Basophilia in a cat

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Signalment: 5-year-old male neutered domestic shorthair cat

History: The patient presented with a 6-week history of lethargy and pica. Pyrexia of one month duration and signs of gastrointestinal disease (GI) (soft feces, intermittent vomiting) were also reported.

Clinical findings: The cat was quiet, alert and responsive with a body condition score of 5/5, weighing 7.6 kg. The mucous membranes were pink with a capillary refill time less than two seconds. Thoracic auscultation and abdominal palpation were unremarkable. Rectal temperature was 40.1°C and the peripheral lymph nodes were normal.

Laboratory findings: On presentation, a CBC was performed on Advia 2120 (Siemens Healthcare Diagnostics, Inc., Tarrytown, NY) – Table 1. Salient microscopic findings are illustrated in Figure 1 (right and left). Plasma biochemistry (Randox RX Imola; Randox Laboratories Ltd, Crumlin, Co. Antrim, UK) was unremarkable except for a moderate decrease in urea (3.1 mmol/L, RI 6.6 – 10 mmol/L) and a mild hypernatremia (157.1 mmol/L, RI 147 – 156 mmol/L). Total calcium was within reference interval, as were cobalamin and

folate concentrations. Urine culture revealed no growth and the patient was negative for Toxoplasma gondii, FIV/FeLV, and Giardia spp infection.

Table 1. *CBC upon presentation at University College Dublin Veterinary Hospital (UCDVH)*

Analyte	Results	Reference range	Units
HCT	0.26	0.24 – 0.45	L/L
Hgb	86	81 - 142	g/L
RBC	5.39	5 - 10	$x10^{12}$/L
MCV	47.7	39 – 55	fL
MCHC	334	300 - 360	g/L
Retics	14.2	0 - 70	$x10^{9}$/L
Platelets	53	180 - 550	$x10^{9}$/L
MPV	22.7	8.6 - 18.9	fL
WBC	36.75	6 - 18	$x10^{9}$/L
Neutrophils	10.29	2.5 – 12.5	$x10^{9}$/L
Lymphocytes	0.37	1.5 - 7	$x10^{9}$/L
Monocytes	0.74	0.04 - 0.85	$x10^{9}$/L
Eosinophils	21.32	0 – 1.5	$x10^{9}$/L
Basophils	4.04	0 – 0.04	$x10^{9}$/L

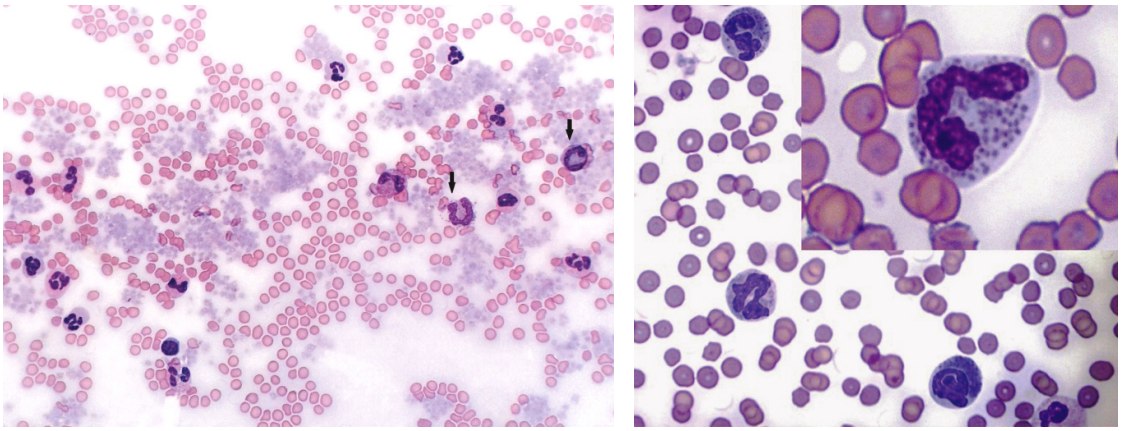

Figure 1. Blood smear (left) x40 objective; (right) x100 objective. Inset: detail of the cytoplasmic granules. Romanowsky

