THE TOTAL AND DIFFERENTIAL BLOOD COUNT IN HODGKIN'S DISEASE AND LYMPHOSARCOMA

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The existence of Hodgkin's disease as a definite disease entity covers a period of more than a century at the time of this survey, but the status of the blood picture in the disease is of much more recent origin. The first work was done abroad by Fabian, who published the initial paper on the subject in 1910. He concluded at that time that the most customary finding consisted of a moderate increase in polymorphonuclear neutrophiles, coupled with a relative decrease in the lymphocytes. He was of the opinion, however, that the findings were not constant enough to be of diagnostic importance.[1,2] Bunting brought forth the first American work on the subject in 1911. His original paper was concerned with the fact that one of the most characteristic findings seen from the hematological aspect was the presence of a large number of platelets during the entire course of the disease. The next paper pointed out that in addition to the high number of platelets usually found, therewas both a relative and an absolute increase in the transitional cells. He noted also that there was a definite tendency for a percentage decrease from a normal or slightly elevated lymphocyte count in early or active stages to a very low count in later stages. He also pointed out that in the late stages the polymorphonuclear neutrophiles were markedly increased. With the above considerations at hand, Bunting was convinced that there was a definite blood picture for the diagnosis of the disease, more so in cases of longer than one year's duration than in those of shorter involvement.

In subsequent papers, Bunting[3] and Yates[4] reported on several additional cases, and came to the following conclusions, hematogically speaking: That throughout the disease there were two constant features,

an increase in blood platelets and an absolute increase in the transitional leukocytes. Early cases (less than one year duration) showed a transitory increase in lymphocytes and basophiles and a decrease in eosinophiles with a normal or low neutrophile count. This was followed by a gradual decrease in lymphocytes and a moderate eosinophilia. Late cases showed a marked neutrophile leukocytosis, and a diminution in percentage of all other elements except the transitional leukocytes, which were absolutely increased in all cases and relatively increased in all cases except those with well marked leukocytosis. It was Bunting's belief at that time that with a case of chronic glandular enlargement and without any suppurative process, and the blood picture as given the diagnosis of Hodgkin's disease could be established. The only confusion was thought to lie between Hodgkin's and tuberculosis, but not withstanding that, a positive diagnosis could usually be obtained by Bunting in the Hodgkin's cases. The diagnoses in all cases were supported by the pathological changes in excised glands.

Longcope and McAlpin[5] agreed essentially with the findings of Bunting and Yates in that the increased platelets and the constant relative or absolute increase in the transitional cells were thought to be characteristic.[6] Three years later, McAlpin in a series of eighteen cases diagnosed as Hodgkin's disease by microscopic section, discredited the original article, and stated emphatically that there was no characteristic blood picture. He studied the platelet count in particular, and observed that in his series of both treated and untreated cases, the platelet count was high in less than half of the cases. He noted also that the treated patients showed both higher platelet counts and more

increased transitionals than did the untreated. He concluded that, judging from his series, it was not possible to diagnose Hodgkin's disease from examination of the blood; that the platelets and transitional cell counts were not consistently high in more than half the cases, and that the length of illness had no bearing on the total white cell count. The highest luekocyte count in his cases was 13,000 per cubic millimeter.

In 1924, Weiss, according to Roth and Watkins,[7] came forth with the innovation that a decrease in the leukocytes was the most important finding and not an increase in the polymorphonuclear neutrophiles, as had been stressed previously. He was of the opinion that although the neutrophiles and eosinophiles might be increased in number, a leukocytosis, exceeding 20,000 cells per cubic millimeter, made the diagnosis of Hodgkin's disease rather questionable.

