The mortality of the operations for rupture of the spleen that I have collected is as follows: of 70 cases recorded since 1891 42 were operated on; of these 27 lived and 15 died, a mortality of 36 per cent. (all those not operated on died). This mortality is probably much too favourable, as some cases that have been operated on and died may not have found their way into the literature.

The causes of failure after operation are: (1) peritonitis; (2) complications, such as rupture of other solid or hollow abdominal viscera, especially the left kidney; injuries of the left pleura, as hæmothorax; and other injuries, as fracture of the base of the skull; and (3) operation performed too late. Out of 28 cases where it is stated how long after the accident the operation took place three operations were performed within the first two hours. All three died (probably very severe cases). Fourteen operations took place from three to 24 hours after the accident; 11 lived and three died. Six operations were done "the next day"; five lived and one died. Five operations were done from two to eight days after the accident, only one of which lived.

The sequelæ of the operation of splenectomy present a most interesting problem. The majority show no abnormal effect except a transient anæmia and leucocytosis which swings back to normal in about a month, and an enlargement of the lymph glands, most often the left axillary and inguinal; otherwise the patients are healthy. In two cases the patients, though pregnant at the time of operation, have gone on to term. Another patient was successfully operated on for a resulting ventral hernia. A fourth recovered from an attack of typhoid fever after losing his spleen. In five recorded cases (viz., those of Mr. C. Ballance, Mr. Bernard Pitts, Mr. J. Rutherford Morison, Mr. Heaton, and Mr. H. Burrows) a curious set of symptoms supervened on and after the tenth day; these were, progressive emaciation (one case lost 3 stones), attacks of epigastric pain, pyrexia, thirst, rapid pulse and respiration, headache, drowsiness, and irritability of temper. These cases have cleared up on the exhibition of arsenic and sheep's spleens; in one case the patient relapsed when the treatment was discontinued. Mr. Ballance has suggested that these symptoms may be due to the fact that it takes some time for the other organs of the body to take over the functions of the spleen and that it is less likely to occur in children in whom the tissues are said to be less specialised. The latter part of his theory is not supported by the ages of the five cases which I have just referred to; they were 4, 9, 16, 36, and 45 years.

Note on the blood.—Ehrlich, in his work on the blood, quotes Gurloff's experiments on excision of the spleen in guinea-pigs. The latter finds a marked increase of the lymphocytes during the first year after splenectomy, corresponding to the enlargement of the lymph glands, and a moderate eosinophilia after the first year. The blood-counts in my case show eosinophilia in the second year, but the earlier counts were probably vitiated by the occurrence of increase of neutrophiles owing to the suppuration of the wound.[2]

Blood Counts.

August 13th, 1904 (three days after admission).—Red corpuscles, 3,376,000; white corpuscles, 10,000; hæmoglobin, 60 per cent. Differential count.—Neutrophiles, 75 per cent.; small mononuclears, 13·3 per cent.; large mononuclears, 10·6 per cent.; eosinophiles, 0·5 per cent.; and nucleated red corpuscles, 0·6 per cent.

August 18th (eight days after admission).—Red corpuscles, 2,592,000; white corpuscles, 16,000; hæmoglobin, 60 per cent. Differential count.—Neutrophiles, 81 per cent.; small mononuclears, 12 per cent.; large mononuclears 5 per cent.; eosinophiles, 1 per cent.; and nucleated red corpuscles, 1 per cent.

August 21st (11 days after admission).—Red corpuscles, 3,480,000; white corpuscles, 44,000; hæmoglobin, 60 per cent. No differential count.

August 28th (18 days after admission).—Red corpuscles, 3,360,000; white corpuscles, 16,000; hæmoglobin, 60 per cent. Differential count.—Neutrophiles, 73·6 per cent.; small mononuclears, 13·6 per cent.; large mononuclears, 11·2 per cent.; and eosinophiles, 0·4 per cent.

