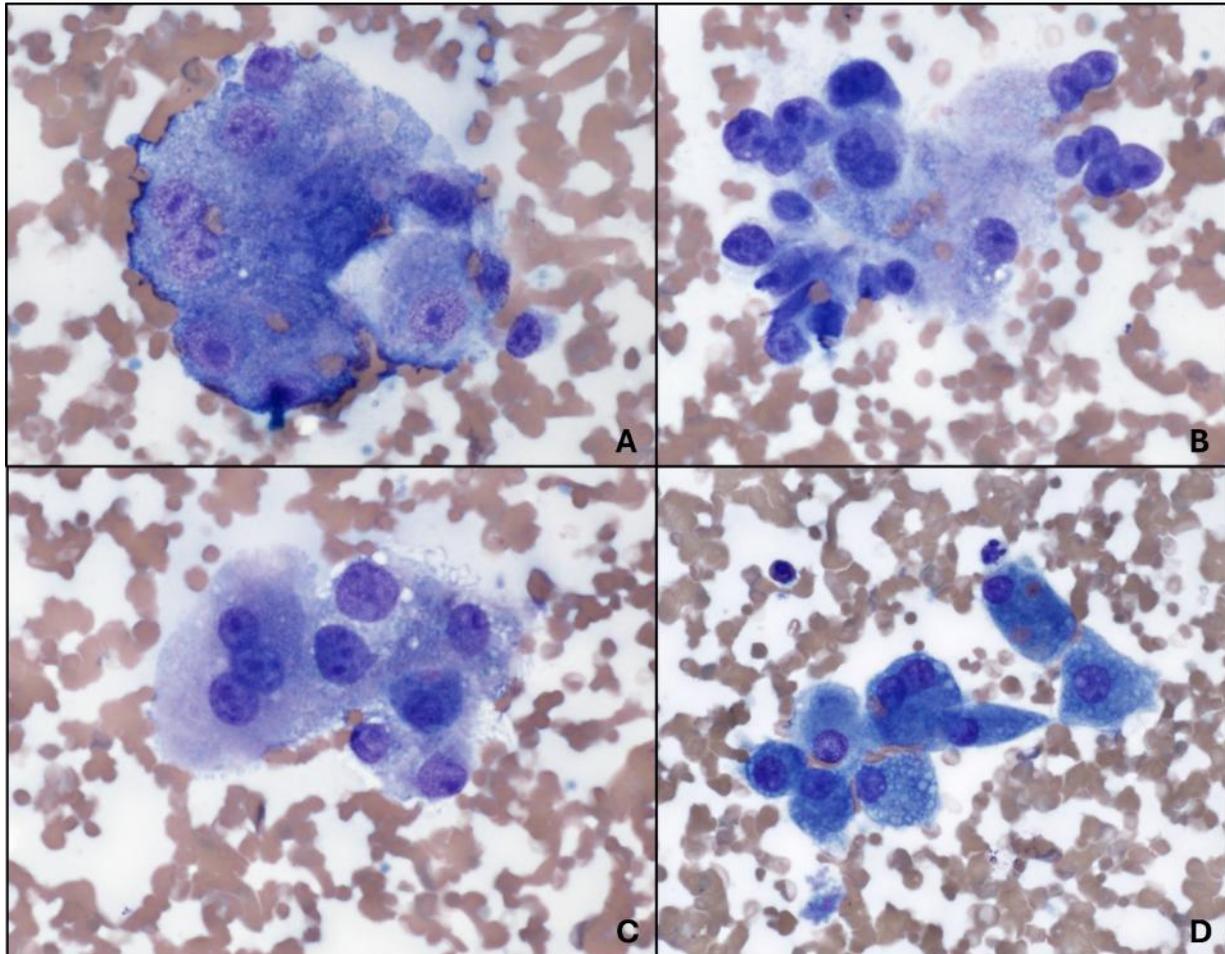


Figure 1. Fine needle aspirate of a mass in the right kidney (ultrasound-guided) in a hedgehog; modified Wright's stain; 60x objective.

ADDITIONAL DIAGNOSTIC TESTS:

Fecal floatation was negative. Urine reagent test strips performed at home by the owner (a veterinarian) over the following few weeks consistently showed 3+ glucose and 1+ ketones. Three days after the initial visit, a full serum chemistry panel was unremarkable, with a normal blood glucose concentration of 118 mg/dL. However, a concurrent urinalysis collected via cystocentesis revealed proteinuria (2+), marked glucosuria (4+), and ketonuria (1+), and a specific gravity of 1.041.

QUESTIONS:

1. What is/are your top differential(s) for the renal nodule?
 - a. Histiocytic sarcoma
 - b. Hepatocellular carcinoma
 - c. Renal cell carcinoma
 - d. Transitional cell carcinoma

2. What is/are a possible explanation(s) for the persistent glucosuria with ketonuria and proteinuria?
 - a. Paraneoplastic syndrome
 - b. Primary renal glucosuria
 - c. Diabetes Mellitus
 - d. Glomerulonephropathy



MYSTERY CASE SESSION
CASE HISTORIES
CASE #7

CONTRIBUTOR NAME*	Latifat Adekunle, DVM, MSc.
CONTRIBUTOR EMAIL*	Adekunll@oregonstate.edu
COAUTHORS	Kyle Hager, Jennifer Johns
COMPANY OR UNIVERSITY	Oregon State University

* Corresponding contributor

SPECIMEN: Peritoneal fluid

SIGNALMENT: 9-year-old, male neutered Pembroke Welsh Corgi

HISTORY AND CLINICAL FINDINGS:

Ryan was presented to the Small Animal Internal Medicine Service at Oregon State University Veterinary Teaching Hospital (OSU-VTH) for further evaluation of suspected abdominal mass and effusion.

On 1/6/25, Ryan presented to his primary care veterinarian, where, during physical exam, a firm mass-like structure was palpated in the abdomen. On ultrasound, an abnormal heterogenous structure cranial to the bladder was visible, while radiographs showed a mixed soft tissue and fat opacity effect that displaced the gastrointestinal tract caudally and to the left. A complete blood count and chemistry were performed and were unremarkable. The patient was referred to the OSU-VTH for advanced imaging on 1/9/25. An abdominal CT was performed, and findings were concerning a linear foreign body (bunching and suspected plication of the duodenum and jejunum) with mineral opaque contents in the pyloric antrum and jejunum, along with a medium volume of peritoneal fluid. Post-imaging abdominocentesis was performed. Peritoneal fluid appeared silver, opaque, and shimmering. The fluid was submitted for cytology fluid analysis and evaluation. Within hours, he was transferred to the OSU Soft Tissue Surgery service for exploratory laparotomy. Surgical findings included extensive fibrous adhesions and abdominal effusion. No intestinal foreign body was present. A diagnosis of sclerosing encapsulated peritonitis with abdominal effusion was made. Biopsy of the thickened peritoneum was also submitted for histopathology.

Two weeks after exploratory surgery (1/24/25), the patient was presented to the Small Animal Internal Medicine (SAIM) unit for a swollen abdomen. Ultrasound showed severe small intestinal aggregation with severe peritonitis/adhesion and small peritoneal nodules. A large amount of peritoneal fluid was noted, aspirated, and submitted for cytological

evaluation. Unfortunately, he was reported to be doing poorly at home a few weeks after the surgery and was humanely euthanized.

LABORATORY DATA:

Automated and manual peritoneal fluid data on 01/09/2025 (Before surgery)

PARAMETER	UNIT	RESULT
Automated nucleated cell count	/uL	22560
Manual nucleated cell count	/uL	108
Total protein	g/dL	2.7
RBC	10 ⁶ /uL	<0.10
PCV	%	<1.0
Fluid color	NA	Milky
Fluid transparency	NA	Opaque

Serum and fluid cholesterol and triglyceride data on 01/09/2025

Parameter	Unit	Result	Reference interval
Serum			
Cholesterol	mg/dL	207	144 - 367
Triglyceride	mg/dL	36	20 - 120
Peritoneal fluid			
Cholesterol	mg/dL	200	144 - 367
Triglyceride	mg/dL	42	20 - 120

Automated peritoneal fluid data on 01/24/2025 (After surgery)

PARAMETER	UNIT	RESULT
Nucleated cell count	/uL	1210
Total protein	g/dL	2.4
RBC	10 ⁶ /uL	1.17
PCV	%	8
Fluid color	NA	Red
Fluid transparency	NA	Opaque

ADDITIONAL DIAGNOSTIC TESTS:

Fecal samples were submitted for fecal float and IDEXX fecal antigen panel. A formalin-fixed paraffin-embedded serosal tissue was sent to Washington State Veterinary Diagnostic Laboratory for PCR analysis and sequencing to attempt speciation of the cestode noted on histology.

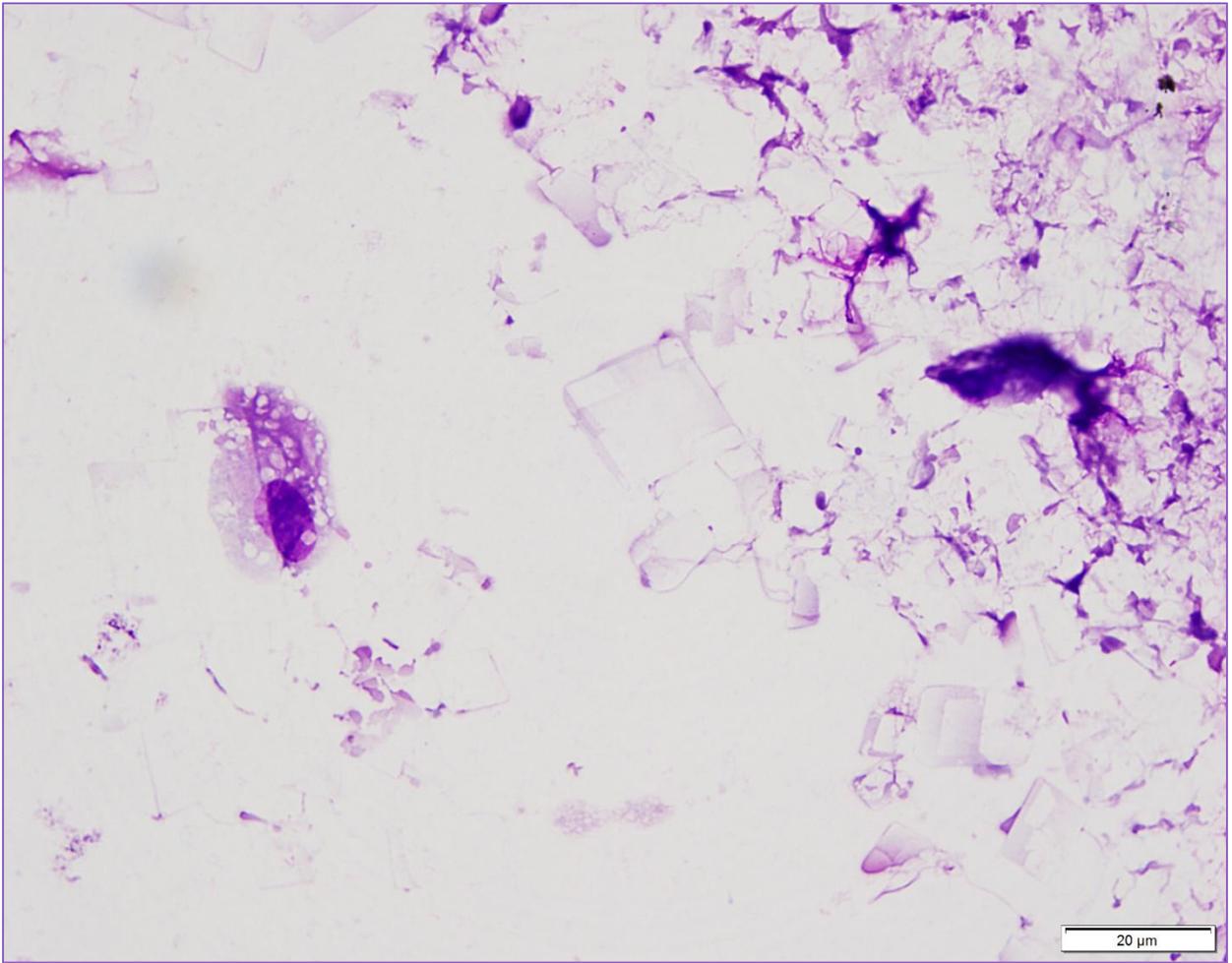


Figure 1. Photomicrograph of cytospin cytology smear from peritoneal effusion. 100x objective. Wright- Giemsa stain.

