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## Hematological Biomarkers in the Diagnosis and Monitoring of Canine Pyometra

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Abstract: This paper presents a complex clinical case in which hematological changes played a key role in the diagnosis, monitoring of disease progression, and therapeutic optimization in a canine patient with pyometra. Throughout the investigations, significant alterations in blood parameters were noted – such as non-regenerative anemia, marked leukocytosis with neutrophilia, and thrombocytopenia – associated with a systemic inflammatory response and potential immunosuppression. Biochemical evaluation supported the suspicion of multiorgan involvement, while blood smear cytology and microbiological investigations led to the identification of opportunistic pathogens such as Candida parapsilosis and Mycoplasma haemocanis. Favorable clinical outcome was achieved through a multidisciplinary therapeutic approach, tailored according to the dynamics of hematological biomarkers and the patient's response to treatment. This case highlights the importance of continuous hematobiochemical monitoring in canine pyometra, underlining their diagnostic and prognostic value in veterinary practice. *Keywords:* canine pyometra, leukocytosis, Candida parapsilosis, blood biomarkers, neutrophilia

#### Introduction

Pyometra is a reproductive disorder of both hormonal and bacterial origin, typically occurring during the luteal phase of the estrous cycle in unspayed females, and is characterized by the accumulation of purulent exudate within the uterine lumen. In affected canines, the condition is frequently accompanied by bacteremia, endotoxemia, and a systemic inflammatory response, which may compromise vital organs such as the heart, liver, kidneys, and hematopoietic bone marrow. These systemic effects raise concerns regarding the potential contribution of pyometra to sudden death in clinically affected animals. Hematological and biochemical alterations associated with pyometra are critical indicators of disease severity and prognosis. As such, hematologic evaluation plays a key role not only in diagnosis but also in therapeutic monitoring, providing valuable information on the animal's general health status and the presence of possible complications or comorbidities.

#### Materials and Methods

A 6.3-year-old female Chow Chow was brought to the Emergency Department of the Clinical Hospital for Pets at the Faculty of Veterinary Medicine in Iași, the owner stating that she has been apathetic for 4 days, has water appetite present, but food appetite is absent. She was diagnosed by her attending physician, 3 days ago with Endometriosis, who instituted her therapy with Alizin (dz. 10 mg/kg) and Amoxicillin (dz. 10 mg/kg). About 6 hours before the presentation, the patient began to refuse to move (walk).

#### Results

The patient presented with tachypnea, purulent vaginal discharge, and pale, adhesive mucous membranes. Imaging investigations revealed pulmonary changes suggestive of chronic bronchopneumonia and ultrasound findings consistent with pyometra. Cardiological and neurological assessments showed no significant alterations. Hematological analysis (Table 1) indicated marked leukocytosis, neutrophilia, normocytic normochromic anemia, and thrombocytopenia. Biochemical evaluation (Table 2) revealed increased levels of urea, alkaline phosphatase, phosphorus, and hypoalbuminemia. The therapeutic approach included fluid therapy, broad-spectrum antimicrobials, glucocorticoids, antifungals, analgesics, hemostatics, and supportive supplementation. Although the general clinical status improved, hematological parameters deteriorated, necessitating two blood transfusions and further diagnostic procedures, including cytological blood smear analysis and blood culture.

Parameter	WBC x10^9/L	NEU x10^9/L	RBC x10^12/L	HGB g/dl	HCT %	<i>PLT</i> x10^9/L
alues at presentation	44.51	37,15	5,12	10,6	27,88	33
Preoperative values	39,05	32,34	5,1	9,8	27,43	19
alues on the day of operation	35,03	28,28	4,14	7,7	22,46	13
'ost-oprator	36,85	32,88	3,73	6,7	20,9	18
Pretransfusion 1	51,24	44,16	2,95	2,95	16,57	20
Posttransfusion 1	64,14	59,51	3,23	6,4	18,86	68
leassessment1	85,58	71,64	3,52	7,7	20,7	93
leassessment2	90,34	75,32	3,28	6,7	19,1	99
leassessment3	37,27	31,5	3,09	5,9	17,91	257
tart fluconazole therapy	34,24	27,88	2,83	5,4	16,72	266
Pretransfusion2	82,67	65,55	2,92	6,4	17,26	282
Transfusion2	55,73	44,52	4,05	8,5	25,74	79
Reassessment4	47,25	41,03	4,56	10,6	28,42	138
Reassessment5	47,97	44,42	4,22	9,3	26,13	86
alues on discharge	22,5	18,55	4,88	10,2	30,6	71
leassessment1	17,15	13,74	5,07	10,1	37,71	315
leassessment2	17,45	11,59	6,33	12,6	38,6	169
leassessment3	11,9	8,55	6,51	12,9	36,9	332
Reassessment4	16,59	11,41	7,73	14,4	42,34	173
leference ranges	6,0-17,00	3,0-12,0	5,5-8,5	12,0-18,0	37,0-55,0	165,0-500,0