Falconer,[8] in 1930, reported a series of forty cases, that being the largest number of cases reported up to that time. His plan of analysis was similar to that used by Bunting in that he divided the cases into two groups, those of apparently less than one year's duration, and those whose duration was of a longer time interval than one year. His results conformed in a general way with those obtained by Bunting. His analysis showed that in the first group the total leukocyte and differential counts were within normal limits, while in the second group only a slight increase in the total leukocyte count occurred, with a slight increase in the polymorphonuclear cells at the expense of a decrease in the number of lymphocytes. Falconer found a fairly constant average increase in the number of monocytes (included large mononuclears and transitional cells). The eosinophile count was normal or slightly below normal, except in one

instance in which it was markedly raised. The platelet counts in his series were not increased. Thus, the most significant part of his exceptional series appeared to be the fairly constant increase in the number of mononuclear cells.

Straube(quoted by Roth and Watkins) in 1931 summarized his findings in twenty-one cases of Hodgkin's disease, and concluded that no uniform or diagnostic hematologic picture for the disease existed. He stated thereupon that it was not possible to establish the diagnosis on the basis of hematologic examination alone.

[9,10]
Wallhauser in a very comprehensive survey of the literature up to 1933 reported flatly that attempts to formulate hematologic criteria for the positive diagnosis of Hodgkin's disease had not been successful. He did state that the most common and constant finding seemed to be a relative and absolute moderate polynucleosis with lymphopenia, but that these factors were too variable to be of diagnostic import. He stated that the percentage of transitional leukocytosis also was variable, and, therefore, not significant.

[11]
In 1934, Doan and Wisemann, stated that in typical Hodgkin's disease there was a fairly typical blood picture, which included an absolute as well as a relative monocytosis, together with a leukopenia, lymphopenia, eosinophilia, and anemia, with the reversed monocyte-lymphocyte ratio reflecting the hyperplasia of monocytes and fibroblasts in lymph nodes and frequently in the bone marrow. It was their opinion that Hodgkin's disease provided an interesting transition between the group of diseases showing monocytosis and the group of pathological states which may be said to be leukemic in nature.

Wisemann, in 1936, observed that no blood picture was pathognomonic in Hodgkin's disease, but that nevertheless in the vast majority of cases quite characteristic changes in the blood accompanied the disease. The most constant findings were a lymphopenia with a monocytosis thus giving a monocyte-lymphocyte ratio of higher than the normal of 0.35 of Sabin and Doan. Ninety per cent of the cases exceeded the normal figure. The total white count was within +10% or -10% of normal limits. He also noted a distinct tendency toward neutrophilia. Secondary anemia was a practically constant finding. He concluded that: given a blood picture that showed lymphopenia with a high M/L index, a fairly normal total white count, a mild neutrophilia, and with any increase in eosinophiles, one would appear justified in suggesting Hodgkin's disease from study of the blood picture alone. Twenty-five per cent of his cases of Hodgkin's disease demonstrated the above described hematologic tendencies. Occasionally a case of tuberculosis showed the same blood findings, however.

Krueger and Meyer[13], also in 1936, in a paper covering sixty cases of Hodgkin's disease, described the blood picture at intervals throughout the course of the disease as nearly as was possible for them to do. Thus, they gave the count on admission, the average during hospital residence, after roentgen ray therapy, and the last count before death. In general, the results were in accord with those of Bunting, except that they showed that in the cases with septic fever curves, there was usually a leukopenia, rather than the expected leukocytosis. Forty per cent of their cases showed immature forms of erythrocytes in the peripheral blood. In the cases where the platelets were studied, they were found to be quite normal in number for the most part. Eosinophilia was rare in these cases.