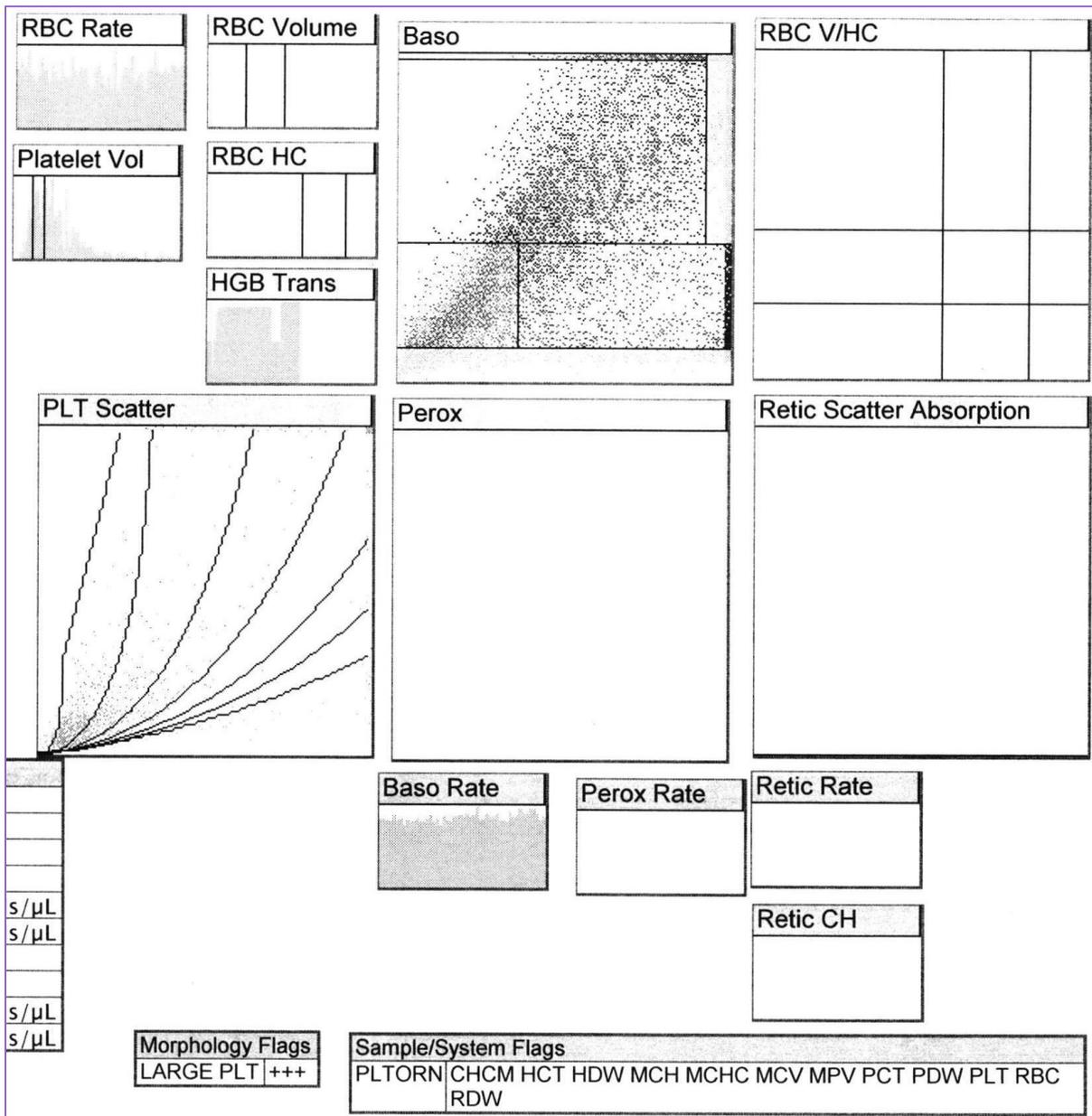


Figure 2. Scatter plot image of peritoneal effusion from ADVIA 2120 automated hematology analyzer.

QUESTIONS:

1. The structures seen in the abdominal fluid cytology images are most consistent with:
 - a. Cholesterol crystals
 - b. Uric acid crystals
 - c. Cysteine crystals
 - d. Calcium oxalate monohydrate crystals

2. Which of the following may explain the disparity between the automated and manual cell counts?
 - a. Pre-analytic error
 - b. Sample clot within the tube
 - c. Artifact
 - d. Analytical error

CONTRIBUTOR NAME*	Kelli Chan
CONTRIBUTOR EMAIL*	kochan@ncsu.edu
COAUTHORS	Devorah Stowe, DVM, DACVP (Clinical) Erika Gruber, DVM, PhD, DACVP (Clinical) Max Beecroft, DVM James Flowers, PhD (Parasitology)
COMPANY OR UNIVERSITY	North Carolina State University CVM

* Corresponding contributor

SPECIMEN: Peritoneal Effusion, glass slide

SIGNALMENT: 12-year-old, male neutered, Mixed Breed Dog

HISTORY AND CLINICAL FINDINGS:

The patient was presented to the NCSU Emergency service on 12/06/2024 for hyporexia, vomiting, and lethargy of 1.5 weeks duration. He presented to his primary veterinarian one day prior and initial diagnostics were performed, including a senior profile (CBC/Chem/UA/TT4) and full body radiographs.

Pertinent Diagnostic Findings:

Complete Blood Count

Analyte	Result	Reference Interval
Neutrophils	28,060	2.94-12.67 x 10 ³ cells/ μ L
Monocytes	1,428	0.13-1.15 x 10 ³ cells/ μ L
Eosinophils	2,820	0.07-1.49 x 10 ³ cells/ μ L

Chemistry

Analyte	Result	Reference Interval
Albumin	2.5	2.7-3.9 g/dL
Globulin	4.3	2.4-4.0 g/dL

Radiographs revealed peritoneal effusion and a suspected splenic mass.

PAST PERTINENT HISTORY:

Lincoln was rescued from Afghanistan in 2012 with no other travel history.

DIAGNOSTIC TESTS:

Abdominal Ultrasound

A large lobular multiseptated cystic mass (Figure 1) and several smaller solitary peritoneal and mesenteric cysts are present in the abdomen. Some portions of the small intestinal and colonic loops appear surrounded by the described mesenteric cystic masses. A large volume of highly echogenic peritoneal effusion is present.

The peritoneal fluid was submitted to the NCSU CVM Cytopathology service for analysis (Figures 2 and 3).



Figure 1. Ultrasound image of a multilobulated cystic mass along with several solitary cysts that surround intestinal loops.

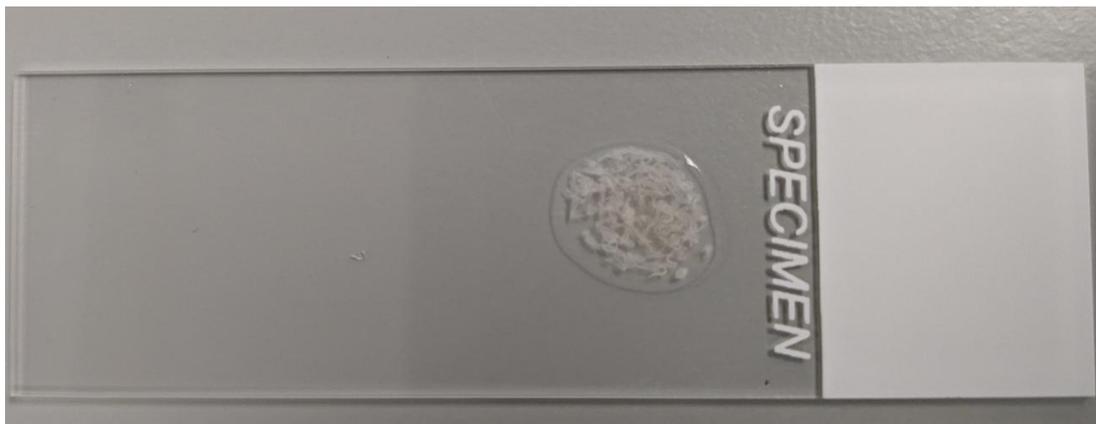


Figure 2. Gross appearance of the peritoneal fluid on a glass slide.

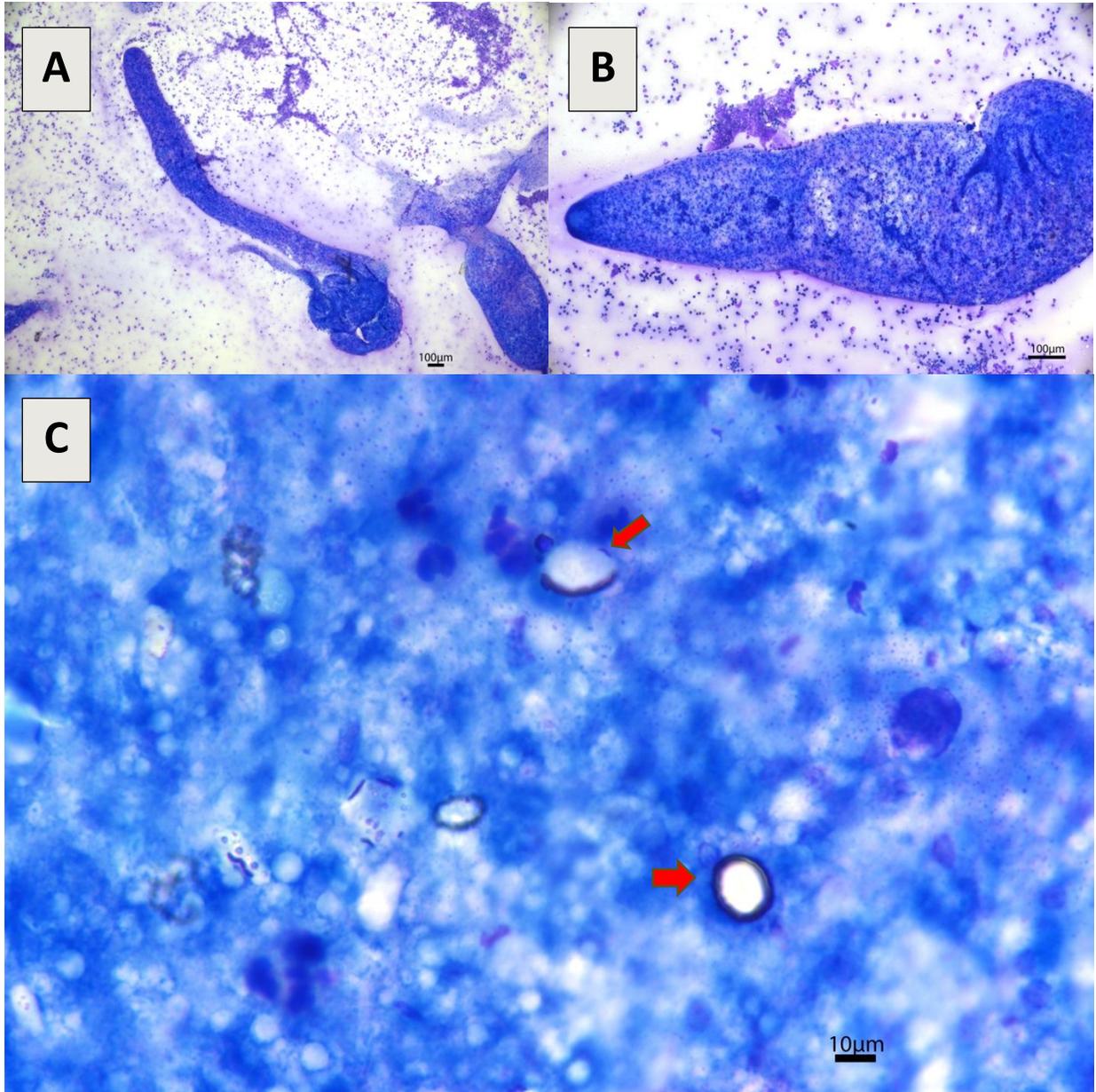


Figure 3. Representative images from the peritoneal fluid, Wright-Giemsa stain. A) 4x objective B) 10x objective C) 50x objective

QUESTIONS:

1. What do the ovoid structures (red arrows) in Figure 3C likely represent?
 - a. Lipid
 - b. Ova
 - c. Germ balls
 - d. Calcareous corpuscles

2. Based on the provided information and cytologic findings, what is the most likely diagnosis for this patient?
 - a. Toxocariasis
 - b. Cestodiasis
 - c. Schistosomiasis
 - d. Trichuriasis

CONTRIBUTOR NAME*	Lina Crespo Bilhalva ¹
CONTRIBUTOR EMAIL*	lina.crespo@tufts.edu
COAUTHORS	Lauren Holley ¹ , Marcelo Carvalho ² , Robert J. Ossiboff ² , Rose Nolen-Walston ¹ , Claire Dixon ¹ , Francisco O. Conrado ¹
COMPANY OR UNIVERSITY	Tufts University ¹ , University of Florida ²

* Corresponding contributor

SPECIMEN: Fecal smear (stained with Ziehl-Neelsen); digital scan.

SIGNALMENT: 1-year-old, intact male, La Mancha Alpine cross goat.

HISTORY AND CLINICAL FINDINGS: A 1-year-old, intact male, La Mancha Alpine cross goat was presented to the Hospital for Large Animals at Cummings School of Veterinary Medicine at Tufts University for evaluation of diarrhea, lethargy, and inappetence. The patient had been recently rescued along with approximately 50 other emaciated goats, and no prior medical or husbandry history was available. On physical examination, the goat was dull and weak, with a low body condition score (2/5). It was normothermic (101.9 °F), tachycardic (180 bpm), and tachypneic (42 rpm), with markedly pale (FAMACHA score 5/5) and tacky mucous membranes, and an extended capillary refill time. Additional findings included hypomotile borborygmi and fecal staining on the hind limbs and perianal region.

LABORATORY DATA: Based on the clinical findings, a CBC (**Table 1**) and serum biochemistry panel (**Table 2**) were performed. A fecal sample was evaluated using the modified McMaster technique (**Figure 1**) to quantify eggs and oocysts, and an acid-fast (Ziehl-Neelsen) stain was performed on a fecal smear (**Figure 2**) as a screening test for *Cryptosporidium* spp.

Table 1. CBC (Advia 2120) with manual differential.

TEST	UNITS	RESULT	REFERENCE INTERVAL
Erythrocytes	x 10 ⁹ /μL	6.74 (L)	8.00 – 18.00
Hemoglobin	g/dL	2.9 (L)	8.0 – 12.0
Hematocrit	%	9 (L)	22 – 38
M.C.V.	fL	13.7 (L)	16.0 – 25.0
M.C.H.C.	g/dL	31.5	28.0 – 34.0
R.D.W.	%	33.4	
Total leukocytes	x 10 ³ /μL	6.50	4.00 – 13.00
Band neutrophils	x 10 ³ /μL	0.07	0.00 – 0.10

Seg. neutrophils	x 10 ³ /μL	1.82	1.20 – 7.20
Lymphocytes	x 10 ³ /μL	4.42	2.00 – 9.00
Monocytes	x 10 ³ /μL	0.20	0.00 – 0.60
Platelets	x 10 ³ /μL	1,887 (H)	300 – 500
Fibrinogen	mg/dL	200	100 - 400
Comments	Poikilocytosis (3+); Basophilic stippling (1+).		

Table 2. Selected serum biochemistry results.