Sept. 4th (25 days after admission).—Red corpuscles, 4,200,000; white corpuscles, 8000; hæmoglobin, 75 per cent. No differential count.

Sept. 11th (one month after admission).—Red corpuscles, 4,920,000; white corpuscles, 8000; hæmoglobin, 90 per cent. Differential count.—Neutrophiles, 65·5 per cent.; small mononuclears, 27·5 per cent.; large mononuclears, 5 per cent.; and eosinophiles, 2 per cent.

Sept. 25th (six weeks after admission).—Red corpuscles, 4,912,000; white corpuscles, 12,000; hæmoglobin, 90 per cent. Differential count.—Neutrophiles, 73·5 per cent.; small mononuclears, 23·5 per cent.; large mononuclears, 2·5 per cent.; and eosinophiles, 0·5 per cent.

Oct. 1st (seven weeks after admission).—Red corpuscles, 4,288,000; white corpuscles, 12,000; hæmoglobin, 80 per cent. No differential count.

Oct. 8th (eight weeks after admission).—Red corpuscles, 4,800,000; white corpuscles, 12,000; hæmoglobin, 90 per cent. No differential count.

Sept. 14th, 1905 (13 months after operation).—Red corpuscles, 4,762,000; white corpuscles, 6500. Differential counts.—Neutrophiles, 57·66; and transitionals 1·21; total 58·87 per cent.; large mononuclears, 15·32 per cent.; small mononuclears, 21·14 per cent.; eosinophiles, 3·89 per cent.; basophiles, 0·73 per cent.; and mastzellen and erythroblasts, 0.

May 5th, 1906 (21 months after operation).—Red corpuscles, 4,450,000; white corpuscles, 18,000; hæmoglobin, 80 per cent. Differential count.—Neutrophiles, 59·8; and transitionals, 1·5; total 61·3 per cent.; large mononuclears, 14·8 per cent.; small mononuclears, 19·5 per cent.; mastzellen, 0·4 per cent.; basophiles, 0·6 per cent.; and eosinophiles, 3·1 per cent.

Sheffield.

[2] See Ehrlich's Histology of the Blood. Translated by Myers of Cambridge, 1900.

SOME UNUSUAL FORMS OF ANÆMIA IN CHILDHOOD,

WITH REMARKS ON LYMPHATIC LEUKÆMIA (LYMPHÆMIA).

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THE subject of anæmia, as it occurs in childhood, is but imperfectly understood, and such diverse opinions are held as to its classification and the existence of different groups that every contribution to the subject recording varieties of anæmia not commonly met with may serve as a link in the chain towards the better understanding of this form of disease. It is for this reason that we publish the cases which form the basis of this paper. The first two tend to support our views as to the existence of an acute lymphæmia without marked leucocytosis, a fact which we consider has not been sufficiently emphasised or fully appreciated by the profession in general. In the consideration of the cases which follows the clinical histories and pathological findings our views will be found in greater detail. The third case is somewhat anomalous; to relegate it to its proper category is a matter of no little difficulty. We must therefore leave the case to speak for itself, though we append a few remarks as to the class to which we consider that it belongs.

CASE 1.[1]—The patient was a girl, aged two years and one month, who attended the Evelina Hospital on August 25th, 1905, with a history that until four days previously she had been quite well but since then she had been crying and fretful, "off her food," and constipated. In addition, she had scarcely been able to walk owing to the inguinal lymphatic glands, which were noticed to be enlarged and seemed painful; there had been no feverishness or vomiting. The patient had had bronchitis as a baby and measles one year ago. The father was healthy; the mother was "delicate." There were three healthy sisters in the family—two older and one younger. Three brothers and sisters had died in infancy from bronchitis or pneumonia. When first seen on August 25th the child was somewhat thin, fretful, and of a sallow complexion, but not anæmic. The

[1] This case was shown at the meeting of the Society for the Study of Disease in Children on Oct. 20th, 1905.