In 1936, Roth and Watkins presented a series of forty cases of Hodgkin's disease, and nine of lymphosarcoma, in which they made an intensive effort to correlate the blood findings with the duration of the disease, and with the location and the extent of the disease. They divided their cases, all proven by study of an excised node and without any previous treatment, into four groups based onthe apparent duration of the disease. The first, included cases of less than six months duration, the second cases of six to twelve months duration, the third of twelve to twenty-four months duration, and the last, of over twenty-four months duration. The cases were also divided into four groups depending upon the situation and extent of the disease: First group, in which a single cervical, axillary, or supraclavicular node was involved; the second, in which a single inguinal node was involved; the third, in which two cervical, axillary or supraclavicular nodes were involved or in which a single lymph node in two of those situations was involved; and the fourth, in which there was general adenopathy. From their study they concluded that there was no specific morphologic blood picture diagnostic of Hodgkin's disease. They did notice a definite but slight increase in the polymorphonuclear neutrophiles, a relative decrease in the number of lymphocytes, and an increase in the number of non-filamented neutrophiles in the cases of twelve to twenty-four months duration. However, those results were not substantial in the cases of longer than two years duration. They postulated that the apparent contradiction to the findings in the two groups might be explained on the basis of increased natural resistance in the cases of the longer duration, or to the cases being in the terminal stage, and for that reason a normal reaction of the hematopoietic elements in the peripheral blood was prevented. They did not observe a monocytosis

in any of the groups, which they thought to be in accord with the results of the then current investigators. The individual cells had a tendency to be more indented than normal (shift to the right), but they regarded that fact as being without significance as it occurs in many other conditions. They noted that polymorphonuclear leukocytosis was not a constant finding, as mentioned, and thought that contradictory evidence for the thesis that Hodgkin's disease has its origin in an infectious process. They likewise concluded that the extent of the disease had but little effect on the changes in the peripheral blood. The blood changes in lymphosarcoma showed in general the same changes as in Hodgkin's disease and were considered to be without any diagnostic significance. Thus, to reiterate, after a very extensive survey, they concluded that there was no specific change in the leukocyte picture which was diagnostic of Hodgkin's disease.

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The latest paper has been by Goldman, and he concluded, too, that most observers feel that the blood picture in Hodgkin's disease is neither typical nor constant. Twenty per cent of his cases showed an eosinophilia. He also noted that irradiation may cause a decrease of 3,000 to 5,000 cells in the total white blood cells with a further absolute lymphopenia.

Judging from the foregoing it is extremely evident that there is great variance in opinion in regard to the diagnostic significance of the hematopoietic picture in Hodgkin's disease. The erythrocytes do not enter into the problem, as practically all have agreed that the secondary anemia which is usually present is not diagnostically significant. The answer, therefore, if it is to be found must lie in the total and differential

leukocyte formulae. With the hope of finding that answer the present study was undertaken.

METHOD OF STUDY

The total number of cases reviewed for this series consisted of forty cases of Hodgkin's disease and twenty cases of lymphosarcoma, all having been patients in the State of Wisconsin General Hospital. Only those cases were selected for this series in which no roentgen therapy had preceded the blood count. Likewise, only those cases were included in which the disease entity had been diagnosed by lymph node biopsy, or from autopsy material. The criteria for the diagnosis of Hodgkin's disease were dependent upon whether the process was in a proliferative or destructive stage. In the former, the presence of Dorothy Reed cells and general hyperplasia of the node had to be present. In the latter stage, there had to be loss of architecture of the node and with eosinophilia, fibrosis, and Dorothy Reed cells present. For the positive diagnosis of lymphosarcoma, there had to be invasion of the capsule, invasion of the surrounding tissue and a demonstrable mass of purported primary involvement, in addition to loss of architecture of the node, cellular hyperplasia and an absence of lymph follicles. There were 500 cells counted for each differential count. The smears were stained with Wright's stain during the years prior to 1938; since the early part of 1938 Kingsley's stain has been used. All counts were all done by the same person, Miss Ethel Thewlis. Platelets were estimated from study of the cover slip smears and not counted.