TEST	UNITS	RESULT	REFERENCE INTERVAL
Total protein	g/dL	3.6 (L)	6.1 – 8.3
Albumin	g/dL	1.7 (L)	3.1 – 4.4
Globulins	g/dL	1.9 (L)	2.2 – 4.3
Creatinine	mg/dL	2.8 (H)	0.6 – 1.3
Urea	mg/dL	135 (H)	17 – 30
Phosphorus	mg/dL	7.7	4.1 – 8.7
Total calcium	mg/dL	7.0 (L)	8.0 – 10.7
Total magnesium	mg/dL	2.1 (L)	3.0 – 4.0
Sodium	mEq/L	132 (L)	140 – 157
Chloride	mEq/L	93 (L)	102 – 118
Potassium	mEq/L	3.2 (L)	3.5 – 5.6
tCO ₂	mEq/L	14 (L)	22 - 32
AGAP	mEq/L	24.8 (H)	16 - 22
Lactate	mmol/L	5.3 (H)	0 - 2

The quantitative fecal floating (modified McMaster technique) revealed the presence of the following parasites:

- Strongylids: 5,940,000 ova/gram
- Eimeria* spp.: 151,200 oocysts/gram
- Trichuris* spp.: 21,600 ova/gram

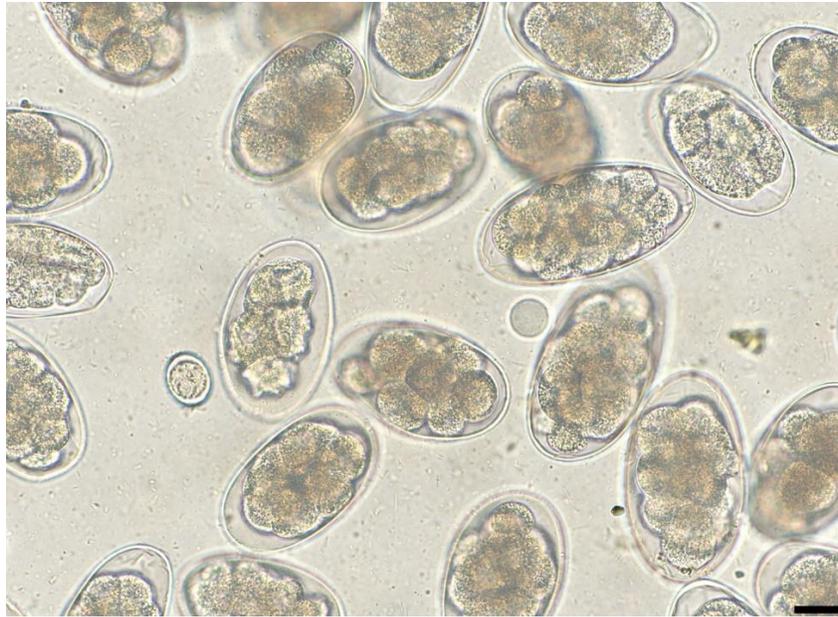


Figure 1. Photomicrograph of a wet-mount fecal flotation preparation from a 1-year-old goat. 40× objective. Bar = 20 μm .

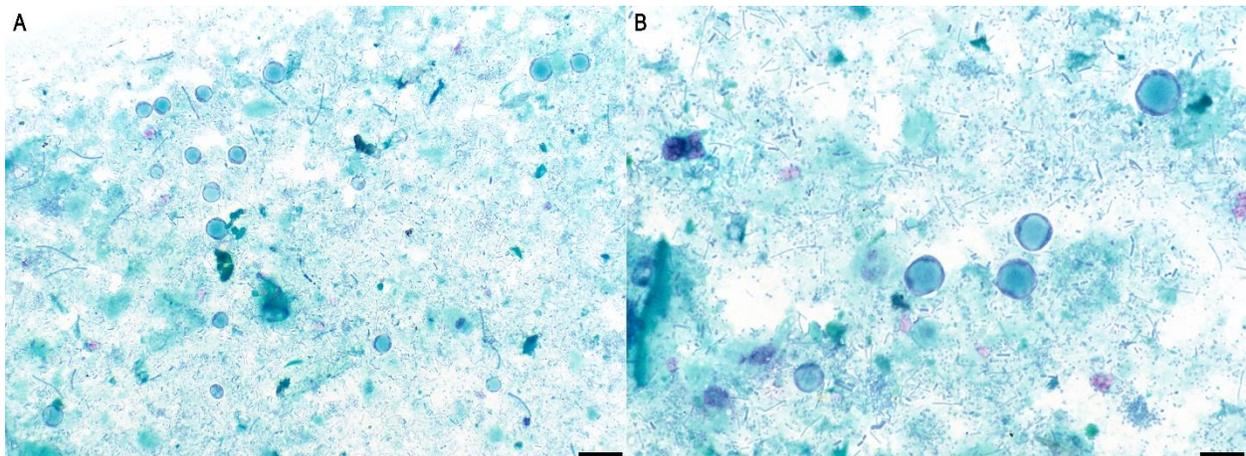


Figure 2. Photomicrographs of a Ziehl-Neelsen-stained fecal smear from a 1-year-old goat. (A) 50× objective (bar = 20 μm), (B) 100× objective (bar = 10 μm).

QUESTIONS:

1. The morphology of the structures observed in the acid-fast-stained fecal smear should be attributed to which of the following?
 - a. Pollen
 - b. Fungal spores
 - c. Protozoa-like organism
 - d. Degenerate helminth egg

2. What would be your next step to identify these structures?
 - a. Fungal culture
 - b. Pan-fungal PCR
 - c. Electron microscopy
 - d. Other targeted conventional PCR



MYSTERY CASE SESSION
CASE HISTORIES
CASE #10

CONTRIBUTOR NAME*	Will Patterson, DVM
CONTRIBUTOR EMAIL	wppatter@ncsu.edu
COAUTHORS	Devorah Stowe, DVM, DACVP Jazz Stephens, DVM
COMPANY OR UNIVERSITY	North Carolina State University

* Corresponding contributor

SIGNALMENT: 12-day-old, male Zebu calf

HISTORY AND CLINICAL FINDINGS:

The patient presented to the North Carolina State University Farm Animal Medicine Service for a 5-day history of progressive lethargy. He was found abandoned in a field and rejected by his dam, suggesting it may have been born prematurely. Initial attempts to allow the patient to nurse were unsuccessful, and he did not receive colostrum until approximately 12 hours post-birth. He was then bottle-fed milk replacer.

The patient was evaluated by the referring veterinarian approximately one week prior to presentation and appeared stable. However, the patient's condition declined – he became increasingly lethargic, remained recumbent for prolonged periods, and was noted to urinate on himself. During a recheck visit, a chemistry profile, CBC, and abdominal ultrasound were performed. CBC and abdominal ultrasound were unremarkable. The chemistry profile was unremarkable aside from a mild hypoproteinemia suspected to be due to failure of passive transfer. The patient was treated with oxytetracycline and gamithromycin. He showed no improvement and was referred.

On physical examination, the patient was dull, recumbent, and dehydrated with injected sclera, cold extremities, and tacky mucous membranes. Thoracic ultrasound revealed pulmonary consolidation suggestive of pneumonia. CBC, chemistry, and blood gas analysis results are below. The most significant laboratory abnormalities were severe hypernatremia, hyperchloremia, hyperkalemia, hypercalcemia, hyperglycemia, and hyperlactatemia.

LABORATORY DATA:**Table 1.** Hematology (Advia 120, Siemens)

TEST	UNITS	RESULT (Day 1)	REFERENCE INTERVAL
HCT (calculated)	%	35.3	23-45
RBC	x 10 ⁶ /uL	8.19	6.2-11.9
Hgb	g/dL	10.6	7.3-14.8
MCV	fL	43.1	33.1-44.2
MCH	pg	13.0	11-14
MCHC	g/dL	30.0 (L)	30.9-34.6
RDW	%	24.1 (L)	25.5-34.1
PLT	x 10 ³ /uL	757	238-1213
MPV	fL	5.6 (L)	6-7.3
PCT	%	0.42	0.2-0.8
WBC	x 10 ³ /uL	11.84	4.8-16.3
Segs	X 10 ³ /uL	6.986	0.9-13.0
Bands	X 10 ³ /uL	0.237 (H)	0
Lymph	X 10 ³ /uL	4.499	0.1-8.4
Mono	x 10 ³ /uL	0.118	0-1.7
Fibrinogen		1400	N/A
Plasma protein	g/dL	6.8	N/A
PP:FIB		5	

Hematology reference values for 5- to 12-day-old Australian dairy calves (1)

Table 2. Chemistry (Abaxis Vetscan VS2, Zoetis)

TEST	UNITS	RESULTS (Day 1)	REFERENCE INTERVAL
Sodium	mmol/L	>180 (H)	130-148
Potassium	mmol/L	7.8 (H)	4.75-6.75
CO2	mmol/L	35 (H)	23-32**
Creatine Kinase	U/L	82	46-326
Glucose	mg/dL	582 (H)	50-124
Calcium	mg/dL	14.3 (H)	9.9-12.6
BUN	mg/dL	36 (H)	4.5-21.6
Creatinine	mg/dL	1.6 (H)	0.6-1.23
AST	U/L	39 (L)	25-51
Bilirubin, Total	mg/dL	1.10 (H)	0.0-0.6**
GGT	U/L	35	32-1037
Albumin	g/dL	1.8 (L)	2.7-3.6
Total Protein	g/dL	6.4 (L)	4.5-8.2
Globulin	g/dL	4.5	1.4-5.3

Comment: Sodium was outside of the linearity range

Biochemistry, electrolyte, and fibrinogen reference values for 5- to 12-day-old Australian dairy calves (1)

**Adult reference interval from UC Davis

Table 3. Venous blood gas (GEM Premier 5000, Werfen)

TEST	UNITS	RESULTS (Day 1)	REFERENCE INTERVAL
pH	-	7.45	7.375-7.459
pCO ₂	mmHg	58 (H)	43.8-56.8
pO ₂	mmHg	38	N/A
Sodium	mmol/L	185 (H)	134.2-139.3
Potassium	mmol/L	7.2 (H)	4.16-5.37
Chloride	mmol/L	135 (H)	95-103
iCa	mmol/L	1.63 (H)	1.18-1.35
Glucose	mg/dL	629 (H)	56-74
Lactate	mmol/L	4.9	N/A
Hemoglobin	g/dL	10.8	8.3-13.2
Base excess	mmol/L	14.1 (H)	2.7-9.6
Bicarbonate	mmol/L	40.3 (H)	27.7-35.4
Hematocrit (calc)	%	32	23-40

Reference intervals for venous blood gas values in 11-30 day old male calves (2)

Table 4. Urine and serum electrolytes (Cobas 501, Roche Diagnostics)

TEST	UNITS	RESULTS URINE (Day 3)	RESULTS SERUM (DAY 3)	REFERENCE INTERVAL
Sodium	mmol/L	233.0	167	-
Potassium	mmol/L	117.1	4.3	-
Chloride	mmol/L	251	131	-
Creatinine	mmol/L	4.67	0.067	-

ADDITIONAL DIAGNOSTIC TESTS:

Lumbar spinal CSF tap: Possible increased microprotein - TNCC: 2 cells/uL, TP: 33.1 mg/dL (RI Not established)

QUESTIONS:

1. What is the likely cause of the hyperglycemia?
 - a. Diabetes mellitus and hyperglycemic hyperosmolar syndrome
 - b. Iatrogenic hyperglycemia
 - c. Stress hyperglycemia
 - d. Post-prandial hyperglycemia

2. What may be an expected finding on histology of the brain?
 - a. Laminar cortical necrosis
 - b. Neuronal storage material accumulation
 - c. Perivascular cuffing
 - d. Endothelial hypertrophy and capillary hyperplasia



MYSTERY CASE SESSION
CASE HISTORIES
CASE #11

CONTRIBUTOR NAME*	Jasmine Hsin Yeh
CONTRIBUTOR EMAIL*	jasmineyeh@vt.edu
COAUTHORS	Natalia Strandberg, DVM, MS, DACVP–Clinical Pathology ¹ Santiago Diab, DVM, DACVP–Anatomic Pathology ¹ Wei-Hsiang Huang, DVM, PhD ²
COMPANY OR UNIVERSITY	¹ Virginia-Maryland College of Veterinary Medicine ² School of Veterinary Medicine, National Taiwan University

* Corresponding contributor

SPECIMEN: Cytology. Fine-needle aspiration from a cutaneous mass over the right mandible.

SIGNALMENT: 15-year-old, spayed female, domestic short-haired cat

HISTORY AND CLINICAL FINDINGS:

The patient presented to the Emergency and Critical Care Service at the Virginia-Maryland College of Veterinary Medicine Teaching Hospital on March 19, 2025, for evaluation of marked hypernatremia, azotemia, and a progressively enlarging right mandibular cutaneous mass. On physical examination, she was found to be in poor body condition with severe muscle wasting and severe dehydration. Other findings included mild earwax buildup, mucoid ocular discharge, and mild bilateral dried nasal discharge.

The right mandibular mass has been present since the patient's adoption in November 2024 and has shown progression in size over time. On presentation, the mass was superficial and measured approximately 8 cm in diameter. A fine-needle aspirate (FNA) of the mandibular mass was performed on March 20, 2025, and submitted to the Clinical Pathology Section at Virginia Tech Animal Laboratory Services (VITALS) for cytologic evaluation.