cervical, axillary, and inguinal glands were moderately enlarged on both sides, the last named being slightly tender. No enlargement of the spleen, liver, or thymus could be made out, and no extraneous cause for the glandular enlargement could be found. During the next ten days no change occurred in the physical signs but the temperature varied between 98° and 101·8° F. On Sept. 8th the inguinal glands were larger and fresh ones had appeared in both femoral regions and in the left axilla. The spleen was felt just below the ribs and the liver edge extended to nearly half way between the costal margin and the umbilicus. All the glands seemed more or less tender and those in the groin prevented the child walking. The general condition was worse and there had been some diarrhœa. The blood showed 4,736,000 red cells and 25,000 white to the cubic millimetre, with 84 per cent. of hæmoglobin. Of the white corpuscles only 2·4 per cent. were polymorphonuclear, while the lymphocytes amounted to 96·4 per cent., of which 65·9 per cent. were of the large variety. A few normoblasts were seen. A fresh gland subsequently appeared on the chest wall in the left axilla and as the inguinal and cervical glands further increased in size the patient was admitted into the hospital on Sept. 15th and the treatment with arsenic continued. The temperature kept under 100° but rose after a week with the onset of some bronchitis, the pulse-rate all along averaging from 110 to 120. On Sept. 26th an attack of herpes zoster of some severity occurred on the left side of the chest and the temperature shot up from normal to nearly 105°, dropping to normal again, however, the next day. The glandular and visceral enlargements continued unchanged and the child's general condition remained for a time the same, so she was allowed to go home at the expressed wish of her parents. On Oct. 20th an outbreak of small purpuric spots occurred over the trunk and legs and 11 days later there was left otorrhœa. On Nov. 10th the general condition was much worse and the anæmia, which had been gradually increasing, was now marked. A loud hæmic bruit was heard over the cardiac area and some bronchitic sounds were present in the lungs. The glands and abdominal viscera were unchanged but the purpura was fading. The temperature was

TABLE I.—GIVING DETAILS OF BLOOD EXAMINATION IN CASE 1.

Date.	Red cells per c.mm.	White cells per c.mm.	Hæmoglobin per cent.	Polymorphonuclears per cent.	Small lymphocytes per cent.	Large lymphocytes per cent.	Large mononuclears per cent.	Transitionals per cent.	Eosinophiles per cent.	Myelocytes per cent.	Basophiles per cent.	Nucleated red cells per 100 leucocytes.	Remarks.
1905.													
Sept. 6th ...	4,736,000	25,000	84·0	2·4	30 5	65·9	—	1·2	—	—	—	0 6	Normoblasts. Colour index = 0 88.
Sept. 16th ...	3,920,000	9,400	70·0	8·0	51·4	32 4	5·3	1·6	0·3	1·0	—	0·6	Colour index = 0·89.
Sept. 25th ...	—	17,400	—	2·0	14·0	80 0	3·2	0·4	—	0·4	-	0·8	—
Oct. 5th ...	—	8,300	—	10 7	9·0	63·6	15·1	0 8	0·4	0·4	-	7·6	Well-marked polychromasia of red cells.
Oct. 13th ...	3,000,000	22,800	58 0	15·1	19·4	53 3	10·0	0·6	0·6	1·0	—	—	Well-marked polychromasia of red cells. Colour index = 0·96.
Nov. 11th ...	1,870,000	5,600	28·0	—	—	—	—	—	—	—	—	-	Colour index = 0·74.

TABLE IA.—GIVING THE ACTUAL NUMBER OF CELLS PER CUBIC MILLIMETRE IN CASE 1.