The cases were grouped in the manner used by Bunting and then divid-

ed into two groups, the first in which the duration of the disease was apparently of less than one year at the time of the initial blood count, and the second, in which the apparent duration was more than one year. No closer division was attempted because of the obvious error in even such a broad division, when attempting to find the exact duration of a disease that may be so insidious in its onset as is Hodgkin's disease. The cases were not divided as to the extent of involvement, as that appeared to present an even greater source of error, as such knowledge would necessarily have to be gained from the records, and obviously many errors probably exist as to the exact number of glands, and their specific location at the time of admission.

Of the total of sixty cases submitted, twenty-nine were included in the Hodgkin's disease series, and ten were taken for the lymphosarcoma series. The cases not considered in this paper were excluded for various reasons, such as having had previous roentgen therapy prior to the blood count, lacking a definite biopsy or autopsy diagnosis, those in which exacting counts of at least 500 cells had not been done, and in those cases in which the count had not been done by Miss Thewlis. Thus, it would appear, from the technical standpoint, that all possible sources of error had been eliminated. It is true that the initial count done on each individual has been the only one incorporated in this survey, so there may be a slight error due to the daily variations in the blood findings. However, with a series of thirty-nine cases that factor should not assume any preponderant source of error.

The normal luekocyte findings as defined by Dr. Bunting have been used as a basis for this series. The average normals under this scheme

are:

Total leukocytes 7500 cells per cubic millimeter.

Differential:

Polymorphonuclear neutrophiles	65.0%
Eosinophiles	2.5
Basophiles	0.5
Lymphocytes	25.0
Monocytes	6.5

It is taken for granted that a slight variation in either direction is still within the normal range.

DATA

GROUP I:

Hodgkin's disease, duration of less than one year (Table I).

There were fifteen cases in this series. The average age was 34.7 years, with the oldest person being 84 and the youngest 1 year at the time the blood count was made. There were twelve males and three females or roughly 80% males. The spleen was palpable in twelve of the fifteen cases. The blood Wassermann was negative in all cases. The average erythrocyte count was 3,863,400 per cubic millimeter, with the lowest figure being 1,000,000 per cubic millimeter. The hemoglobin averaged 10.4 grams. The total leukocyte count averaged 13,277 per cubic millimeter, with the average for the counts above 7,500 per cubic millimeter being 15,396 per cubic millimeter and 4,896 per cubic millimeter for those below 7500 cells per cubic millimeter. Nine, or 60%, of the cases were above the normal figure, with the highest count attaining a level of 35,275 cells per cubic millimeter. Six, or 40 per cent, were below the

average figure, and the lowest was 2,888 per cubic millimeter.

The differential count showed the following:

1. The average per cent of polymorphonuclear neutrophiles was 68.5 . Nine of the fifteen cases, or 60%, were above the average figure of 65, while 6, or 40%, were below that level. The highest percentage was 90.6 and the lowest 43.4
2. The average percentage of eosinophiles was 1.2, well below the average of 2.5. Three cases, or 20%, were above the average figure with the highest percentage being 5.4. Eighty per cent of the cases, or twelve in all, had a percentage figure below 2.5.
3. The basophile count was well within normal limits in all cases.
4. Six of the fifteen cases, or 40%, had an increased percentage figure for lymphocytes. The highest percentage was 40.4, this being in the infant twelve months old. Nine, or 60%, had a lymphocyte percentage below the average level, with the lowest figure at 4.0%. The average percentage figure here was 20.9, somewhat below the average normal of lymphocytes.
5. Six of the fifteen cases, or 40%, had a percentage figure above the average normal of 6.5 for monocytes. The highest was 16.0. Nine or 60% had percentages below 6.5, the lowest being 2.0. The average total was 6.4 for the fifteen cases.
6. The platelets were estimated to be increased in twelve of the fifteen cases, or in 80% of the total.

