Blood Studies in Normal Hogs*

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IN THE course of an investigation on the effect of carbon tetrachloride on the blood morphology in hogs†, two healthy and apparently normal animals were employed as controls. Peripheral blood studies performed at weekly intervals during periods of twenty-two and twenty-five weeks are now reported, with the purpose of presenting data for comparison with those of investigators who employ hogs as experimental animals.

Erythrocyte and reticulocyte counts, hemoglobin determinations, volume of packed red cells, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, leucocyte counts, differential and platelet counts were performed weekly. Blood was drawn from the tail vein (by removing scab of a previous wound a free flow of blood was obtained from the distal segment of the tail), two or three c.c. were collected in bottles containing 6 mgs. of dry ammonium oxalate and 4 mgs. of potassium oxalate for each c.c. of blood. The hemoglobin was determined in grams per 100 c.c. of blood and in percentage by a single Newcomer-Klett instrument with a solid standard. One hundred per cent hemoglobin was considered equivalent to 14.5 gms. per 100 c.c. of blood. Smears for differential white cell counts, reticulocytes, and study of red cell morphology were made with unoxalated blood. The usual technique was followed in performing the blood counts and certified apparatus was used. The direct method was followed in the enumeration of the platelets, and the diluting fluid, recommended by Rees and Echer was used.

The animals (hog 1, male and hog 2, female) were of Berkshire stock born in Puerto Rico, and of about 3 months of age when the studies were begun; they came from the same litter and weighed about 15 kilograms each. By the end of the study each weighed over 75 kilos. Their diet consisted of fresh, unspoiled refuse from the University Hospital, supplemented by raw vegetables and fruits. The hogs were kept in a large, dry, spacious yard with a cement floor, under very clean conditions. Examination of feces to determine parasitic infestations performed at monthly intervals was negative for both animals.

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† See previous article, page 362 of this issue.

RESULTS

For the sake of brevity the reader is referred to the tables showing the various determinations and their means. In Tables 1 and 2 are shown the erythrocytes, hemoglobin in grams and percentage, volume of packed red cells, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, leucocytes, differentials and platelets for each hog.

Reticulocyte counts are not included in the tables, neither the observations made on red blood cell morphology.

Considering individual variations, the mean of the various determinations in both animals showed a high degree of similarity. The red cells and hemoglobin showed a definite tendency to increase with age. The average mean corpuscular volume of the erythrocytes for both animals was slightly below what is considered the normal minimum for man (80 cubic microns). The mean cell hemoglobin was likewise slightly under the human minimum (27 micromicrograms). The mean corpuscular hemoglobin concentration fell above what is considered the normal minimum for human beings (29 per cent).

Reticulocyte counts did not exceed two per cent in both animals during the period of study.

Slight to moderate anisocytosis, poikilocytosis and hypochromia of the red cells was found in both hogs during the first ten weeks of observation. Later these findings were infrequent. Nucleated erythrocytes were only occasionally encountered, but strangely enough in the twenty-fourth week, when the red cell count reached the peak in Hog 2 (6.56 millions), several normoblasts and microcytes were found, as well as marked anisocytosis, poikilocytosis and hypochromia.

No changes were observed in the leucocytes or the platelets, and no megakaryocytes were found. As the number of metamyelocytes and staff cells encountered during the study were few, they have been included with the segmented polymorphonuclear leucocytes and so reported. As the basophils were rarely found, their means were not computed.

SUMMARY

Peripheral blood studies were performed in two young, healthy and apparently normal hogs during periods of twenty-two and twenty-five weeks at intervals of one week. Erythrocyte and reticulocyte counts, hemoglobin determinations, volume of packed red cells, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, leucocyte counts, differential and platelet counts were performed each week. Observation on the morphology of all cell types was made also. Results of study are represented in the tables.

TABLE I

Mean Corpuscular Volume; Mean Corpuscular Hemoglobin; Mean Corpuscular Hemoglobin Concentration; Erythrocytes; Hemoglobin; Volume Packed Red Cells; Platelets, Leucocytes and Differentials for Hog #1, at Weekly Intervals