Date.	White cells.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Large mononuclears.	Transitionals.	Eosinophiles.	Myelocytes.	Nucleated red cells.
1905.									
Sept. 6th	25,000	600	7625	16,475	—	300	—	—	150
Sept. 16th	9,400	752	4831·6	3,045·6	498·2	150 4	28·2	94	38·4
Sept. 25th	17,400	348	2436	13,920	556·8	69 6	—	69 6	139·2
Oct. 5th	8,300	888·1	747	5,278·8	1253·3	66·4	33·2	33 2	630 8
Oct. 13th	22,800	3442·8	4423·2	12,152·4	2280	136·8	136 8	228	—

TABLE II.—GIVING DETAILS OF BLOOD EXAMINATION IN CASE 2.

Date.	Red cells per c.mm.	White cells per c.mm.	Hæmoglobin per cent.	Polymorphonuclears per cent.	Small lymphocytes per cent.	Large lymphocytes per cent.	Large mononuclears per cent.	Transitionals per cent.	Eosinophiles per cent.	Myelocytes per cent.	Basophiles per cent.	Nucleated red cells per 100 leucocytes.	Remarks.
1905.													
Nov. 3rd ...	2,196,000	20,000	42 0	0·8	25 8	72 6	—	0 4	0·2	—	0·2	—	Colour index = 0·95.
Nov. 6th ...	2,140,000	17,000	40·0	4·5	15·5	72·0	6·5	0·5	—	1	—	0·5	Colour index = 0·93.

TABLE IIA.—SHOWING THE ACTUAL NUMBER OF CELLS PER CUBIC MILLIMETRE IN CASE 2.

Date.	White cells.	Polymorphonuclears.	Small lymphocytes.	Large lymphocytes.	Large mononuclear.	Transitionals.	Eosinophiles.	Myelocytes.	Basophiles.	Nucleated red cells.
1905.										
Nov. 3rd	20,000	160	5160	14,520	—	80	40	—	40	—
Nov. 6th	17,000	765	2635	12,240	1105	85	—	170	—	85

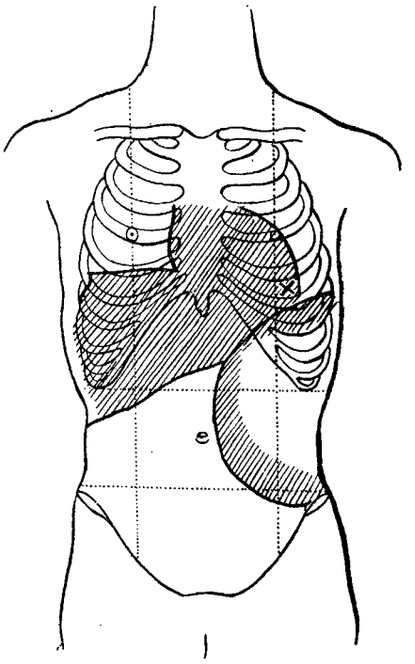
104° and the pulse was from 160 to 180. A bed was consequently again obtained for her in the hospital and she was put on iron, strychnine, and arsenic and brandy. The next day bleeding occurred from the lips and gums but no ocular hæmorrhages could be seen. A blood count showed a diminution of the red corpuscles to 1,870,000, while the leucocytes were 5600. The temperature varied between 102° and 104° and the child was very sick. On the following day (Nov. 12th) she rapidly sank and died.

The various estimations of the blood are given in Tables I. and I A.

Post-mortem examination.—The body was fairly well nourished. Rigor mortis was well marked. Hypostasis was slight. There were small purpuric spots, fading slightly, on the body, face, and limbs. There were large, firm, discrete glands in the cervical, axillary, inguinal, and femoral regions. The lungs were very œdematous and presented several large areas of collapse. There were a few sub-pleural hæmorrhages which were recent and not extensive. The right pleural cavity was normal but the left contained a small quantity of clear fluid and there were a few recent adhesions at the base of the left lung. The bronchial and mediastinal glands were greatly enlarged and of a red colour. There was a little bronchitis. The heart muscle was pale but not flabby; the valves were normal. There were large pale clots in both sides of the heart. Under the epicardium there were a few small hæmorrhages. The spleen was only slightly enlarged; it was soft and of a dark-red colour. The liver was pale and slightly enlarged but otherwise normal in appearance. The stomach and intestines presented no abnormal appearances. There was no obvious change in the lymphoid tissue of the intestine. The mesenteric glands were considerably enlarged, moderately firm, and reddish in colour; some were hæmorrhagic. The retro-peritoneal glands were large and of a deep red colour. The bone-marrow of the ribs was pale and thicker than normal.

