NORMAL VALUES FOR COMPOSITION OF PERIPHERAL BLOOD AND OF BONE MARROW OF DOGS

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The composition of the bone marrow of dogs was first studied by A. F. Aleksandrov in 1930 [1]. He came to the conclusion that the formed elements of the bone marrow and peripheral blood of dogs are structurally more similar to those of humans than are those of other animals. However, he drew attention to certain features peculiar to dogs, which should be taken into consideration in evaluating the results of hematological studies.

For example, dogs' blood differs from human in the following respects: 1) its high hemoglobin content, 2) high red cell content, 3) general microcytosis, 4) presence of polychromatophiles. The white cell count is much higher, there is a relative lymphopenia, monocytosis, an inconstant eosinophilia, and in almost every case there is basophilia, with Turk cells. A. F. Aleksandrov found, further, that the variations in the morphology of the bone marrow did not coincide with those of the peripheral blood. Sternal puncture specimens do not give a true picture of the bond marrow, as the aspirate always includes a greater or smaller admixture of peripheral blood, but it is possible, from the relative counts of formed elements of the specimen, to draw conclusions regarding the state of hemopoiesis in any given case.

TABLE 1

Normal Values for the Composition of Peripheral Blood and Bone Marrow of Dogs
(according to A. F. Aleksandrov)

Peripheral blood		Bone marrow	
Hemoglobin	92—100%	Myeloblasts	0.5—3.2%
		Promyelocytes	0.2—1.8%
Erythrocytes	3 960 000—8 400 000	Neutrophilic myelocytes	0.2—2%
		Eosinophilic "	0.9—1.2%
Leucocytes	7 260—20 200	Juvenile neutrophiles	4.3—1.9%
Juvenile neutrophiles	0.17—1.25%	" eosinophiles	0.7—2.6%
Neutrophiles	57.25—75.75%	Neutrophiles	27.5—43.55%
		Polymorphonuclear	—
Eosinophiles	0.75—5.75%	Eosinophiles	0.6—3.77%
Basophiles	0.06—0.75%	Basophiles	0.2—1.8%
Lymphocytes	25.5—3.75%	Lymphocytes	3—12.3%
Monocytes	2.75—22.5%	Monocytes	4.1—18.6%
Plasma cells	0.5—2%	Plasma cells	0.2—0.8%
Reticulo-endothelial cells	0.25—0.02%	Reticulo-endothelial cells	1.8—12%
Botkin-Gumprecht cells	0.5—2.25%	Proerythroblasts	1—3.5%
		Erythroblasts	14.3—32.2%

A. F. Aleksandrov's tables of normal values for peripheral blood and bone marrow were based on the data obtained on 12 dogs. Our values are based on a study of 54 dogs, and include data not covered by Aleksandrov, such as erythrocyte sedimentation rate (ESR), color index, thrombocyte count, and reticulocyte count of bone marrow and peripheral blood.

Our results have been evaluated by the method of variational statistics, and are presented in Table 2; Table 1 gives the values taken from Aleksandrov.

TABLE 2

Normal Composition of Peripheral Blood and Bone Marrow of Dogs (our values)

	M ± m	± σ	Corrected norm $M \pm \sigma$
Peripheral Blood			
ESR	6±1.10	±9.09	6—15.0
Hemoglobin	69±1.28	±10.62	58.38—79.62
Erythrocytes	$5.995 \cdot 10^6$ ±0.087	$±0.713 \cdot 10^6$	$5.282 \cdot 10^6$ —6.708 $\cdot 10^6$
Color index	0.58±0.01	±0.08	0.572—0.596
Leucocytes	12 745±490	±4 040	8 705—16 785
Juvenile neutrophiles	0.58±0.13	±1.14	0—1.72
Band neutrophiles	14.14±1.89	±9.6	4.54—23.74
Polymorphonuclear neutro- (philes	42.41±1.01	±18.12	24.29—60.53
Eosinophiles	2.7±0.42	±3.75	0—6.45
Basophiles	0.11±0.12	±1.11	0—1.22
Lymphocytes	12.05±0.94	±8.48	3.11—20.54
Monocytes	6.34±0.47	±4.2	4.14—10.54
Reticulo-endothelial cells	0.73±0.04	±0.35	0.38—1.08
Plasma cells	0.37±0.06	±0.5	0—0.87
Botkin-Gumprecht cells	0.024±0.01	±0.13	0—0.12
Erythroblasts	0.08±0.03	±0.28	0—0.36
Reticulocytes	0.01±0.24	±1.9	0—2.91
Thrombocytes	152,587±13,880	±103.779	48 808—256 366
Bone Marrow			
Myeloblasts	0.48±0.58	±0.58	0—1.06
Promyelocytes	0.66±0.1	±0.69	0—1.35
Neutrophilic myelocytes	2.24±0.22	±1.58	1.66—3.82
Eosinophilic "	0.54±0.07	±0.53	0.01—1.07
Neutrophilic metamyelocytes	6.58±0.96	±6.75	0—13.33
Eosinophilic metamyelocytes	0.7±0.11	±0.75	0—1.45
Band neutrophiles	23.2±0.93	±6.53	16.67—29.73
Polymorphonuclear neutro- (philes	15.8±1.53	±10.72	5.08—26.52
Eosinophiles	2.6±0.33	±2.32	0.29—4.91
Basophiles	0.34±0.06	±0.39	0—0.73
Lymphocytes	5.3±0.63	±4.44	1.86—10.74
Monocytes	4.4±0.3	±2.12	2.28—6.52
Plasma cells	1.03±0.16	±1.1	0—2.13
Reticulo-endothelial cells	2.7±0.31	±2.19	0.51—4.89
Proerythroblasts	2.9±0.23	±1.64	1.26—4.54
Erythroblasts I	7.2±0.6	±4.2	3—11.4
" II	13.8±1.11	±7.78	4.02—21.58
" III	5.8±0.72	±5.04	0.76—10.84
Botkin-Gumprecht cells	0.6±0.15	±1.02	0—1.62
Ferrat cells	0.16±0.03	±0.22	0—0.38
Reticulocytes	0.40±0.058	±0.4	0—0.8
Megacaryocytes	0.05±0.02	±0.17	0—0.22

M - arithmetic mean; m - experimental error; σ - mean quadratic deviation.

It will be seen from the tables that our values for peripheral blood differ somewhat from those of A. F. Aleksandrov; a striking feature of those tables is the very great difference between maximum and minimum values for red cell counts, and who does not give separate values for band neutrophiles, which are an important criterion of leucopoiesis. Wide deviations between maximum and minimum values for other cells of the leucocyte series are also evident in his tables. There is reason to believe that our values, being based on a considerably larger number of animals, approximate more closely to the true ones.

As for the bone marrow values, A. F. Aleksandrov gives only the extreme limits, which vary over a very wide range. He does not distinguish the band neutrophiles, although the evaluation of maturation of elements of the leucocyte series is of great importance.

D. Birt has advanced a value of 300,000 for the thrombocyte count of peripheral blood of dogs; we find a range of from 48,808 to 256,366 (thrombocyte count done according to the Fonio method). We mention this because Birt's is the only published value, as far as we have been able to find, for the thrombocyte count of dogs' blood.

LITERATURE CITED

[1] A. F. Aleksandrov, Folia Haematol. 41, 1-2, 428-434 (1930).