TABLE I

DATA ON FIFTEEN CASES OF HODGKIN'S DISEASE OF LESS THAN 1 YEAR IN DURATION

	Age	Sex	Hb.	Erythrocytes per Cu. MM	Leukocytes per Cu. MM		Differential Count Per Cent									
							Polymorphonuclear Neutrophiles		Eosinophiles		Basophiles		Lymphocytes		Monocytes	
					+	−	+	−	+	−	+	−	+	−	+	−
1	84	F	12.2	4,152,000	8,125		83.0			0.6		0.2		8.8		4.4 *
2	18	M	10.0	5,135,000	35,275		88.0			0.4		0.2		6.0		4.4
3	31	M	10.5	4,100,000	15,875			51.4		0.6		0.0	36.4			5.4
4	47	F	13.7	4,370,000		4,263	66.0		4.0		0.8			15.8	16.0	
5	16	M	12.0	4,092,000		3,050		44.4		0.2		0.0	39.6		10.8	
6	49	M	15.0	5,006,000	11,300			61.6	3.6			0.2	26.4		7.2	
7	1	M	7.7	3,555,000		7,025		53.0		2.0		0.0	40.4			2.0
8	39	M	3.5	1,000,000		2,888		54.5		0.5		0.5	30.5		8.5	
9	61	M	13.0	3,825,000		6,775		43.4	5.4		0.8		38.0		10.2	
10	26	M	11.0	4,745,000	9,250		73.2			0.4		0.2		17.6	7.4	
12	26	M	5.6	3,220,000	16,963		90.6			0.0		0.0		4.0		4.6
13	36	M	9.0	3,445,000	12,100		73.4			0.2	0.6			15.8		3.2
14	34	M	7.7	3,052,000	7,913		75.0			0.2		0.0		15.6		4.0
15	19	F	10.0	3,512,000		5,475	84.8			0.0	1.2			9.4		3.2
16	29	M	14.0	4,742,000	21,763		84.8			0.4		0.4		10.0		4.0
Av	34.7		10.4	3,863,000	13,277		68.5		1.2		0.53		20.9		6.4	
% of each above or below normal					60	40	60	40	20	80	27	73	40	60	40	60

* Total Percentage Does not equal 100% due to the small percentage of atypical cells, unclassified cells, and pathological cells which were not considered in this problem.

GROUP II:

Hodgkin's disease, duration of more than 1 year (Table II).

There were fourteen cases in this series. The average age was 37.7 years, the oldest was 66 and the youngest was 6. There were twelve males and two females. The spleen was palpable in eight of the fourteen (57%) of the cases. The average erythrocyte count was 4,404214 per cubic millimeter, definitely greater than in the former group. The hemoglobin averaged 12.3 grams, also higher than in the former group. The average total leukocyte count was 14,293 per cubic millimeter, with 10 or 71% of the cases being above 65 and 4, or 29%, being below that figure. This represents an increase of about 1,000 cells per cubic millimeter over the average of the first group. The highest count here was 39,513, the lowest 6,512.

The differential count showed:

1. The average percentage figure for the polymorphonuclears was 69.9, not significantly increased over the first group. Ten of the fourteen cases, or 71%, showed an increase over the average figure, while 4, or 29%, showed a decrease. This demonstrates a very slight trend toward a polymorphonuclear leukocytosis, when compared to the first group, but neither show a polymorphonuclear leukocytosis of any remarkable or significant degree. The highest percentage was 91.0, and the lowest was 28.4.
2. The average percentage figure for the eosinophiles was 1.9, which is well within normal limits. This was somewhat higher than Group I, but still of no consequence. Five of the cases, or 36%, showed a figure above the normal average, with

the highest being 5.8. Nine of the fourteen, or 64%, were below the normal figure, with the lowest being 0.3

3. The basophile percentage was 0.3 and not of significance.
4. The average percentage figure for the lymphocyte series was 18.4, a small decrease as compared to Group I, and a definite lymphopenia. Three of the cases, or 21%, were above the average normal, with the highest being 63.2. Eleven of the fourteen cases, or 79%, were below the average normal, with the lowest being 1.2. This represents a quite decided change from Group I.
5. The average monocyte percentage figure was 9.0, a rise above both the normal figure of 6.5 and above the figure of Group I. This demonstrates a moderate degree of monocytosis. However, only seven of the fourteen cases, or 50%, were above the average figure for the monocytes. The highest percentage was 22.4, while the lowest was 3.8, a marked variation.
6. The platelets were decreased in only one instance.