Microscopical sections. — Lymph glands: The lymph follicles were distinct. The lymphocytes were mostly small. The lymph sinuses appeared dilated but were nearly empty. There were a slight increase of connective tissue and slight proliferation of the endothelial cells. The large cells described by Andrewes which occur in lymphadenomatous glands could not be seen. Spleen: The Malpighian bodies were mostly ill-defined and in many of them the centre was occupied by a small, granular, structureless mass. The pulp was very crowded with red blood cells but the vessels were not distended. The lymphoid cells were mostly small. The connective tissue was increased slightly and there was a little thickening of the capsule. Liver: Microscopical sections showed very small deposits of lymphoid cells almost entirely confined to the portal canals. Films of the bone-marrow of a rib showed an enormous increase in number of the non-granular cells, the majority of them being considerably larger than a red blood corpuscle. Myelocytes and eosinophiles were present, but in very small numbers. Comparatively few red blood cells were to be seen and of them hardly any were nucleated.

CASE 2.—While the last case was still under observation a small girl, aged four years and eight months, was brought to the hospital on Nov. 3rd, 1905, on account of general pallor of three weeks' duration. Prior to that she had seemed quite well and strong and had had a good colour. Two weeks before a rash had appeared and this had become much more plentiful during the preceding few days. The appetite had been good and the child did not seem ill at first but latterly had had slight coryza and headache. She had been sick occasionally, the vomit being streaked with blood. The patient had had measles when two and a half years of age and diphtheria six months before the onset of the present symptoms. There was a history of rheumatism on both sides of the family and of the death of three brothers and sisters from bronchitis in infancy; three brothers and sisters, two of whom were older, were living and in good health. When first seen the child was irritable and very pale, the mucous membranes being blanched. The whole of the trunk and extremities were covered with discrete purpuric spots of small size; a few were apparently in the deeper tissues but for the most part they were in the skin. One was present on the anterior surface of the lower gum. The cervical, axillary, and inguinal glands on both sides were enlarged, shotty, and moveable, but not tender. In the chest there were signs of general bronchitis and of considerable dilatation of the heart. The apex beat was in the fifth space half an inch external to the nipple line and the cardiac dulness extended to the third left interspace and to just beyond the sternum on the right; a systolic murmur was audible in the pulmonary area and to a less extent at the apex but it was not conducted into the axilla. The abdomen was full, the spleen being much enlarged and soft but not tender and extending from the eighth rib in the mid-axillary line to three inches above the centre of Poupart's ligament. The liver also was big, being soft, smooth, and painless on palpation. The upper limit was the fifth rib in the right nipple line, while the lower edge could be distinctly felt four inches below the ensiform cartilage. The blood was



watery and pale and showed very little tendency to coagulation. The red cells numbered 2,196,000 and the white 20 000 to the cubic millimetre; the hæmoglobin was 42 per cent. Of the leucocytes only 0·8 per cent. were polymorphonuclear, while the lymphocytes totalled 98·4 per cent., 72·6 per cent. being of the large variety. Through the kindness of Dr. F. Willcocks the patient was admitted into the hospital two days later when an examination of the eyes revealed a large, fairly recent, hæmorrhage with a central decolourised area to the outer side of the left optic disc. In the right eye there was a marked myopic crescent on the inner side of the disc but no hæmorrhage in the fundus could be seen. The pupils were dilated but there was no external abnormality in either eye. For the first few days the child was drowsy and fretful and vomited occasionally, the ejecta being streaked with blood. The bronchitis became more marked and on the 9th the patient became very restless and obviously worse. Frequent retching and occasional vomiting persisted. The temperature, which was only slightly raised on admission, now fluctuated between 100° and 102° F. accompanied by rapid pulse and respiration. On the 10th she was weaker and somewhat delirious and slight hæmorrhage occurred from the gums. She died early in the morning of Nov 11th. (See Tables II. and II A.)