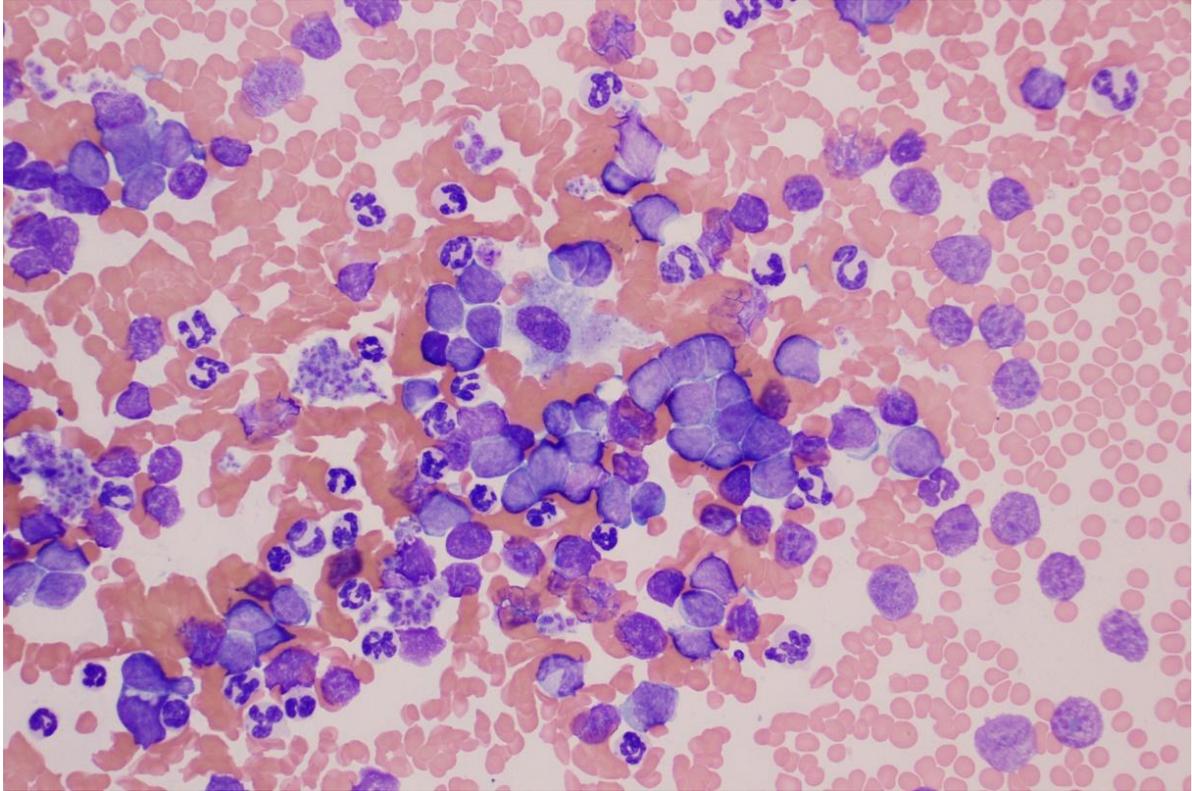


Figure 1: FNA of cutaneous right mandibular mass; 50x objective, Wright-Giemsa stain

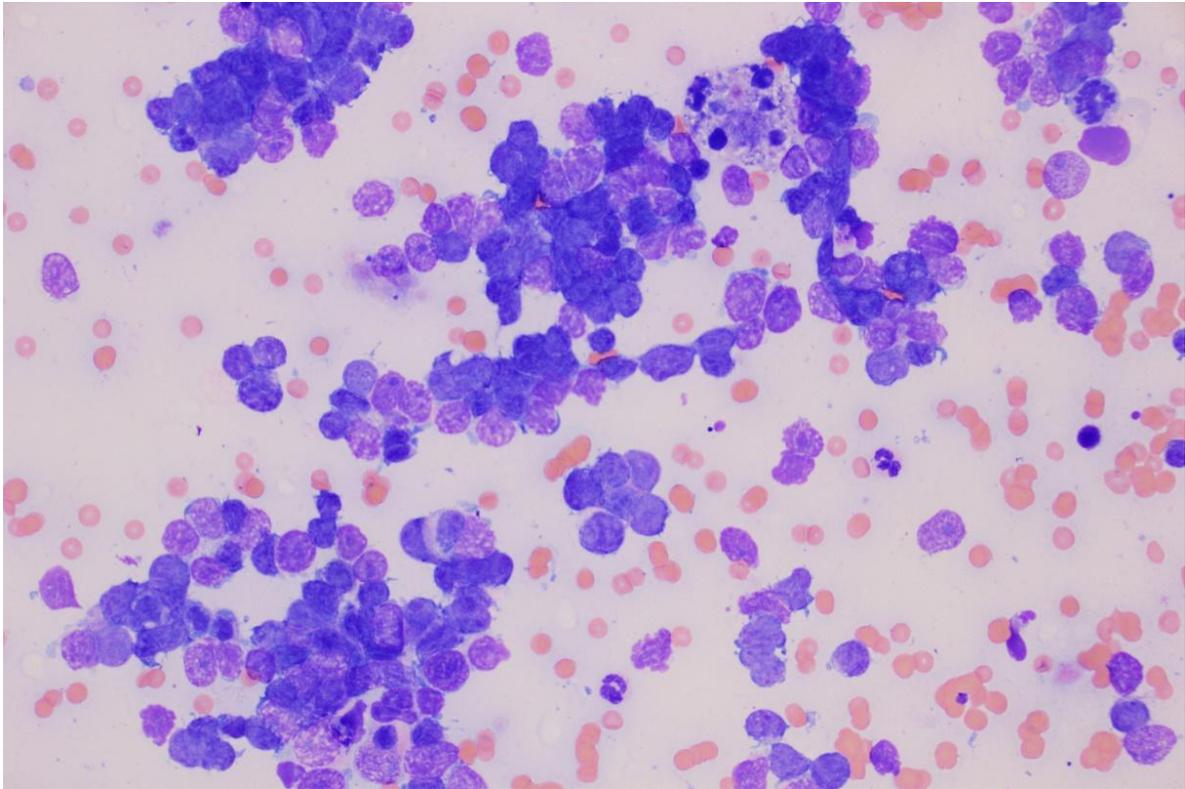


Figure 2: FNA of cutaneous right mandibular mass; 50x objective, Wright-Giemsa stain

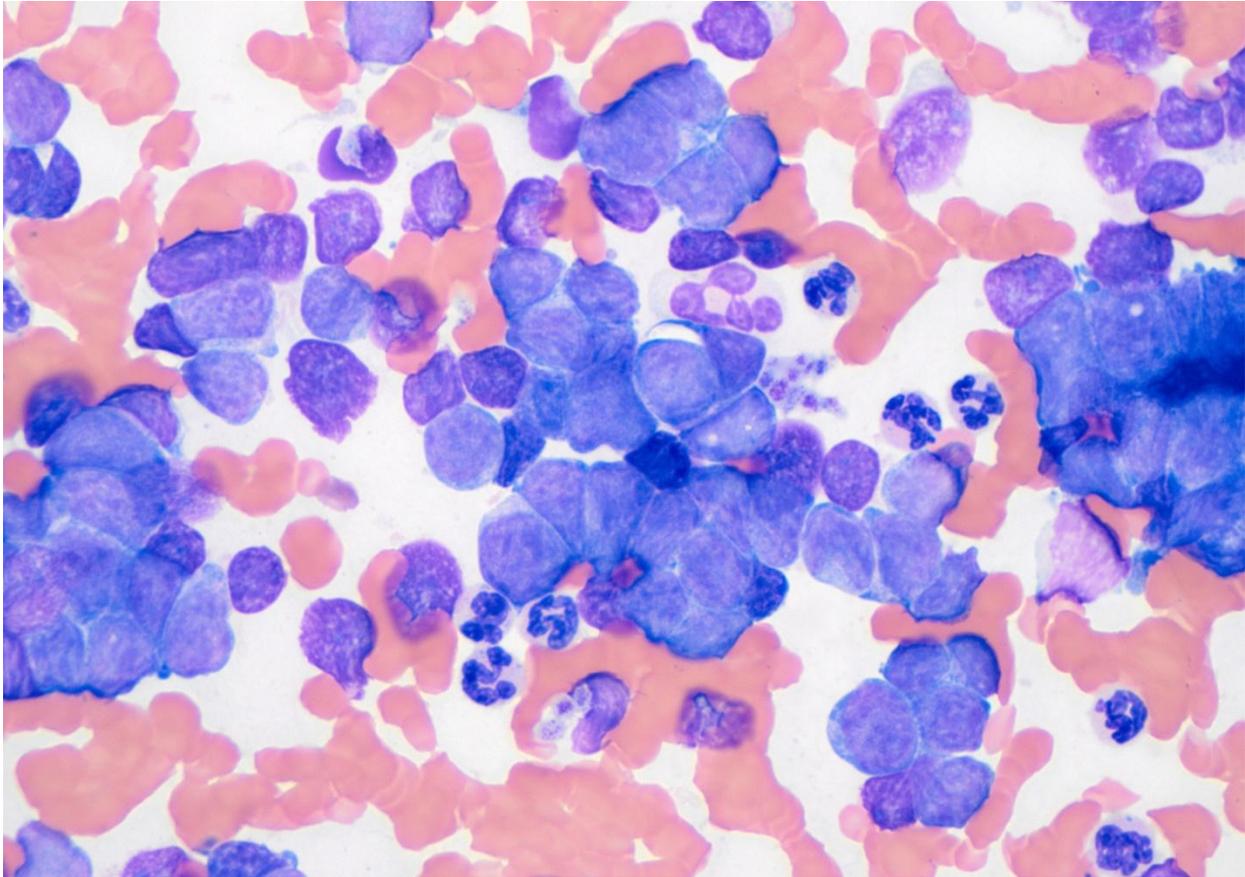


Figure 3: FNA of cutaneous right mandibular mass; 100x objective, Wright-Giemsa stain

ADDITIONAL DIAGNOSTIC TESTS:

Abdominal ultrasound showed bilateral pyelectasia suggesting chronic kidney disease and/or an active kidney infection. Thickened intestines with reduced motility were observed and the stomach was gas-distended, but no evidence of an obstruction was appreciated. The remaining findings were unremarkable.

On lateral thoracic radiographs, a well-demarcated soft-tissue opacity was appreciated in the right lung region. However, the structure could not be accurately assessed from alternative views due to the low imaging quality, which was secondary to the patient's poor body condition.

The patient was euthanized on March 28th, 2025, due to poor response to the treatment and a decline in energy. Necropsy was performed the next day.

QUESTIONS:

1. Which cytological classification best fits this case based on the cytomorphological features?
 - a. Round cell tumor
 - b. Epithelial neoplasm
 - c. Mesenchymal neoplasm
 - d. Endocrine/ neuroendocrine neoplasm

2. Which immunohistochemistry stain would exhibit a positive result on this mass?
 - a. CD3
 - b. CK15
 - c. CD31
 - d. Neuron specific enolase (NSE)

CONTRIBUTOR NAME*	Jacqui Nunnelley, DVM
CONTRIBUTOR EMAIL*	jnunnelley@missouri.edu
COAUTHORS	Michelle DeCoursey, DVM, MS, DACVP (Clinical)
COMPANY OR UNIVERSITY	University of Missouri

* Corresponding contributor

SPECIMEN: Peritoneal fluid, cytocentrifuge preparation

SIGNALMENT: 15-year-old Friesian stallion

HISTORY AND CLINICAL FINDINGS: Dedrick presented to the University of Missouri's Equine Medicine Service on 10/7/24 for further workup of severe weight loss, ventral edema, decreased appetite, and a mild intermittent cough. He had dropped approximately 150 pounds, including muscle mass, in one week. Current medications at the time of presentation included firocoxib, omeprazole, and fenbendazole. At that time, the stallion had primarily been used for breeding, with no known issues with his offspring. He had a history of cryptorchidism, and his retained right testicle was removed laparoscopically in April 2022, due to the presence of a testicular mass.

Upon presentation, Dedrick was bright, alert, and responsive with a mild fever of 102.1°F and otherwise normal vitals. Sheath swelling, decreased muscle mass, and ventral pitting edema were observed on intake as well as a cresty neck (grade 2/5) and focalized muscle fasciculations behind the shoulders bilaterally. Mucoïd discharge was also noted from his right nostril. On thoracic and abdominal FAST scans, pleural irregularity in the cranioventral lung fields bilaterally and free fluid in the peritoneal cavity were observed. Initial diagnostics included a CBC and biochemistry panel (Table 1). Apart from a stress leukogram, the CBC was unremarkable. Dedrick was hospitalized and started on LRS IV fluids and ceftiofur.

The following morning Dedrick started showing neurologic signs, including head pressing, a mild left sided head tilt, and mild ataxia. On physical examination, Dedrick had a droopy lip, slight icterus in his sclera bilaterally, was reluctant to move, and had persistent muscle fasciculations behind the shoulders. His fever had resolved, and other vital parameters were within normal limits. A spot blood glucose revealed a severe hypoglycemia of 28 mg/dL and treatment with oral Karo Syrup and IV dextrose supplementation was initiated. Spot glucose values were monitored over the next 24 hours and fluctuated, ranging from 58 to 107 mg/dL, but could not be maintained consistently within the normal range.

Further diagnostics were performed, which included an abdominal ultrasound, rectal palpation with ultrasound, and peritoneal fluid analysis (Table 2). On abdominal ultrasound, excessive free fluid was found in addition to small, irregular kidneys and a small liver with numerous nodules, hypoechoic foci, and irregular parenchyma. Rectal palpation with ultrasound revealed a large, firm, smooth, vascularized mass in the caudal abdomen which was adhered to the dorsal body wall. Additionally, a 2.5 cm, smooth, round nodule was palpated in the right inguinal region.