FNA of mesenteric and sternal lymph node:

Cytologic findings: a representative photomicrograph is provided (Figure 2)

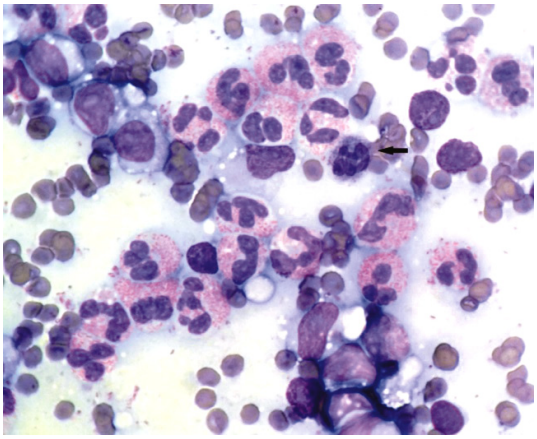

Figure 2. Photomicrograph of the mesenteric lymph node. Romanowsky – x100 objective

Questions:

1. What is your presumptive diagnosis based on the cytological findings?
2. What diagnostic test would you recommend to further characterize this neoplasm?
3. What is the significance of the eosinophilia and basophilia in the peripheral blood?
4. How are basophils usually identified and reported?

Data Interpretation:

Hematology data (Table 1): Borderline anemia with a low-normal reticulocyte count. Marked thrombocytopenia with increased platelet size and a 2-fold increase in leukocytes due to moderate-to-marked eosinophilia and marked basophilia.

Blood smear: (left) x40 objective – Representation of all 5 leukocytes. Manual count revealed a relative value of 11% basophils (arrows) and 58% eosinophils. Marked and diffuse platelet clumping noted throughout the smear area. In felines, difficulty with automated platelet counts and a tendency for in-vitro clumping suggest the thrombocytopenia in the current case is an artefact. (right) x100 objective. – Basophil morphology: occasionally larger than an eosinophil, with a ribbon-like, sometimes bi- or tri-lobed, and rarely U-shaped nuclei with moderately-condensed chromatin and numerous, relatively uniform, round, lavender cytoplasmic granules. >95% of basophils were well-granulated with prominent, individual granules (inset), rarely with peripheralized or poorly stained granules.

Cytologic findings: The mesenteric lymph node (Figure 2) was highly cellular with good cell preservation in a hemodiluted background. Approximately 1/3 – 1/2 of nucleated cells were well-granulated eosinophils, markedly out of proportion to the blood contamination. Rare basophils were noted. The lymphoid population consisted of mostly (>80%) medium-sized, occasionally large lymphocytes with round-to-oval, often irregular nuclei, usually 2 - 3 RBCs in diameter with fine chromatin and usually indistinct, small to medium-sized nucleoli. Light-blue cytoplasm was in moderate amounts, frequently with small, clear vacuoles.

Q1. What is your presumptive diagnosis based on the cytological findings?

Cytologic diagnosis: Lymphoma with marked eosinophilic and mild basophilic inflammation.

Q2. What diagnostic test would you recommend to further characterize this neoplasm?

Immunocytochemistry, flow cytometry and PARR can be used to differentiate between B and T-cell lymphoma. In this patient, immunocytochemistry and PARR proved inconclusive due to insufficient material recovered; however, a faint band suggestive of a clonal population was noted on the electropherogram.

Additional tests: A tru-cut biopsy of the mesenteric lymph node was later submitted for analysis. Histopathological examination revealed a diffuse infiltrate of round cells admixed with large numbers of intact, degranulated eosinophils. Immunohistochemistry (University of Liverpool, Veterinary Laboratory Services) revealed smaller diameter lymphocytes to be strongly CD3+, while the larger cells were multifocally, mildly positive. Both were MHC II class+ and CD45R-. Toluidine blue staining and CD117 were negative, ruling out a visceral mastocytoma.