Necropsy.—A post-mortem examination was made about 15 hours after death. Rigor mortis was well marked; there was only very slight hypostasis. The body was extensively marked with a purpuric rash, somewhat faded and brownish. The rash was present also on the limbs and face. The superficial lymphatic glands generally were enlarged; they were moderately firm and were not matted together. The lungs showed many hæmorrhages of various sizes, both sub-pleural and into the lung substance. The left apex was the seat of an extensive hæmorrhage. The majority of the hæmorrhages were recent but some were apparently older, the clots being decolourised and firm. There were some slight pleural adhesions. The bronchial glands were enlarged, of firm consistence, but succulent. Many of the glands contained hæmorrhages of varying extent. The thymus appeared normal but was rather large for a child of this age, weighing 12 grammes. The tonsils were large and both contained hæmorrhages. The heart was large; there was no valvular

disease but the heart muscle was flabby and pale. There were many small hæmorrhages to be seen under the epicardium, under the endocardium, and also into the heart muscle. The pericardium contained a slight excess of fluid which was clear but stained with hæmoglobin. The stomach was normal in appearance. In the small intestine there were numerous punctiform submucous hæmorrhages, but neither Peyer's patches nor the solitary glands were enlarged or unduly prominent. Of the mesenteric glands some were normal in size, but many were enlarged, soft, and juicy, and pinkish in colour, while many showed more or less extensive hæmorrhages. The retro-peritoneal glands were large, soft, and of a deep pink colour. The liver weighed 26 ounces and was pale; on section no lymphoid deposits were visible to the naked eye. The spleen was considerably enlarged, weighing ten ounces; it was friable and of a dark red colour; there were no infarcts. The pancreas, kidneys, and suprarenal capsules were normal in appearance. The bone-marrow from a rib was pale pinkish in colour and thick.

Microscopic Sections.—The lymph glands showed great hyperplasia of the lymphoid elements; the outlines of the lymphatic follicles could not be clearly recognised, the normal structure of the gland being obliterated by the diffuse lymphoid proliferation. The cells were chiefly large lymphocytes. Many of the lymph sinuses were packed with lymphocytes, but some were empty. There were no increase of connective tissue and no proliferation of the endothelium. Spleen: The Malpighian bodies were few, small, and indistinct. The pulp contained large numbers of large lymphocytes and red blood cells. The vessels were not distended. The connective tissue was slightly increased, but the capsule was not thickened. Liver: There were numerous collections of lymphoid cells, some circumscribed, some diffuse. The deposits were not limited to the portal canals and connective tissue round the interlobular veins, but occurred anywhere in or round the lobules. There were many small areas of degeneration of the liver cells. Kidneys: Microscopic sections showed fairly numerous small diffuse infiltrations with lymphoid cells. These deposits were chiefly round the larger vessels and about Bowman's capsules.

Films made from the bone marrow of a rib consisted chiefly of mononuclear non-granular cells with a very small amount of protoplasm surrounding the nucleus. These cells were of two sizes, one of about the same size as a red blood corpuscle, the other nearly twice the size, the larger cells being much more numerous than the smaller. There were a few cells with large nuclei, either oval or spherical, and a considerable amount of slightly basophilic, non-granular protoplasm. Granular cells were extremely scarce. Red blood cells were not numerous and nucleated red cells were rare.