LABORATORY DATA:

Table 1: Biochemistry Panel (Beckman Coulter AU480 Chemistry Analyzer)

TEST	UNITS	RESULT	FLAG	REFERENCE INTERVAL
Glucose	mg/dL	49	L	77 - 107
Urea Nitrogen	mg/dL	33	H	11 - 24
Creatinine	mg/dL	3.1	H	0.9 - 1.7
Sodium	mEq/L	130	L	132 - 141
Potassium	mEq/L	4.4	H	2.7 - 4.3
Chloride	mEq/L	91	L	96 - 105
Bicarbonate	mEq/L	25		25 - 33
Anion Gap	mEq/L	18	H	8 - 15
Albumin	g/dL	3.3		2.5 - 3.6
Total Protein	g/dL	7.2		5.7 - 7.5
Globulin	g/dL	3.9		2.4 - 4.1
Calcium	mg/dL	11.9		11.2 - 12.8
Phosphorus	mg/dL	7.1	H	1.8 - 4.0
Magnesium	mg/dL	1.1	L	1.5 - 2.3
Triglyceride	mg/dL	1217	H	14 - 62
Total Bilirubin	mg/dL	3.6	H	0.6 - 2.8
Direct Bilirubin	mg/dL	0.4		0.2 - 0.7
AST	U/L	950	H	203 - 415
GGT	U/L	35	H	10 - 30
CK	U/L	109	L	112 - 444
GLDH	U/L	39	H	0 - 22

Table 2: Fluid Analysis Results (ADVIA® 2120i Hematology Analyzer)

TEST	RESULT
Specimen Description	Peritoneal Fluid
Pre-Centrifuge Color	Red
Post-Centrifuge Color	Yellow
Pre-Centrifuge Clarity	Opaque
Post-Centrifuge Clarity	Clear

Fluid Specific Gravity	1.022
Total Protein- Refractometer	3.2 g/dL
Fluid PCV	3%
Total Nucleated Cell Count	4660 cells/uL

ADDITIONAL DIAGNOSTIC TESTS:

Lactate: 1 mmol/L (no reference interval)

Ammonia: 14.4 $\mu\text{mol/L}$ (17.0-29.0)

Equine Survey Salmonella: No significant growth

Equine Viral Arteritis Serology: Negative

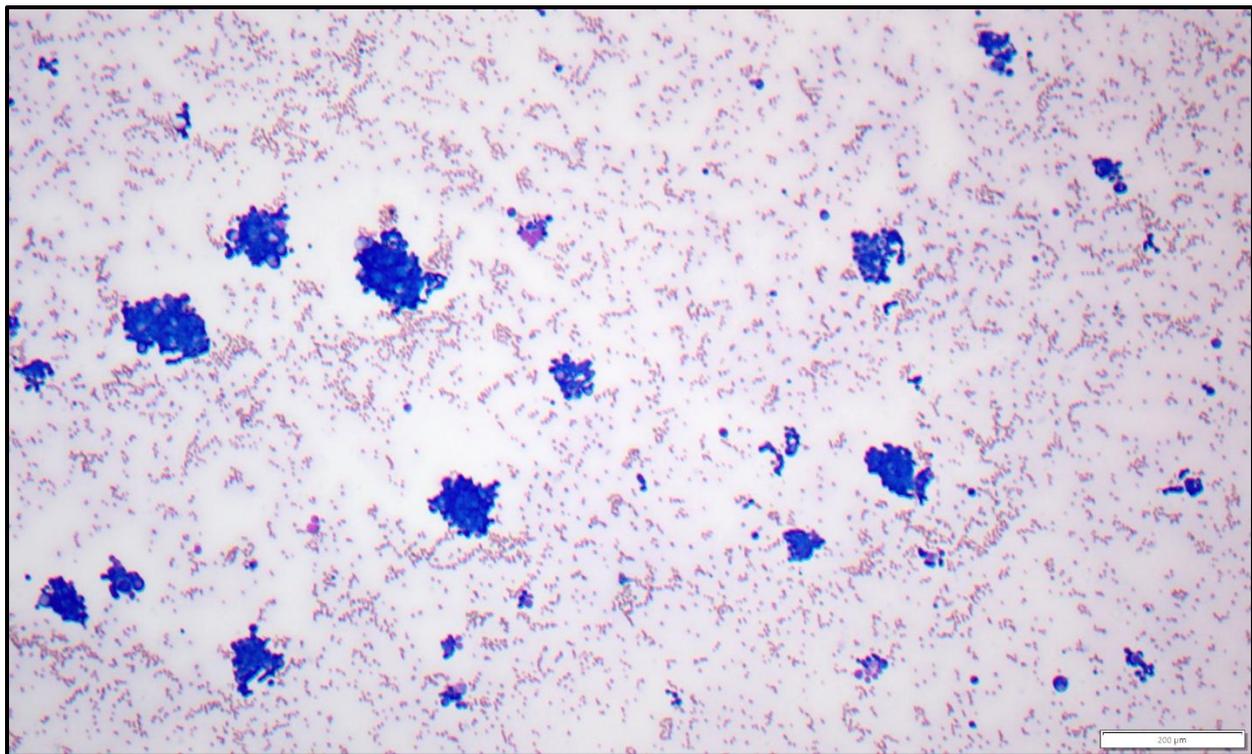


Figure 1: Line preparation of collected peritoneal fluid, modified Wright-Giemsa stain, 10x objective.

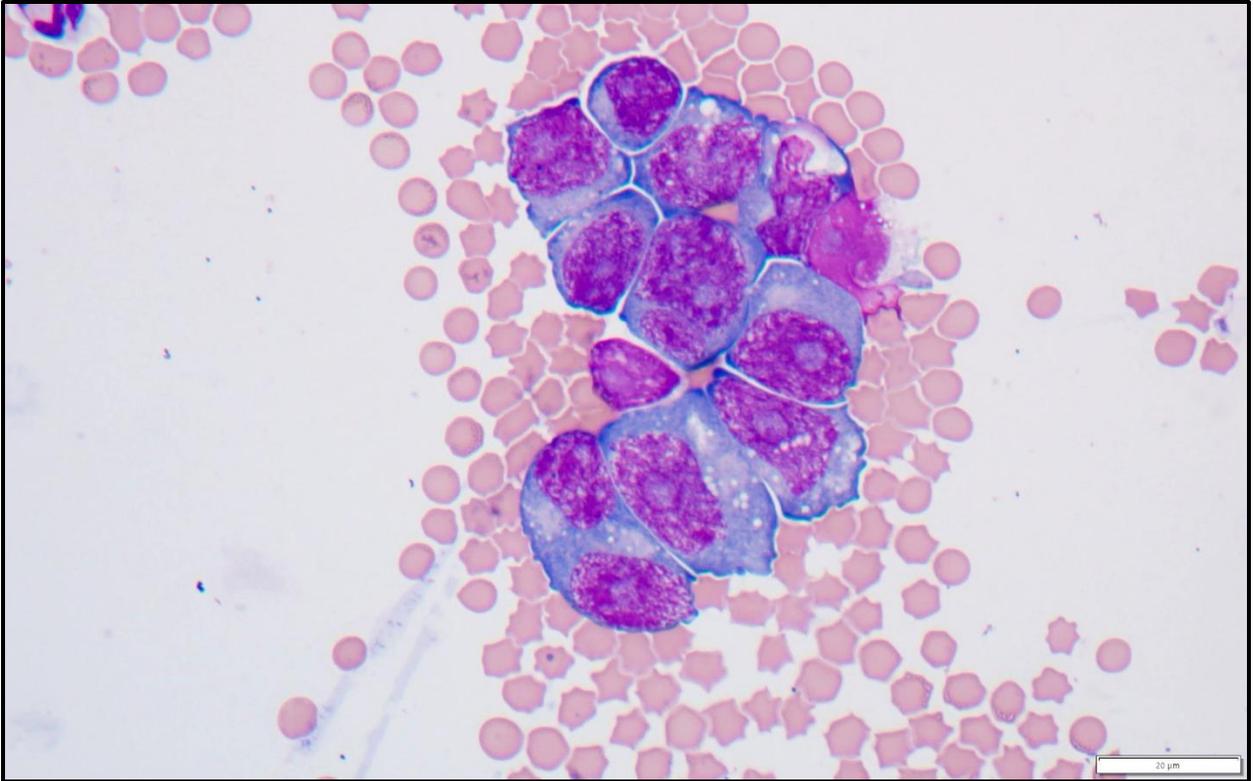


Figure 2: Cytocentrifuge preparation of collected peritoneal fluid, modified Wright-Giemsa stain, 100x objective.

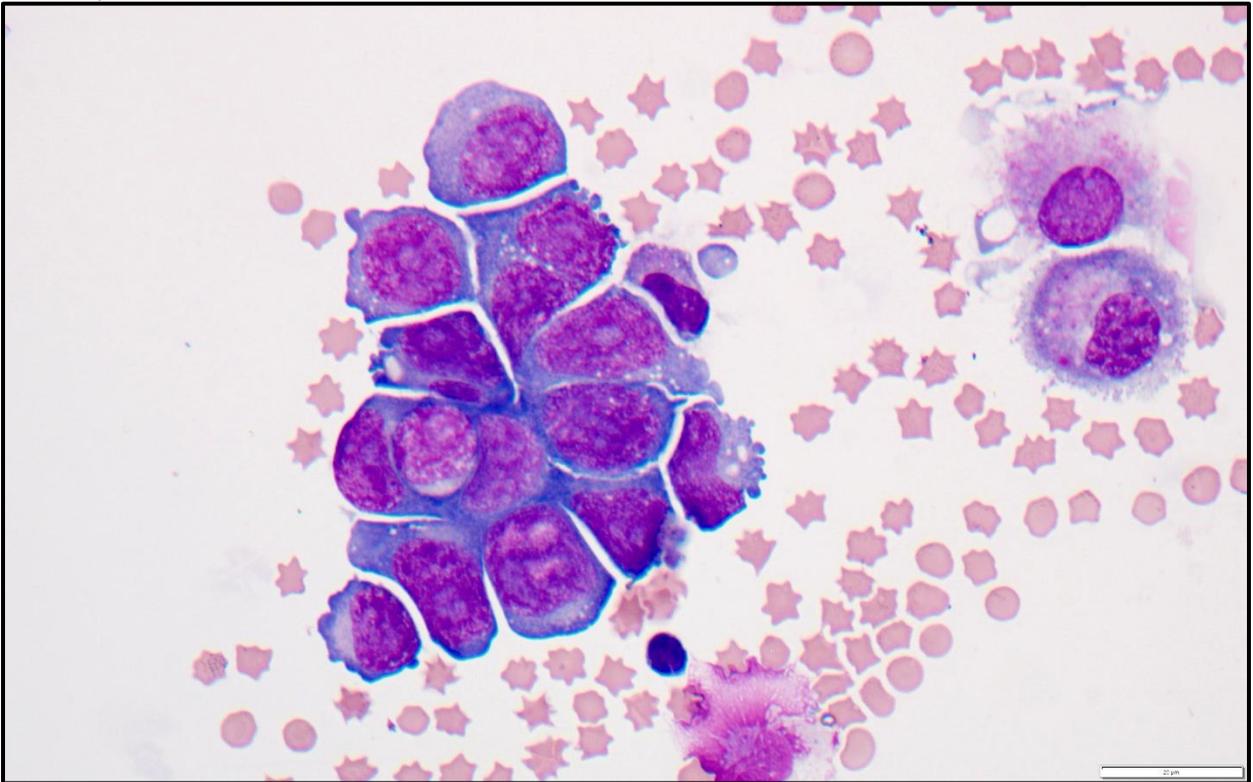


Figure 3: Cytocentrifuge preparation of collected peritoneal fluid, modified Wright-Giemsa stain, 100x objective.

QUESTIONS:

1. What is the suspected mechanism of the hypoglycemia?
 - a. Sepsis
 - b. Insulinoma
 - c. Liver failure
 - d. Paraneoplastic

2. Which combination of positive IHC results is most likely?
 - a. PGP9.5, c-kit, vimentin
 - b. Vimentin, inhibin-alpha, S-100
 - c. Cytokeratin, vimentin, Wilms' tumor gene 1
 - d. Cytokeratin, vimentin, NSE, luteinizing hormone

CONTRIBUTOR NAME*	Kathleen Hu ¹
CONTRIBUTOR EMAIL*	k.hu@tamu.edu
COAUTHORS	Margret L. Casal ² , DVM, PhD, DECAR Candice Chu ¹ , DVM, PhD, DACVP
COMPANY OR UNIVERSITY	¹ Texas A&M University; ² University of Pennsylvania

* Corresponding contributor

SPECIMEN: Venous blood (blood smear)

SIGNALMENT: 1 year-old, male intact, chihuahua-dachshund mix

HISTORY AND CLINICAL FINDINGS:

The patient has been non-ambulatory since birth. Approximately 2 weeks prior to presentation, the owner observed two episodes of presumed generalized seizure activities at home, characterized by loss of consciousness, paddling, and loss of bowel control. Each episode lasted about 3-5 minutes, followed by a 5-10 minute post-ictal state.

At an emergency clinic after the second seizure episode, the patient was noted to be tetraparetic with contracted hind limbs (static and historically noted by the owners). A grade II/VI left apical systolic murmur was auscultated. No further seizure activities were noted since, and the patient was referred to Texas A&M Cardiology for further diagnostics. At this appointment, the following CBC was submitted for review.

LABORATORY DATA:

Hemogram results:

TEST	UNITS	RESULT (FLAG-H/L)	REFERENCE INTERVAL
PCV	%	45	
RBC	$\times 10^6/\mu\text{L}$	6.76	5.50 – 8.50
HGB	g/dL	15.5	10.0 – 20.0
HCT	%	48.5	37.0 – 56.0
MCV	fL	71.8	60.0 – 77.0
MCHC	g/dL	31.9 (L)	32.0 – 36.0
Plasma protein	g/dL	6.5	6 – 8
Platelet	$/\mu\text{L}$	325,000	200,000 – 500,000
Seg. Neutrophils	%	63	60 – 77
Absolute neut	$/\mu\text{L}$	6048	3000 – 11500
Lymphocytes	%	19	12 – 30

Absolute lymph	/ μ L	1824	1000 – 4800
Monocytes	%	18 (H)	3 – 10
Absolute mono	/ μ L	1728	150 – 1250

Leukocytes on blood smear review:

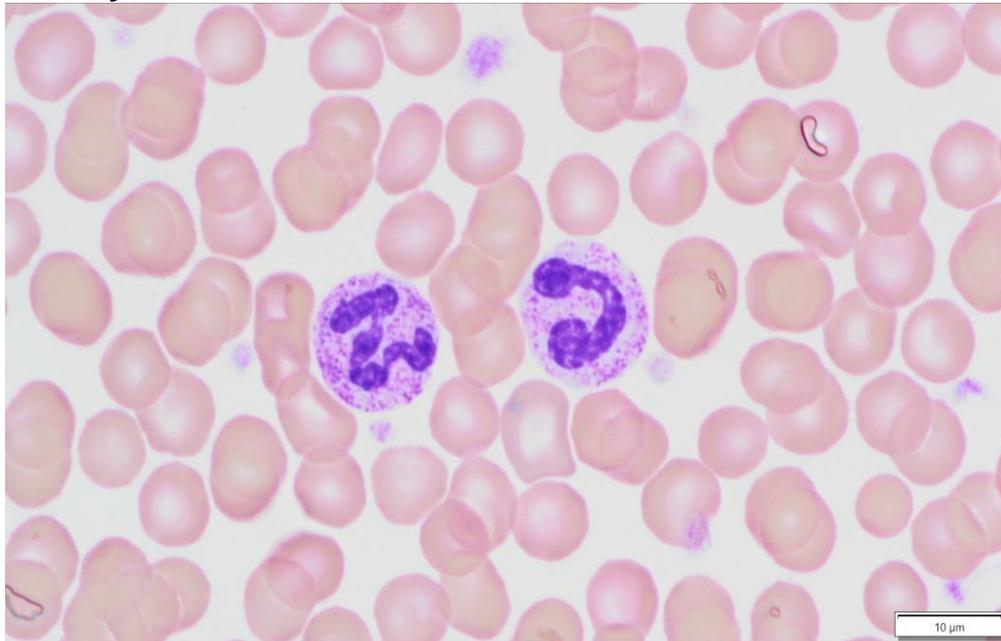


Fig. 1: Venous blood, blood smear. Modified Wright's stain. 100x objective.