*Table 1. Hematological biomarkers in dynamics* 

### Table 2. Evolution of the biochemical biomarkers of blood

Parameter	Values at presentation	Operation day	Posttransfusion 1	Reassessment1	Reassessment1	Postransfuzion 2	Reassessment1	Reassessment2	Reassessment3	Reassessment4	Reassessment5	Reference ranges
BUN mg/dl	59	49	31	55	23	45	19	22	31	27	27	16-56
PHOS mg/dl	11	5,91	4,67	5,05	5,16	5,78	5,28	4,64	5,95	4,75	5,28	2,9-5,3
ALB g/dl	15	15	15	21	22	26	25	25	27	19	27	28-39
ALP U/L	200	569	464	349	568	818	628	514	363	228	119	1-114
TGO U/L	0	452	221	68	52	42	45	67	49	42	45	13-15
CRE mg/dl	0,8	0,56	0,37	0,52	0,56	0,4	0,44	0,44	0,6	0,5	0,41	0,5-1,4
YGT U/L	1	1	1	70	8	17	16	18	9	3	4	1-9,7
GLU mg/dl	70	76	57	81	90	66	60	75	80	85	72	76-119
CA mg/dl	9,3	7,26	7,33	8,13	7,88	8,8	8,56	8,72	9,18	8,8	10,2	9,1-11,7
TBIL mg/dl	0,4	0,25	0,16	0,25	0,22	0,11	0,22	0,14	0,19	0,22	0,22	0,0-0,4

Cytological evaluation of blood smears (Table 3, Figure 1) revealed anisocytosis, Howell-Jolly bodies,

intraerythrocytic crystals, and perierythrocytic formations suggestive of Mycoplasma haemocanis, later confirmed via positive diagnosis. The hematological profile indicated a microcytic, hypochromic, hyporegenerative anemia, neutrophilia with left shift, monocytosis, and thrombocytopenia. Postdischarge home treatment included antifungals (fluconazole), doxycycline, hematopoietic TOTAL supplements (iron, cobalamin), gastroprotectors, electrolyte support (potassium), probiotics, hepatoprotectors, and hemostatics.

At the 5-day follow-up, clinical status had significantly improved, with normalized behavior, appetite, and cessation of rhinorrhagia. Hematological reassessment showed remission of anemia and leukocytosis (RBC: 5.7×10<sup>12</sup>/L, HGB: 10.1 g/dL, HCT: 37.71%; WBC: 17.15×10<sup>9</sup>/L; Table 1), and partial correction of biochemical imbalances (Table 2). Therapy was maintained with minor adjustments.

A second follow-up revealed continued hematological improvement (RBC: 6.33×10<sup>12</sup>/L, HGB: 12.6 g/dL, HCT: 38.6%; WBC: 17.45×10<sup>9</sup>/L, neutrophils: 11.59×10<sup>9</sup>/L; Table 1), and ongoing normalization of biochemical markers (Table 2). Therapy was continued unchanged, with periodic reassessment every 7 days.

At the final 30-day evaluation, hematological values remained within physiological limits and biochemical parameters showed stability (Tables 1 and 2), confirming sustained remission and therapeutic efficacy.



Figure 1. (a) Microcytic anemia and Howell-Jolly Corpuscles (red arrow). Microcytic anemia and Mycoplasme haemocanis isolated perieritrocytic (red arrows). (c) Reactive giant platelet.



Figure 2. (a) The appearance of Candida parapsilosis colonies. On Sabouraud dextrose agar medium, Candida parapsilosis colonies show a white, creamy and glossy appearance. This species does not form true hyphae, but develops pseudohyphalous type structures. (b) The microscopic image shows morphological elements characteristic of the species Candida parapsilosis, col.Gram positive. Levuriform cells of oval or round shape, isolated or clustered, showing active budding (blastoconidia) are observed, as well as pseudohyphal structures, arranged in a chain, without formation of true hyphae

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Date	15.05.2024	21.05.2024
VSH	mm/2h(N<20)	mm/2h(N<20)
RETICULOCYTES	0,44%(N<100)	3,3%(N<1,5)
	23x10^3/ul(N<100)	116x10^3/ul(N<100)
TOTAL NEUTROPHILS	74,2%(28,9x10^3/ul)	85,3%(72,99x10^3/ul)
YOUNG NEUTROPHILS (1-2 lobes)	54,70%	34,37%
Nf (3lobes)	30,50%	36,71%
Nf(4-5 lobes)	14,80%	30,40%
Ео	1,5%(0,58x10^3/ul)	2%(1,71x10^3/ul)
Мо	17,2(6,70x10^3/ul)	4,0%(3,42x10^3/ul)
Во	0%(x10^3)	0%(x10^3/ul)
Lf	7%(2,7x10^3/ul)	8,7%(7,44x10^3/ul)
Т	91x10^3/ul	
Result	<ul> <li>Anisocytosis, Jolly bodies, intraerythrocytic crystals, isolated and stringy perierythrocytic formations</li> <li>Mycoplasma haemocanis (positive)</li> <li>Microcytic, hypochromic, hyporegenerative anemia</li> <li>Neutrophilia with left shift of nuclear index</li> <li>Monocytosis</li> <li>Thrombocvtopenia</li> </ul>	<ul> <li>Microcytic, normochromic, hyperregenerative anemia</li> <li>Neutrophilia with left shift of INN</li> <li>Leukocytosis</li> <li>Thrombocytopenia</li> <li>Eosinophilia</li> <li>Monocytosis</li> </ul>

Table 3. Result of cvtological examination of blood smear

Lymphocytosis
 Mycoplasma haemocanis –negative