GROUP III:

Lymphosarcoma, duration of less than 1 year. (Table III).

There were seven cases in this series, ranging in age from 4 to 69 years, with an average age of 23.9, a younger group than those with Hodgkin's Disease. There were six males and one female. The spleen was palpable in three, or 42%, of the seven cases. The blood Wassermann was negative in all instances. The average erythrocyte count was 3,874,714 cells per cubic millimeter, while the hemoglobin averaged 11.6 grams. The total average leukocyte count here was 15,492 cells per cubic millimeter

TABLE II

DATA ON FOURTEEN CASES OF HODGKIN'S DISEASE OVER 1 YEAR IN DURATION

	Age	Sex	Hb.	Erythrocytes per Cu. MM	Leukocytes per Cu. MM		Differential Count Per Cent										
							Polymorphon. Neutrophiles		Fosino-philes		Basophiles		Lymphocytes		Monocytes		
					+	−	+	−	+	−	+	−	+	−	+	−	
20	52	M	15.0	4,335,000	26563			76.2				1.4		0.6		13.6	8.0		*
21	60	F	9.5	3,960,000		5,775	72.0			3.0				0.4		11.6	9.2		
22	35	M	14.5	4,651,000	11,325			69.6				1.4		0.4		21.6		6.0	
23	42	M	15.5	5,180,000	10,412			71.0		2.6				0.4		13.8	12.6		
24	28	M	14.0	4,840,000		6,512			56.2			1.8		0.2	33.4		8.4		
25	38	M	7.5	2,670,000	39,513			87.3				0.3		0.3		7.2		4.3	
26	66	M	14.0	4,810,000		6,637			58.0	2.4				0.2		22.4	16.8		
27	42	M	11.5	4,805,000	23,088			86.0				1.2		0.0		9.0		3.8	
28	33	M	14.5	4,950,000	19,065			91.0				1.4		0.2		2.2		5.2	
29	57	M	11.0	4,173,000	16,963				28.4	3.2				0.2	63.2			4.2	
30	7	M	11.0	3,990,000	7,875			69.8				0.4		0.2		15.2	14.2		
31	64	M	12.0	4,865,000	9,025			70.4				1.0		0.4		5.8	22.0		
32	36	F	10.0	3,875,000		7,238		89.6				0.6		0.0		1.2		6.8	
33	6	M	12.0	4.555,000	9,575				53.2	5.8				0.4	37.6			4.4	
Av	37.7		12.3	4,404,214	14,293		69.9		1.9		0.3		18.4		9.0				
% of each above and below normal					71%	29	71	29	36	64			100	21	79	50	50		

* Total Percentage Does not equal 100% due to the small percentage of atypical cells, unclassified cells, and pathological cells which were not considered in this problem.

slightly but not significantly increased over that of the cases of Hodgkin's disease. Six of the seven cases, or 86%, were above the normal figure. The highest figure was 24,125 cells per cubic millimeter. The one subnormal count was 7075 cells per cubic millimeter.