These two cases, as so often happens with rarities or abnormalities, occurred almost simultaneously in hospital practice and, as a matter of fact, died within one day of each other, though one was of 12 weeks' duration and the other of only four. As will have been seen, the course of each of the two cases was in many ways identical, while the estimations of the blood and the differential counts of the leucocytes showed a great similarity. Both patients were small girls and in each case there was a history of sudden onset of the illness, although the initial symptoms showed a slight disparity, general malaise and glandular enlargement being noticed in the first case and the outbreak of a purpuric rash without constitutional disturbance in the second. The glandular swellings in the latter, though not previously noticed by the mother, were very evident when the patient was first seen, so that, even if they had not existed from the first, at any rate they occurred at an early stage of the disease. It is to be noted that the onset of purpura in the first case was prodromal to a rapidly fatal termination, only 16 days elapsing between its occurrence and death, while the second, in which, as already stated, the purpura was present from the beginning, was of only one month's duration. In the latter case the marked cardiac dilatation was a prominent feature.

The blood in both instances showed a remarkable diminution in the number of polymorphonuclear cells, with a corresponding increase in the mononuclear elements, which at one time amounted to 97·2 and 98·4 per cent. of the total leucocytes in the two cases respectively. Of these the majority consisted of large lymphocytes; in only one count during the earlier stages of Case 1 did the small variety seem to preponderate, while towards the end of Case 1 and throughout the course of Case 2 the excess of the larger form was very marked. Of the other leucocytes, a few eosinophiles and myelocytes were found in both, and an occasional basophile in the second. This lymphocytic excess, it will be observed, occurred without any great increase in the total number of white cells, the leucocytosis in neither instance at any time exceeding 25,000 per cubic millimetre. The red cells in both cases showed a decided decrease towards the end with the presence of a small number of normoblasts, and degenerative changes were exemplified, in Case 1 at all events, by polychromatophilia. The colour indices throughout were only slightly below 1.

Clinically the signs were consistent with a diagnosis of acute lymphatic leukæmia, early involvement of the lymphatic glands generally, enlargement of the spleen and liver, a progressive anæmia and cachexia, and a tendency to hæmorrhages (very marked in Case 2) followed by an early death, while the markedly increased proportion of lymphocytes in the blood, in spite of the fact that at no time was the leucocytosis of any unusual extent, further completes the picture.

Cases of acute lymphatic leukæmia without marked leucocytic increase have been described, such as that by Cabot,[2] in which the leucocytes fell as the result of sepsis from 40,000 to 471 on the day of death; that by F. Taylor[3] of a boy, aged ten years, whose white cells numbered 15,000 when first seen, but with an increasing lymphocytosis amounted subsequently to 50,000; one by Gilbert and Weil,[4] in which all the leucocytes were lymphocytes and the total numbers varied between 22,010 and 46,400; and two by McCrae,[5] one of a boy, aged three years, who at the first count had 26,000 leucocytes, of which 86·5 per cent. were lymphocytes (45 large and 41·5 small) and subsequently 60,800 with 99·2 per cent. of lymphocytes, the small variety amounting to 96·6 per cent.; the other of a man, aged 20 years, whose leucocyte count was 12,000, the percentage of the total lymphocytes being 94·2 and that of the small kind 93·3. Furthermore, Hutchison[6] states that "it must be admitted that cases of true lymphatic leukæmia do occur in which, at one stage of the process at least, there is no *absolute* increase of the total leucocytes, but in such cases there is notwithstanding a marked absolute increase of lymphocytes, whilst the normal total count is due to a great reduction of the polynuclear forms."