Final diagnosis: Mesenteric T-cell lymphoma with paraneoplastic basophilia accompanying eosinophilia

Outcome: While hospitalized, the patient received fluid therapy and remained alert with a body temperature below 40° C. After discharge and a mild episode of anorexia at home, the owner opted for euthanasia which was carried out by the referring veterinarian. The body was not available for post-mortem examination.

Discussion

Lymphoma is one of the most common neoplasms reported in cats[1]. It is located predominantly in the GI tract where up to 25% are T-cell in origin (CD3+)[2].

Q3. What is the significance of the eosinophilia and basophilia in the peripheral blood?

They are both paraneoplastic syndromes attributed to the mesenteric T-cell lymphoma. Various inflammatory disorders such as food allergy, flea dermatitis, eosinophilic granuloma, asthma, endo and ectoparasitism can have peripheral eosinophilia with the highest values ranging from 23.5 $x10^9$/L in cats with flea allergy to 46.2 $x10^9$/L in cats with eosinophilic granuloma complex[3]. Severe eosinophilia (>50 $x10^9$/L) is characteristically seen in rare disorders such as idiopathic hypereosinophilic syndrome (IHES) and eosinophilic leukemia[3]. Neoplasia-associated eosinophilia is a feature of mast cell tumors, previously reported in cats with myeloproliferative disease, transitional cell carcinoma and lymphoma[4]. The cause of the increased circulating eosinophils was attributed to the confirmed mesenteric T-cell lymphoma, while other inflammatory conditions were eliminated based on clinical signs and history.

Feline basophilia is rarely reported and usually accompanies eosinophilia. Primary causes are attributed to allergic reactions and parasitism, although all differentials for eosinophilia must be considered. Previous reports have described basophilia with mast cell tumors, heartworm infection, polycythemia vera and intestinal T-cell lymphoma[5]. Basophilic leukemia as a primary neoplasm has been reported exclusively in dogs[6] and humans[7]. Neither eosinophilic nor basophilic leukemia were suspected in the present case as circulating granulocytes were mature, well-differentiated with rare band forms, rare eosinophilic metamyelocytes and no blast cells were noted during the blood smear examination.

Q4. How are basophils usually identified and reported?

Basophils were identified by routine examination of the blood smear. Special consideration should be given to both automated and manual counts, as basophils can often be

misinterpreted. When performing manual counts, emphasis should be put on differentiating basophils from monocytes or toxic neutrophils by their cytoplasmic characteristics[8], and from mast cells based on their nuclear morphology[9]. In one study, three hematology analyzers were evaluated with respect to their ability to detect canine, feline and leporine basophils, considered to be resistant to acid lysis, differentiating them from the rest of the white cell population. Canine basophils were not detected by the Sysmex XT-2000iV or CELL-DYN 3500 analyzers, and neither canine nor feline basophils were identified by the Advia 2120[8].

Electronic records from the UCDVH Clinical Pathology laboratory identified only 7 cases of basophilia from approximately 7000 cats in the last 7 years. Values ranged from 0.23 to 3.49 x 10^9/L (RI 0 – 0.04 x10^9/L). Internal records also revealed that slight basophilia, defined as ~1% or ~0.3 x10^9/L basophils was observed in 8 – 10% of cats.

Paraneoplastic basophilia and eosinophilia in cats have been rarely reported together, predominantly with hemolymphatic malignancies, and usually accompanied by clinical signs of GI disease[4,5,10,11].

Previously reported cases of feline basophilia had mild to moderate increases with values of 0.28 x10^9/L in a myeloid leukemia[4] and up to 2.8 x10^9/L in an intestinal lymphoma[5]. Eosinophil values in these cases were 14.36 x10^9/L and 6.5 x10^9/L, respectively.

In conclusion, this is a marked case of peripheral basophilia as a paraneoplastic syndrome accompanying eosinophilia in a feline intestinal T-cell lymphoma.

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