The differential count showed the following:

1. Five of the seven cases, or 78.5%, of the cases showed an increase over the normal percentage of polymorphonuclears. The highest was 83.4%. Two of the seven, or 28%, showed low percentage figures, with the lowest being 26.4%. The average percentage count for the seven cases was 69.7%, really no different than that of the cases with Hodgkin's disease.
2. The eosinophile average was 1.6%, very comparable to Groups I and II.
3. The basophiles were within normal range, averaging 0.4%.
4. Only one of the seven cases, or 14%, showed an increased percentage of lymphocytes. This figure was 52%, and seemingly is the exception to the rule. Six of the seven cases, or 86%, showed a percentage figure below normal, with the lowest being 9.0%. The average total for the seven cases was 17.4%, moderately below that of Groups I and II and representing a definite lymphopenia.
5. The total average percentage of monocytes was 5.7, slightly below the normal figure but within the normal range. Only one case, or 14%, was above the average normal percentage figure. In that instance the figure was 9.0%. Six of the

TABLE III

DATA ON SEVEN CASES OF LYMPHOSARCOMA OF LESS THAN 1 YEAR IN DURATION

	Age	Sex	Hb.	Erythrocytes per Cu. MM	Leukocytes per Cu.MM.		Differential Count Per Cent											
							Polymorphon. Neutrophiles		Fosinophiles		Basophiles		Lymphocytes		Monocytes			
					+	−	+	−	+	−	+	−	+	−	+	−		
5:	69:	M	15.5:	4,938,000	24,125:			26.4	3.2			0.0	52.0			6.0	*	
2:	17:	M	15.0:	4,742,000	9,325:		77.2			0.2		0.5		9.0		6.0		
6:	16:	M	12.0:	4,545,000		7,075:	83.4			2.0		0.5		9.0		5.0		
7:	11:	M	15.5:	5,557,000	18,113:			60.0	3.2			0.5		22.6		2.4		
8:	4	M	6.9:	2,126,000	9,369:		68.0			1.0		0.2		9.0	9.0			
9:	18:	F	11.0:	3,421,000	19,875:		83.0			0.6		0.2		9.0		6.0		
10:	32:	M	5.0	1,794,000	19,163:		80.8			1.2	1.0			11.0		5.2		
AV:	23.9		11.6:	3,874,714	15,492		69.7		1.6		0.4		17.4		5.7			
% of cases above and below normal					86	14	72	28	28	72	14	86	14	86	14	86		

* Total Percentage does not equal 100% due to the small percentage of atypical cells, unclassified cells, and pathological cells which were not considered in this problem.

seven cases, or 86%, were below the average figure, with the lowest being 2.4.

6. The platelets were normal, or only slightly elevated or slightly decreased in this series.

GROUP IV:

Lymphosarcoma, duration of more than 1 year (Table IV)

There were only three cases in this series, not a very representative group, all females, and varying in age from 54 to 57 years. The spleen was palpable in all three cases. The blood Wassermann was negative in all. The only finding of significance in this series was a total average leukocyte count for the three cases of 6,421 cells per cubic millimeter. All the counts were below the normal average of 7500 cells per cubic millimeter. The polymorphonuclear average was 70.7%. Eosinophilia and basophilic figures were within normal ranges. The total average lymphocyte count was 18%, quite comparable with that of the other three groups of cases. The platelets were normal in each instance.

TABLE IV

DATA ON THREE CASES OF LYMPHOSARCOMA OF MORE THAN 1 YEAR DURATION

					Differential Count Per Cent									
Age	Sex	Hb.	Erythrocytes per Cu. MM	Leukocytes per Cu.MM	Polymorphon. Neutrophiles +	Polymorphon. Neutrophiles −	Eosinophiles +	Eosinophiles −	Basophiles +	Basophiles −	Lymphocytes +	Lymphocytes −	Monocytes +	Monocytes −
4: 57	F	13.0	3,240,000	6,650		61.6		1.0		0.5	27.0		9.2	*
3: 54	F	10.0	3,517,000	5,280	80.4			0.0	2.0			8.0	8.0	
1: 55	F	9.5	4,098,000	7,463	70.2		5.4		1.0			12.0	7.6	
Average 55		10.8	3,618,337	6,421	70.7		2.1		1.2		18.0		8.3	
% of cases above and below normal				100	66	33	33	66	66	33	33	66	100	

* Total Percentage does not equal 100% due to the small percentage of atypical cells, unclassified cells, and pathological cells which were not considered in this problem.