Weeks	Red cells millions per c.mm.	Hemoglobin gms. %	Volume of packed R.B.C. cc.	Mean corp. vol. cubic microns	Mean corp. hbg. γγ°	Mean corp. hbg. conc. %	Platelets thousands per c.mm.	Leucocytes thousands per cc.mm.	Differential Counts—%				
									Polymorphonuclears	Lymphocytes	Eosinophils	Monocytes	Basophils
1	4.1	12.2–84	33	80	27	34	200	8.8	42	53	0	5	0
2	4.5	11.7–80	32	71	26	36	205	10.9	43	55	1	1	0
3	5.37	11.7–80	36	67	21	32	204	8.25	45	50	3	2	0
4	5.55	12.8–88	37	67	23	34	262	12.1	29	63	4	4	0
5	5.67	13.2–90	34	60	23	38	244	12.8	9	90	0	1	0
6	5.9	14.0–95	37.5	63	23	37	257	13.7	24	70	2	4	0
7	5.0	12.0–83	39	78	24	30	188	14.1	39	45	5	11	0
8	5.1	11.2–76	42	82	22	26	170	9.95	24	68	3	5	0
9	4.85	11.8–80	42	86	24	28	174	11.2	30	58	3	8	1
10	5.6	13.8–93	41	73	24	33	195	10.8	30	63	2	5	0
11	5.2	13.9–94	40	77	26	34	194	11.2	33	60	2	5	0
12	5.6	13.3–91	42	75	22	29	171	11.3	40	60	0	0	0
13	5.7	13.5–93	39	68	23	34	182	9.5	35	61	1	3	0
14	5.3	13.2–90	37	70	24	35	169	14.1	35	58	4	6	0
15	4.8	13.3–91	39	81	27	34	202	18.2	40	50	4	6	0
16	5.9	15.8–109	51	86	26	31	193	12.7	22	73	1	3	0
17	6.4	15.9–110	52	81	24	30	188	14.1	22	78	0	0	0
18	6.1	16.0–111	51	83	26	31	165	15.1	26	65	1	8	0
19	5.8	13.6–94	48	82	23	28	177	16.2	35	55	2	8	0
20	6.1	16.2–112	48	79	21	33	194	15.1	39	56	2	3	0
21	5.3	14.5–100	40	75	27	36	116	18.0	33	58	5	3	0
22	6.3	14.5–100	47	74	23	30	219	12.1	30	60	3	7	0
MEANS	5.46	13.55–93	43.1	79.9	24	32	194	12,731	32	61	2.1	4.45	

° γγ Greek letters gamma gamma representing micromicrograms.

TABLE 2

Mean Corpuscular Volume; Mean Corpuscular Hemoglobin; Mean Corpuscular Hemoglobin Concentration; Erythrocytes; Hemoglobin; Volume Packed Red Cells; Platelets, Leucocytes and Differentials for Hog #2, at Weekly Intervals

Weeks	Red cells millions per c.mm.	Hemoglobin gms. %	Volume of packed R. B. C. cc.	Mean corp. vol. cubic microns	Mean corp. hbg. γγ°	Mean corp. hbg. conc. %	Platelets thousands per c.mm.	Leucocytes thousands per c.mm.	Differential Counts—%				
									Polymorphonuclears	Lymphocytes	Eosinophils	Monocytes	Basophils
1	4.4	13.4–92	34.0	77	30	39	270	9.5	42	50	3	5	0
2	4.2	11.1–76	33	79	21	33	370	10.5	37	59	3	1	0
3	4.8	11.1–76	34	70	23	32	394	9.85	36	60	3	1	0
4	4.98	11.1–76	34	68	22	32	494	14.3	58	33	3	6	0
5	5.3	13.4–92	36	68	23	34	413	15.3	44	54	1	1	0
6	5.5	14.3–98	37	67	28	38	201	17.8	62	30	2	6	0
7	5.4	12.3–84	39	72	21	31	120	17.8	70	27	0	3	0
8	5.05	9.7–66	37.5	74	19	26	254	15.3	42	45	1	2	0
9	5.3	10.8–74	42	79	20	25	276	10.8	46	52	1	1	0
10	5.1	11.7–80	37	72	22	31	323	15.1	47	50	0	3	0
11	5.0	11.8–81	38	76	23	31	301	17.1	40	55	2	3	0
12	4.9	11.7–80	39	79	23	30	306	13.5	33	60	2	5	0
13	5.1	12.2–83	39	76	23	31	311	12.7	37	60	2	1	0
14	4.9	12.6–87	38	77	25	33	251	15.2	51	40	3	6	0
15	4.9	12.8–88	39	79	26	32	286	17.2	50	40	3	7	0
16	5.2	12.8–88	40	77	24	31	201	11.2	32	65	2	0	1
17	5.9	12.9–89	41	69	22	31	204	8.9	49	45	0	4	2
18	6.0	13.0–90	42	70	21	30	213	10.1	50	48	1	1	0
19	5.3	13.0–90	41	77	24	31	202	9.8	48	46	3	3	0
20	5.7	14.5–100	51	89	25	28	212	11.45	50	40	3	7	0
21	5.0	13.2–91	48	90	26	27	164	9.0	50	48	0	2	0
22	6.0	15.2–105	51	85	25	29	217	10.5	44	52	2	2	0
23	6.18	12.6–86	43	69	20	29	110	13.5	63	29	0	7	1
24	6.56	13.4–92	43	65	20	31	216	16.2	44	46	1	9	0
25	6.11	13.1–90	48	78	21	27	176	17.0	37	60	1	2	0
MEANS	5.31	12.5–86	42	75.28	23	30.8	259.4	13,180	46.48	47.76	1.68	3.52	

° γγ denoting micromicrograms.