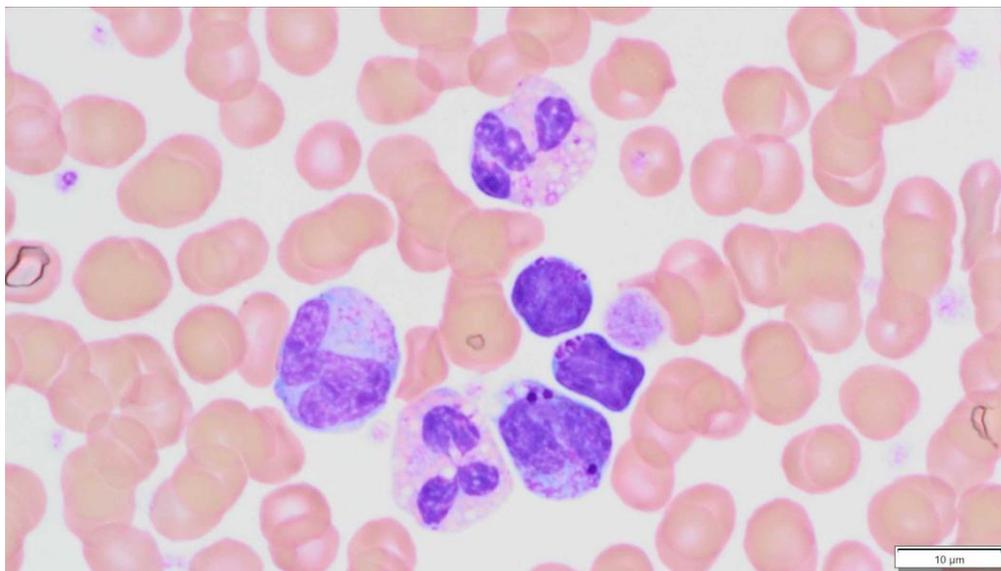


Fig. 2: Venous blood, blood smear. Modified Wright's stain. 100x objective.

ADDITIONAL DIAGNOSTIC TESTS:

1. **Echocardiogram:** An echocardiogram revealed significant mitral valve thickening with prolapse into the left atrium. Moderate to severe mitral regurgitation was apparent. The left atrium and ventricle measured normal in size.
2. **Thoracic radiographs:** No evidence of congestive heart failure or additional pulmonary pathologies were seen. Severe diffuse osteopenia and epiphyseal dysplasia were noted.

QUESTIONS:

1. What additional diagnostic steps could you consider to help confirm your diagnosis?
 - a. Fecal float test
 - b. Urine spot test
 - c. Blood SNAP test
 - d. Gram stain of the venous blood
2. Apart from Wright-Giemsa, which other special stain would be expected to highlight the cytoplasmic granules observed in these cells?
 - a. Congo Red
 - b. Von Kossa stain
 - c. Perls Prussian blue
 - d. Periodic Acid-Schiff (PAS)

CONTRIBUTOR NAME*	Basant Ahmed ¹
CONTRIBUTOR EMAIL*	Ahmed.1126@buckeyemail.osu.edu
COAUTHORS	Elaina Davis ¹ , Jonathan Miller ¹ , Maxey Wellman ¹ , Hamideh Esmailzadeh ¹ , Ryan Jennings ¹ , Laurie Millward ¹
COMPANY OR UNIVERSITY	The Ohio State University

* Corresponding contributor

SPECIMEN: Scanned glass slide and photomicrographs of a fine needle aspirate of a lesion in the os penis, Wright-Giemsa stain

SIGNALMENT: 11-year-old male neutered Labrador-Mix

HISTORY AND CLINICAL FINDINGS:

An 11-year-old male neutered Labrador mix was presented to The Ohio State University Veterinary Medical Center (OSU-VMC) with a one-month history of persistent urine dribbling, bloody penile discharge, and straining to urinate. CBC, serum biochemical profile, and urinalysis performed by the referring veterinarian (rDVM) were within normal limits. Abdominal radiographs and ultrasound conducted by the rDVM revealed a mildly enlarged prostate but were otherwise unremarkable. A urine culture performed a few days prior to the presentation showed no bacterial growth. The patient was treated empirically with clindamycin, and cystoscopy was recommended for further evaluation.

At OSU-VMC, abdominal and thoracic computed tomography (CT) were performed. The abdominal CT revealed a 4.0 × 2.3 × 2.8 cm isoattenuating, contrast-enhancing soft tissue mass surrounding the os penis, with slightly expansile lysis of the dorsal and right margins of the os penis (Figure 1A). Thoracic CT demonstrated numerous small soft tissue nodules scattered throughout the lungs, measuring up to 7 mm in diameter.

A fine-needle aspirate (FNA) was obtained and submitted. The patient underwent surgery for penile amputation, and the lesion was submitted for histopathological evaluation.

Representative images of the fine needle aspirate of the mass and CT findings are shown below.

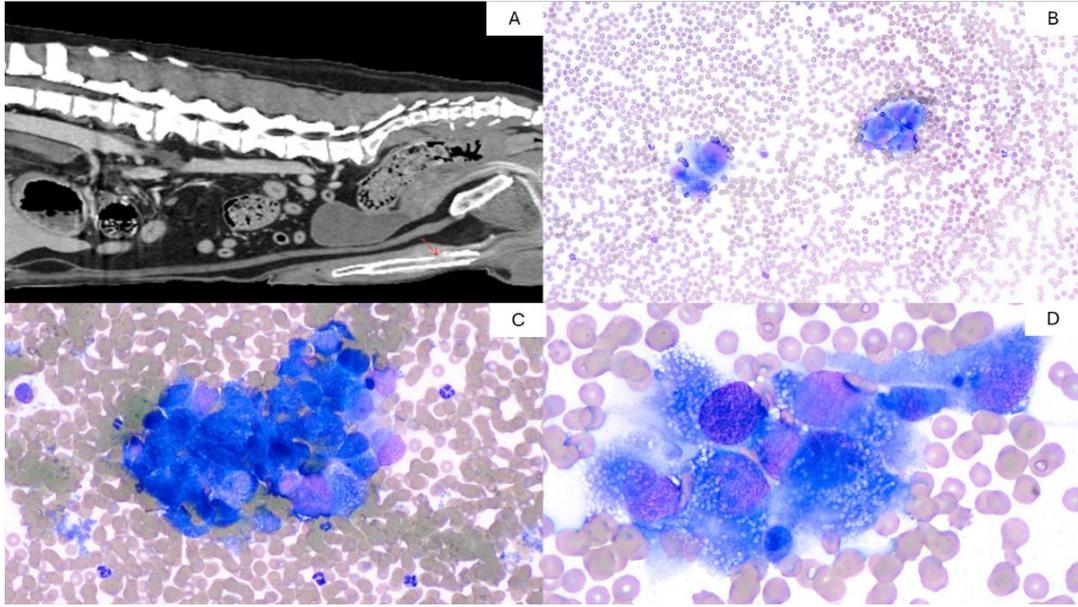


Figure 1. Abdominal CT and fine-needle aspirate of the os penis lesion (A) Abdominal CT examination shows a 4cm x 2.3cm x 2.8cm isoattenuating, contrast-enhancing soft tissue mass surrounded the os penis with slightly expansile lysis of the dorsal and right margins of the os penis in this region; (B) Fine-needle aspirate of the os penis lesion stained with Wright Giemsa (20x); (C) 50x; (D) 100x.

QUESTIONS:

1. Based on the cytology and CT findings, what is the most likely lineage of the cells in this case?
 - a. Epithelial
 - b. Mesenchymal
 - c. Round
 - d. Unspecified – poorly differentiated

2. What additional diagnostic test can be considered to confirm your top differential diagnosis?
 - a. 5-bromo, 4-chloro, 3-indolyl phosphate/nitroblue tetrazolium (BCIP/NBT) cytochemical stain
 - b. CD31 immunohistochemistry
 - c. MUM-1 immunohistochemistry
 - d. CD1a immunohistochemistry



MYSTERY CASE SESSION
CASE HISTORIES
CASE #15

CONTRIBUTOR NAME*	Sarah Jacobson
CONTRIBUTOR EMAIL*	sjacobson@cvm.tamu.edu
COAUTHORS	Christina Middendorf, Dominique Wiener, Katia Groch, Raquel Rech, Laura Bryan, Grace Flynn, Sue Yee Lim, Audrey Cook, Ali Pankowski, Vanna Dickerson, and Jessica Hokamp
COMPANY OR UNIVERSITY	Texas A&M University

*Corresponding contributor

SPECIMEN: Liver fine needle aspirate cytology, glass slide

SIGNALMENT: Two-year-old, male, mixed breed dog

HISTORY AND CLINICAL FINDINGS: The patient presented to Texas A&M University (TAMU) emergency services for evaluation of progressive hyporexia, hindlimb weakness to lameness, and possible neurologic signs of two months duration, as well as persistently elevated liver enzymes of nine months duration. Initial physical examination was unremarkable except for bilateral tightness appreciated on hip extension, but no overt neurologic or musculoskeletal abnormalities were noted. A consultation with the neurology service did not reveal any neurologic abnormalities and referred abdominal or lumbosacral pain was suspected for the cause of the patient’s kyphotic posture. Current medications included gabapentin, clindamycin, lactulose, Denamarin, and cefpodoxime. The patient’s diet consisted of Hill’s Science Diet, and he lived with his male littermate, who was apparently healthy.

Two months prior to the visit at TAMU, a point of care abdominal ultrasound revealed a “mixed echogenicity pattern” within the liver that was concerning for a tumor. At this time, a fine needle aspirate of the liver was performed and sent for pathologist review; this was interpreted as vacuolar hepatopathy (glycogen vs. hydropic degeneration) and moderate neutrophilic inflammation.

Six weeks prior to the visit at TAMU, testing for Histoplasma, Heterobilharzia, Toxoplasma, Neospora, and Leptospira were negative.

Initial diagnostics at current presentation included a CBC (mildly elevated plasma protein, otherwise unremarkable), serum chemistry, and routine urinalysis (USG, 1.028; trace protein; moderate bilirubin with positive ictotest; trace blood; 1-2 RBC/hpf; and sperm present). The patient was transferred to the internal medicine service, where an abdominal

ultrasound was performed, revealing a central divisional hepatic mass as well as a diffusely nodular liver. The spleen also appeared diffusely mottled. Fine needle aspiration of the hepatic parenchyma, central divisional hepatic mass, and spleen were performed, and smears were submitted for cytologic evaluation.

LABORATORY DATA (Serum Chemistry - VITROS 4600 Analyzer)

TEST	UNITS	RESULT	REFERENCE INTERVAL
Glucose	mg/dl	125	60-135
Lactic Acid	mg/dl	9.7 (L)	9.9-46.8
Blood Urea Nitrogen	mg/dl	10	5-29
Creatinine	mg/dl	0.73	0.5-1.5
Sodium	mmol	141	139-147
Potassium	mmol	4.3	3.3-4.6
Enzymatic Carbon Dioxide	mmol	20 (L)	21-28
Chloride	mmol	119 (H)	107-116
Anion Gap (Calculated)	mmol	7.2 (L)	10-18
Calcium	mg/dl	10.8	9.3-11.8
Phosphorus	mg/dl	5.3	2.9-6.2
Magnesium	mg/dl	1.7	1.7-2.1
Total Protein	g/dl	7.0	5.7-7.8
Albumin	g/dl	3.4	2.4-3.6
Globulin	g/dl	3.6	1.7-3.8
Total Bilirubin	mg/dl	0.5	0-0.8
GGT	U/L	27 (H)	0-25
ALT	U/L	769 (H)	3-114
ALP	U/L	938 (H)	24-147
Cholesterol	U/L	361 (H)	120-247
Ammonia	ug/dl	<15	0-50

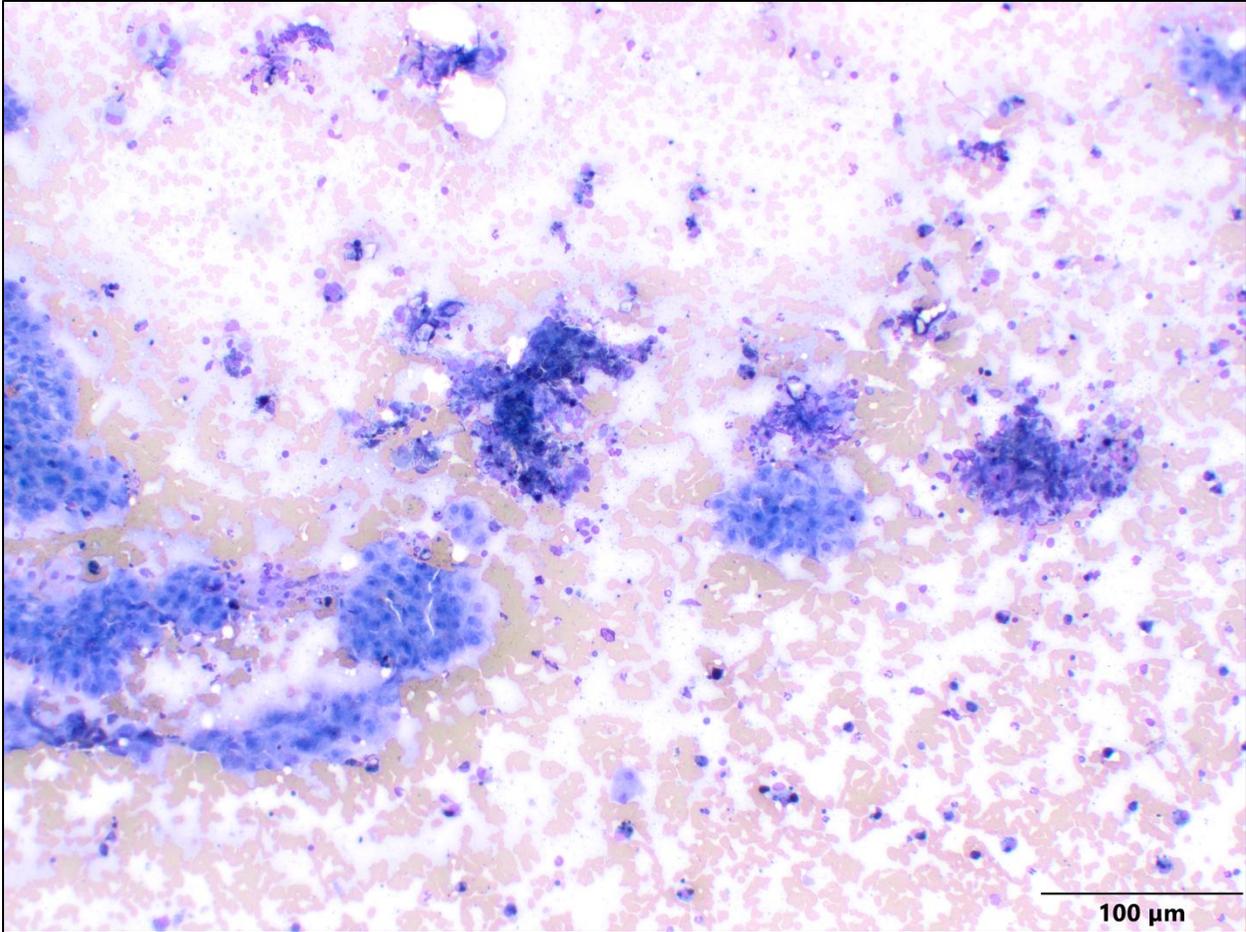


Figure 1: Fine needle aspirate cytology of hepatic parenchyma. Modified Wright's stain.