COMMENT

The various comparisons have been touched upon briefly in the presentation of the data. From the evidence presented, it would appear that from a statistical standpoint there are no characteristic, or especially significant, peripheral blood findings in either Hodgkin's disease or lymphosarcoma that can accurately be used for diagnostic purposes (Table V). In the cases with Hodgkin's disease, Group I, there is a moderate leukocytosis, but not of a degree to be in any way diagnostic. The leukocytosis in Group II is also moderate, comparable to Group I, and certainly not diagnostic. The eosinophile and basophile counts were of no aid in this series of cases as regards the development of a characteristic blood picture. There is a definite lymphopenia in all four Groups, but to me is of only a moderate degree in that a lymphopenia which does not fall below 17.4% can hardly be used for diagnostic purposes. In the relatively late cases of Hodgkin's disease, there is a noticeable monocytosis, but with an average of 9.0% and with cases equally divided on both sides of the normal range and varying from 22.0% to 38%, the monocytosis could not well be fitted into a diagnostic armamentarium. The platelet findings cannot be evaluated from this study because there were no accurate counts done, not withstanding the fact that the estimations, in this instance at least, are probably more accurate than many series of counts which have been reported.

It is granted that this survey does not include the very late and terminal cases for the most part, but by that time so many mitigating factors become a part of the disease-hematologic complex that it is, indeed, difficult to ascertain what part of the blood findings are due to the disease process per se and what part to the many extrinsic factors

TABLE V

SUMMARY OF AVERAGE RESULTS, GROUPS I-IV, INCLUSIVE

	Number of Cases	Average Age	Aver. grams of Hb.	Average Number of Erythrocytes per Cubic Millimeter	Average Number of Leukocytes per Cubic Millimeter	Differential Count, Per Cent				
						Polymorphonuclear Neutrophiles	Lymphocytes	Monocytes	Eosinophiles	Basophiles
Group I	15	34.7	10.4	3,863,000	13277	68.5	20.9	6.4	1.2	0.53*
Group II	14	37.7	12.3	4,404,214	14293	69.9	18.4	9.0	1.9	0.3
Group III	7	23.9	11.6	3,874,714	15492	69.7	17.4	5.7	1.6	0.4
Group IV	3	55.0	10.8	3,618,337	6421	70.7	18.0	8.3	2.1	1.2

* Total Percentage Does not equal 100% due to the small percentage of atypical cells, unclassified cells, and pathological cells which were not considered in this problem.

which have supervened. The latter factors include lowered resistance of the patient, cachexia, secondary infection, the changeable clinical course, the profound effects of irradiation therapy, the effects of diet and metabolism, and the influence of localization, especially in regard to the hematopoietic system. Furthermore in the late cases, usually there are lymph nodes available for biopsy anyway, so a characteristic blood picture is not essential for diagnosis and prognosis, such as is the need in many early cases.

This survey further points out a rather obvious fact in that the blood findings cannot be used for differentiation between Hodgkin's disease and lymphosarcoma.

SUMMARY

1. Twenty-nine cases of Hodgkin's disease and ten cases of lymphosarcoma were studied from a hematological standpoint.

2. The cases were divided into two groups, those of apparently less than one year in duration, and those of more than one year in duration.

3. None of the cases considered had been treated by roentgen therapy prior to the blood counts.

4. The only blood findings of any possible significance were a very moderate leukocytosis, a moderate lymphopenia, and in late cases of Hodgkin's disease, a slight monocytosis.

5. None of the blood findings were found to be present in a "characteristic" or "pathognomic" sense.

6. The blood count in untreated, not far advanced cases of Hodgkin's disease and lymphosarcoma is not of diagnostic significance if judged from the results of this survey.

7. The study of an excised lymph node is still the only accurate means of diagnosing Hodgkin's disease and lymphosarcoma.

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