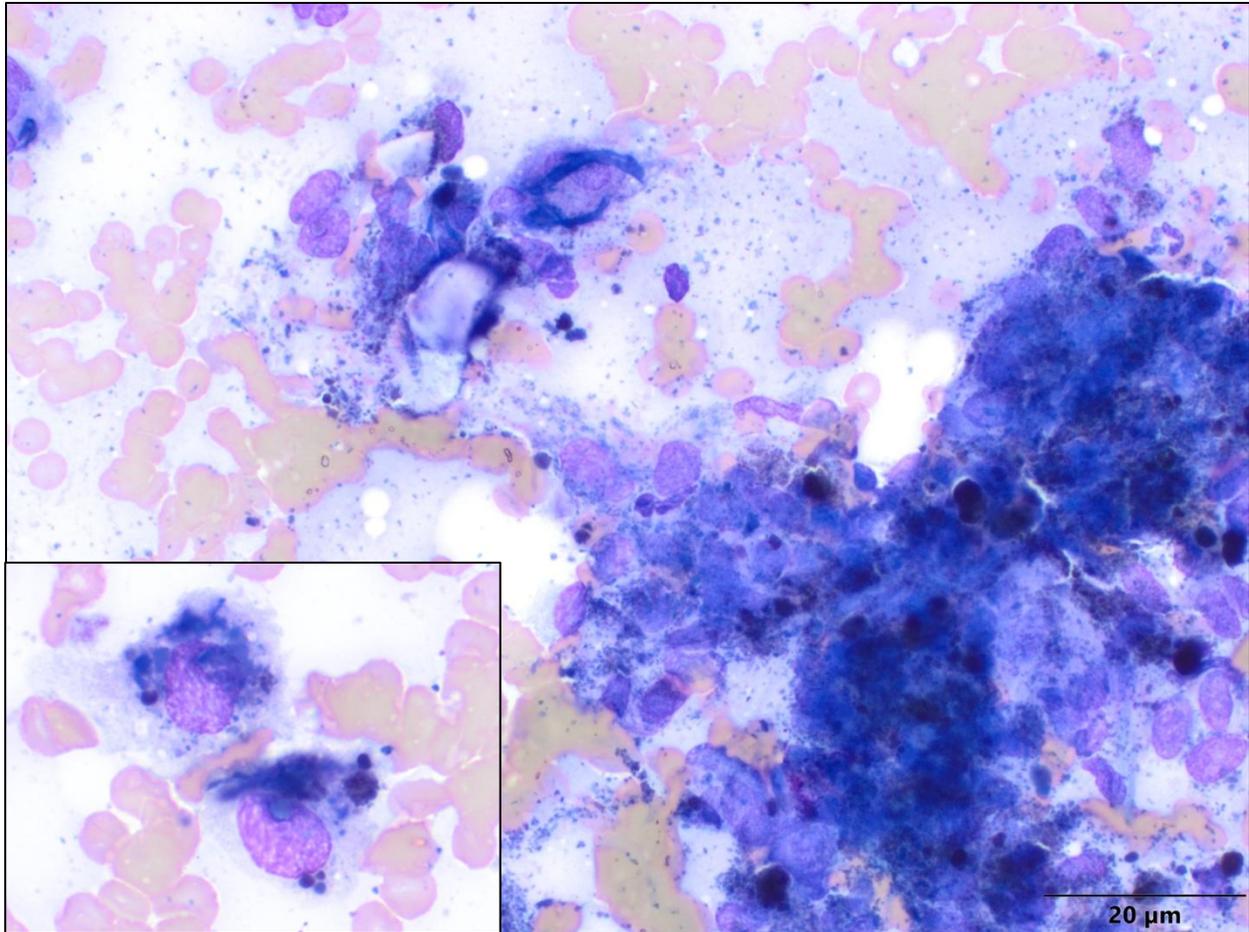


Figure 2: Fine needle aspirate cytology of hepatic parenchyma. Modified Wright's stain. Inset taken at 100x objective.

ADDITIONAL DIAGNOSTIC TESTS:

Cytology of splenic aspirates collected at the same time as the liver aspirates revealed mild to moderate lymphoid hyperplasia and mild extramedullary hematopoiesis.

QUESTIONS:

1. Which stain would best support your top differential for the structures identified?
 - a. Prussian blue
 - b. Calcofluor white
 - c. Alkaline phosphatase
 - d. Grocott-Gomori methenamine silver
2. Which diagnostic test would best support your leading suspicion regarding the cause of the observed cytologic changes in the liver?
 - a. Serum iron panel
 - b. Fecal sedimentation
 - c. Fungal PCR on whole blood
 - d. Hepatic copper quantification

CONTRIBUTOR NAME*	Elyssa L. Armstrong
CONTRIBUTOR EMAIL*	elyssa.armstrong.dvm@gmail.com
COAUTHORS	Francisco O. Conrado, Rachel E. Whitman, Kathryn H. Shaffert, Fabio Brum Rosa
COMPANY OR UNIVERSITY	Cummings School of Veterinary Medicine at Tufts University

* Corresponding contributor

SPECIMEN: Peripheral blood film, digital scan.

SIGNALMENT: 12.5-year-old, SF, Maine Coon mix

HISTORY AND CLINICAL FINDINGS:

Jewels, a 12.5-year-old spayed female Maine Coon mix, was presented to Tufts University's Emergency Service on 6/17/2024 for evaluation of lethargy and a bleeding axillary mass. The mass in question was noticed one month prior to presentation and became firmer with time but had not changed in size; minimal dark tan discharge was noted coming from the mass on 6/14, which has since progressed to hemorrhagic discharge/bleeding. Jewels' owner reports she has been eating and drinking less, hiding more, and not acting herself. No coughing, sneezing, vomiting, or diarrhea has been observed. Jewels lives with one other cat, but they live on separate floors and rarely meet. Both cats are indoor-only, and Jewels does not have any travel history outside of Massachusetts.

Abnormal physical exam findings included a 2.0-cm firm, pigmented, ulcerative cutaneous mass in the right axilla superimposed over an enlarged 4.0-cm axillary lymph node. At least four firm pinpoint pigmented cutaneous masses on the right lateral thorax, mildly icteric sclera, mild cachexia, and tacky mucous membranes. A complete blood count (CBC), serum chemistry, and urinalysis were performed on admission.

LABORATORY DATA:

CBC Results

TEST	UNIT	RESULT	REFERENCE INTERVAL
HCT	%	26 (L)	30-50
RBC	× 10 ⁹ /L	5.00 (L)	6.80-10.00
HGB	g/dL	8.8 (L)	10.1-17.1
MCV	fL	52.3 (H)	38.9-50.3
MCH	pg	17.6 (H)	12.9-17.0

MCHC	g/dL	33.7	32.1-36.0
Reticulocytes	%	1.23 (H)	0.06-0.63
Reticulocytes	× 10 ³ /μL	61.5	4.5-63.6
WBC	× 10 ³ /μL	18.79 (H)	4.50-15.70
Neutrophils	%	88 (H)	35-82
Neutrophils	× 10 ³ /μL	16.535 (H)	2.100-10.100
Lymphocytes	%	3 (L)	21-58
Lymphocytes	× 10 ³ /μL	0.56 (L)	1.10-6.00
Monocytes	%	6	0-12
Monocytes	× 10 ³ /μL	1.13	0.00-1.60
Eosinophils	%	3	0-23
Eosinophils	× 10 ³ /μL	0.56	0.00-1.90
Platelets	× 10 ³ /μL	44 (L)	126-629
Comments	Icterus present; marked lipemia present		

Serum Chemistry Results

TEST	UNIT	RESULT	REFERENCE INTERVAL
Glucose	mg/dL	70	70-120
Urea	mg/dL	49 (H)	15-33
Creatinine	mg/dL	1.0	0.9-2.1
Phosphorus	mg/dL	4.8	3.0-6.3
Calcium	mg/dL	8.9	8.8-11.7
Magnesium	mg/dL	4.4 (H)	2.0-3.1
Total Protein	g/dL	6.5	6.0-8.4
Albumin	g/dL	3.3	2.2-4.0
Globulins	g/dL	3.2	2.5-5.8
A/G Ratio	-	1.0	0.5-1.4
Na	mEq/L	147	146-158
K	mEq/L	4.0	3.4-5.2
Cl	mEq/L	109 (L)	110-125
tCO ₂ (Bicarbonate)	mEq/L	12 (L)	13-22
Anion Gap	-	26.2 (H)	9.0-21.0
Total Bilirubin	mg/dL	1.64 (H)	0.10-0.30
ALP	U/L	100 (H)	10-79
GGT	U/L	4	0-5
ALT	U/L	927 (H)	25-145
AST	U/L	1194 (H)	5-42
CK	U/L	502	14-528
Cholesterol	mg/dL	89	77-258
Triglycerides	mg/dL	358 (H)	25-191

Amylase	U/L	704	496-1940
Comments	Icterus present; marked lipemia present		

Urinalysis Results

TEST	RESULT	REFERENCE INTERVAL
Collection Method	Cystocentesis	
Color	Amber	
Turbidity	Clear	
USG	1.061	
pH	6.0	
Protein	1+	Negative
Glucose	Unable to determine due to color interference	Negative
Ketones	Unable to determine due to color interference	Negative
Bilirubin	3+	Negative
Heme Protein	Unable to determine due to color interference	Negative
WBC	0-3	≤3/hpf
RBC	0-5	<5/hpf
Bacteria	None seen	
Crystals	Trace bilirubin	
Transitional Cells	Occasional	
Granular Casts	Occasional	

PERIPHERAL BLOOD FILM:

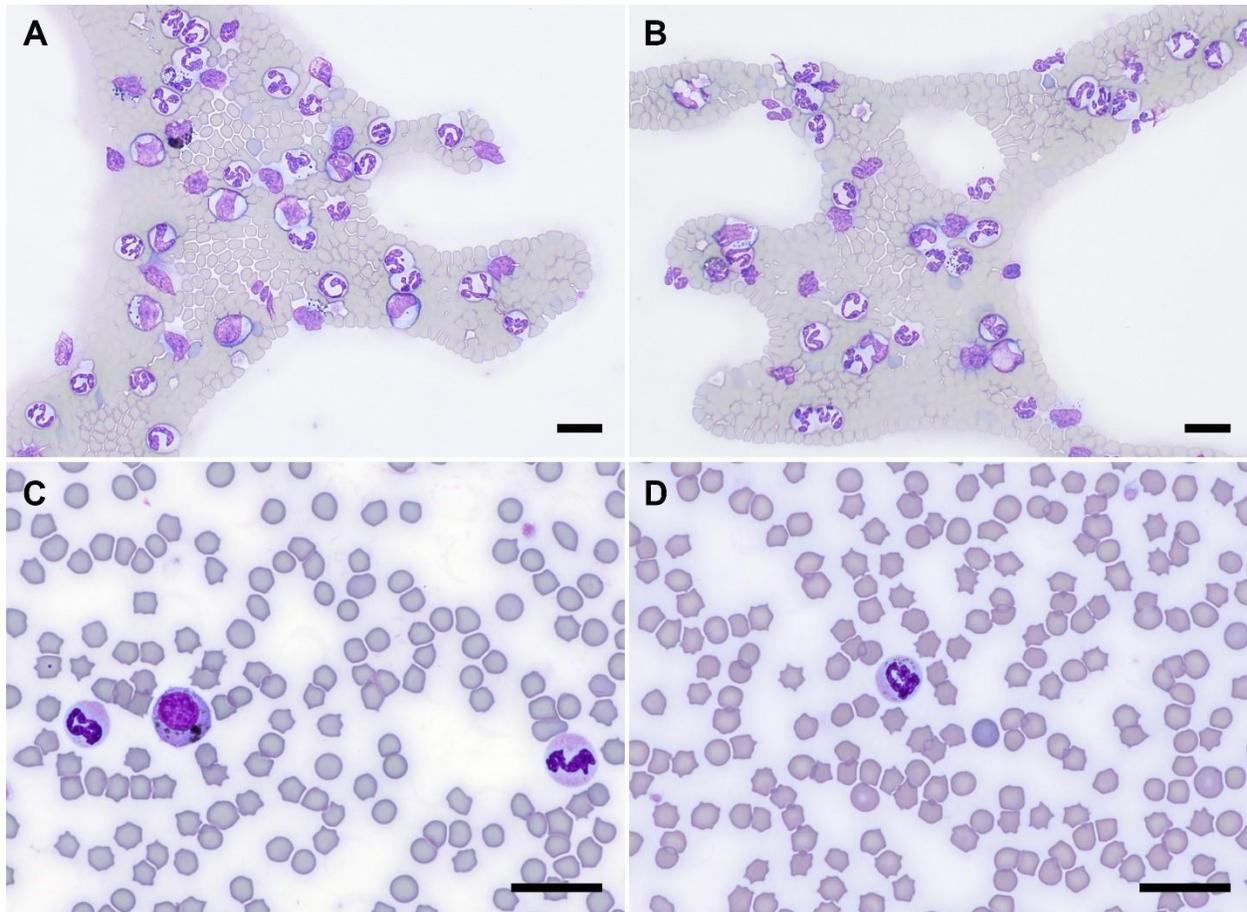


Figure 1. Photomicrographs of the peripheral blood film at 50× objective (**A, B**) and 100× objective (**C, D**) (bar = 20 μm; Wright-Giemsa).

QUESTIONS:

1. What stain(s) would you recommend prioritizing in this case?
 - a. Wright's Stain and Periodic Acid Schiff (PAS)
 - b. Congo Red
 - c. Prussian Blue and Fontana Masson
 - d. Prussian Blue and Acid-Fast

2. In cats, which of the following anatomic sites is the most commonly associated with your top differential diagnosis based on the blood film findings?
 - a. Haired skin
 - b. Digits
 - c. Eye
 - d. Oral cavity

CONTRIBUTOR NAME*	Jeremy Bessett
CONTRIBUTOR EMAIL*	jbessett@wisc.edu
COAUTHORS	Kimberley Sebastian, Kristen Friedrichs
COMPANY OR UNIVERSITY	University of Wisconsin-Madison

* Corresponding contributor

SPECIMEN: Peripheral Blood

SIGNALMENT: 11-year-old female spayed Golden Retriever

HISTORY AND CLINICAL FINDINGS: The dog was presented to the University of Wisconsin Veterinary Care (UWVC) Medical Oncology service with an acute history of vomiting, diarrhea, hyporexia, and lethargy. Two months prior, the dog had a subcutaneous mass removed by the primary veterinarian, submitted to VDX®, and interpreted as a round cell neoplasm. Giemsa and Toluidine blue histochemical staining did not highlight metachromatic granules. Immunohistochemical staining was negative for CD3, CD79a, CD117, and Iba-1. PCR for antigen receptor rearrangement (PARR) showed a TRG (A)-clonal on a light polyclonal background, TRG (B)-polyclonal, TRG (C)-polyclonal, IgH2-polyclonal, and IgH3-polyclonal. Overall, the morphology and these ancillary diagnostic findings were interpreted to be most consistent with a high-grade T-cell lymphoma. Since the removal of the subcutaneous mass, no other mass lesions had been noted. On physical examination, peripheral lymph nodes were normal, but there was hepatomegaly.

LABORATORY DATA:

Table 1. Hemogram results (ADVIA 2120i)

Test	Units	Initial UWVC Presentation (6/11/24)	Final CBC (6/23/24)	Reference Interval
RBC	x10 ⁶ /uL	5.25 (L)	4.33 (L)	5.6-8.4
HGB	g/dL	12.7 (L)	10.5 (L)	14.0-21.0
HCT	%	39	34 (L)	39-57
PCV	%	38 (L)	33 (L)	40-59
MCV	fL	74 (H)	78 (H)	61-73
MCH	pg	24	24	22-26
MCHC	g/dL	33 (L)	32 (L)	34-38
Retic	x10 ⁶ /uL	0.289 (H)	0.046	0.013-0.102

RBC Morphology		1+ Poly*	1+ Sphero**	
Platelet	x10 ³ /uL	89 (L)	81 (L)	175-500
MPV	fL	30.4 (H)	15.5 (H)	7.9-14.4
PLT Clump		None seen	Slight	
WBC	x10 ³ /uL	15.1 (H)	53.7 (H)	5.0-14.0
WBC Corrected	x10 ³ /uL	14.9	52.6	
Segmented Neutrophil	x10 ³ /uL	8.6	9.7	2.6-10.0
Band	x10 ³ /uL	2.9 (H)	0.5 (H)	0.0-0.2
Lymph	x10 ³ /uL	2.6	1.1	0.7-4.3
Mono	x10 ³ /uL	0.8	1.6 (H)	0.1-0.9
Eos	x10 ³ /uL	0.2	0	0.1-1.7
nRBC	x10 ³ /uL	0.2	1.1	
Atypical Mononuclear	x10 ³ /uL	See WBC Comment	39.7 (H)	0.0-0.0
WBC Comment (6/11/24)	<ul style="list-style-type: none"> <1% atypical mononuclear cells Rare macrophages and monocytes with phagocytosed erythrocytes and hemosiderin at feathered edge 			
Toxic Change		None seen	None seen	

*Poly = polychromasia; **Sphero = spherocytes

Table 2. Serum Biochemistry (Vitros 4600) and Urinalysis Results

Test	Units	Initial UWVC Presentation (6/11/24)	Final Chem (6/23/24)	Reference Interval
Urea	mg/dL	61 (H)	32	7-32
Creatinine	mg/dL	2.5 (H)	0.9	0.5-1.5
Phosphorus	mg/dL	6.0	3.1	2.2-7.9
Sodium	mmol/L	147	-	141-150
Potassium	mmol/L	5.3	-	3.9-5.3
Chloride	mmol/L	115	-	109-119
TCO2	mmol/L	23	-	19-30
Anion Gap		14	-	
Total Protein	g/dL	6.5	6.0	4.8-6.9
Albumin	g/dL	3.7	3.5	2.3-3.9

Globulin	g/dL	2.8	2.5	2.2-3.5
Total Bilirubin	mg/dL	0.9 (H)	0.4	0.1-0.8
Cholesterol	mg/dL	207	198	149-319
AST	IU/L	57 (H)	90 (H)	21-53
ALT	IU/L	15	365 (H)	14-87
ALP	IU/L	60	1453 (H)	20-157
GGT	IU/L	<10	52 (H)	5-16
CK	IU/L	299	90	22-491
Calcium	mg/dL	10.4	9.5 (L)	9.7-12.3
iCa (ABL VET90)	mmol/L	-	1.22	1.16-1.40
USG		1.011	-	N/A
Urine Protein (Dipstick)		1+	-	N/A
Urine Protein (SSA)		1+	-	N/A

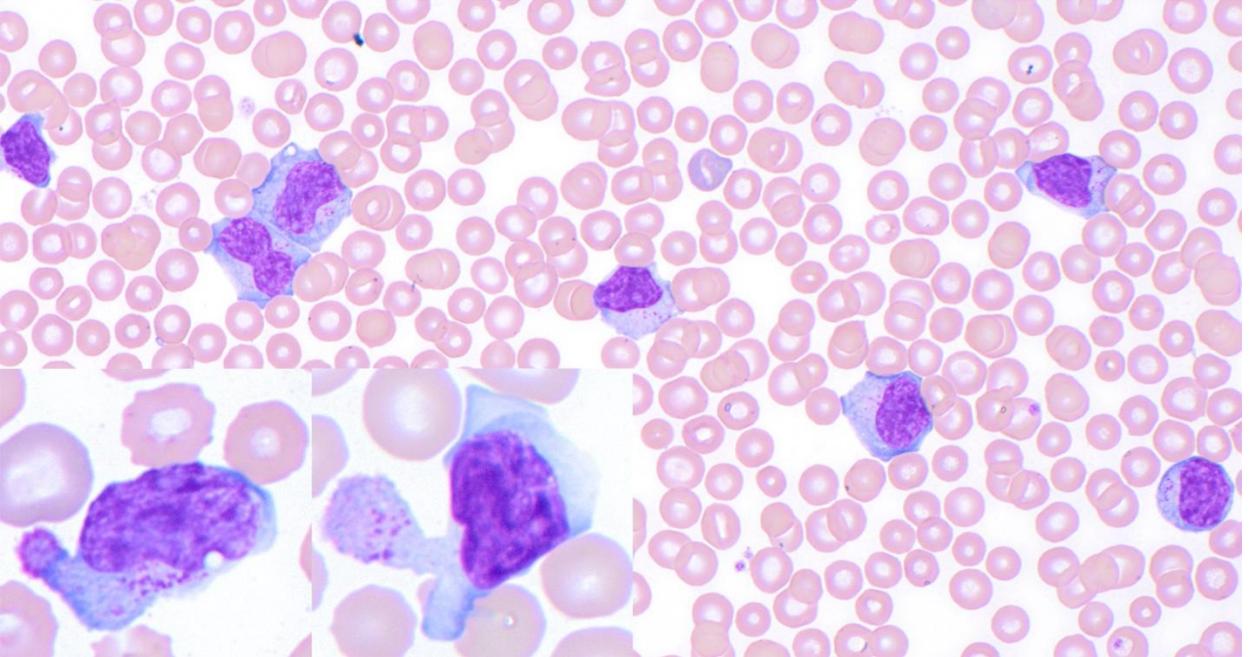


Figure 1. Peripheral Blood (6/23/24). Atypical mononuclear cells (60x objective) Modified Wright-Giemsa stain.

ADDITIONAL DIAGNOSTIC TESTS:

On 6/11/24 an abdominal ultrasound showed a diffusely mildly hyperechoic liver with rounded margins and decreased portal conspicuity. The spleen was diffusely heterogeneous with many ill-defined approximately 2 cm hypoechoic nodules. The left and right kidneys measured 8.41 cm and 8.92 cm, respectively, and had a hypoechoic cortical rim with hyperechoic peri-renal fat. Ultrasonographic findings were interpreted as

hepatomegaly, nodular splenomegaly, and bilateral renomegaly. Differentials included multicentric round cell neoplasia (liver, spleen, kidney), renal injury (infectious/inflammatory) with peri-renal steatitis, nodular splenic changes, and vacuolar hepatopathy.

Aspirates of the spleen, liver, kidney, and bone marrow were performed on 6/13/24, and at that time the CBC was similar to that reported above for 6/11/24.

Splenic aspirates contained mostly hematopoietic precursors of all lineages and stages, with orderly maturation and progression, with a smaller number of heterogeneous lymphocytes. There were low numbers of atypical cells similar to those observed in peripheral blood. Rarely macrophages contained metarubricytes within their cytoplasm.

Liver aspirates contained unremarkable hepatocytes, moderate to focally large numbers of hematopoietic cells (mostly erythroid lineage with orderly maturation and progression), and moderate numbers of atypical cells similar to those observed in peripheral blood.

Renal aspirates contained numerous atypical cells similar to those observed in peripheral blood. Renal tissue was not observed.

Bone marrow aspirates were hypercellular with unit particle cellularity estimated to be 80-100%. Approximately 89% of nucleated cells were the atypical cells observed in other sites and peripheral blood. Macrophages exhibiting metarubriphagocytosis were occasional.

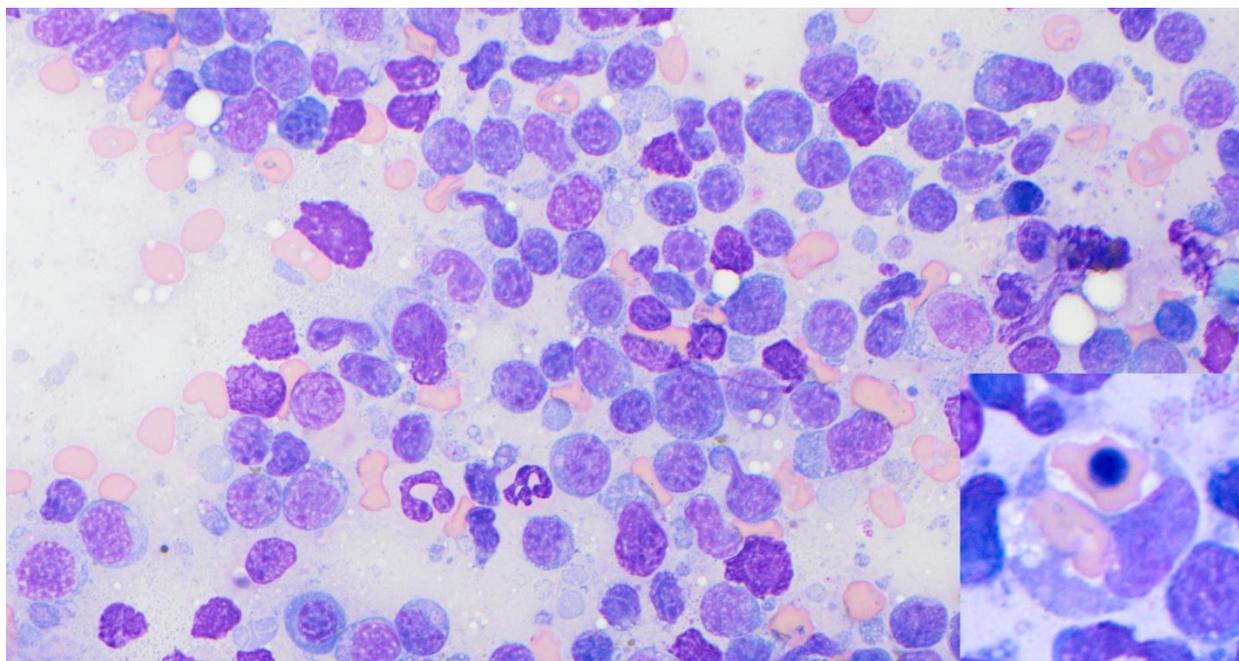


Figure 2. Bone marrow aspirate (6/13/24). Atypical mononuclear cells (60x objective). Inset: Macrophage with metarubriphagocytosis. Modified Wright-Giemsa stain.

QUESTIONS:

1. Given the patient history, laboratory data, and expansion of hematopoietic cells with magenta granules, what is the best diagnosis?
 - a. Chronic lymphocytic leukemia
 - b. Acute myeloid leukemia
 - c. Acute lymphocytic leukemia
 - d. Progression of the previously diagnosed subcutaneous round cell neoplasm

2. What would be the most appropriate next diagnostic test based on your answer above?
 - a. Flow cytometry
 - b. Cytochemical staining
 - c. PCR for Antigen Receptor Rearrangement (PARR)
 - d. Additional immunohistochemical staining of the original subcutaneous mass biopsy