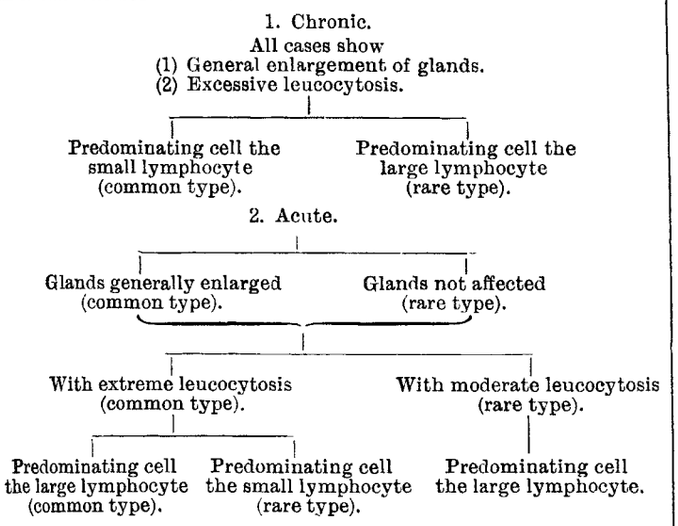
A consideration of the disease from a general standpoint leads to the conclusion that lymphatic leukæmia, or more correctly speaking lymphæmia or lymphocythæmia, is a condition presenting itself in many different forms. The differences met with in these cases are so various that at first it appears that one would be almost justified in asserting that every case is atypical. In spite, however, of the diverse appearances shown by this disease we can divide it into two distinct classes—namely, acute and chronic—and furthermore we can subdivide these two into several types with which are associated certain more or less definite characteristics. In the *chronic* cases, which are decidedly less common than the acute, we have two constant features: (1) there is always a general glandular enlargement; and (2) there is always an extreme leucocytosis—i.e., one approaching 100,000 per cubic millimetre and frequently exceeding that number. The majority of the white cells are lymphocytes (from 85 to 99 per cent.) and in these chronic cases the small lymphocytes generally, but not always, predominate. Thus, in a chronic case observed by one of us recently there were 138,000 white cells per cubic millimetre, of which 91·2 per cent. were large lymphocytes and 1·8 per cent. were small.

In the *acute* cases, on the other hand, there may be a general enlargement of the lymph glands or there may not. Cases without glandular enlargement have been described by Reed,[7] Houston,[8] Donovan,[9] Dudgeon,[10] and others. Secondly, the leucocytosis may be extreme or of only a very moderate extent, the total number of white cells not exceeding that frequently seen in an inflammatory leucocytosis. And in the third place, such leucocytosis, whether of a marked or of a moderate grade, may be

[2] Cabot: Clinical Examination of the Blood.
[3] F. Taylor: Transactions of the Clinical Society, 1904, p. 46.
[4] Diseases of the Blood, Nothnagel's Encyclopædia, p. 555.
[5] Brit. Med. Jour, 1905, vol. i., p. 404.
[6] Goulstonian Lectures, 1904.
[7] American Journal of the Medical Sciences, 1902, p. 653.
[8] Meeting of British Medical Association, Oxford, 1904.
[9] Brit. Med. Jour, February, 1905.
[10] Transactions of the Pathological Society of London, 1905.

accompanied by extensive increase in size of the lymphatic glands or by the absence of glandular enlargement. The commonest type of acute lymphæmia is that in which there is a general enlargement of the glands associated with an extreme leucocytosis, the predominating cell being the large lymphocyte. In some cases with a high grade leucocytosis, however, the small lymphocyte is in excess and this may be associated or not with general glandular enlargement. On the other hand, in those cases in which there is a comparatively slight leucocytosis the predominating cell is, as far as we know, always the large lymphocyte.

The varieties of lymphæmia may be conveniently expressed in a tabular form thus:—



A point which we consider of great pathological importance in cases of acute lymphæmia is the fact that there may be a marked general enlargement of the lymph glands or there may be little or no such enlargement. Moreover, the cases in which there is no increase in size of the lymph glands may show an enormous increase in the number of lymphocytes, generally of the large variety but occasionally of the small, while those cases, such as the two we now report, in which a well-marked and extensive glandular enlargement is present may show only a comparatively mild leucocytosis, the diagnosis in such cases depending largely on the high percentage of lymphocytes and being confirmed post mortem by the condition of the marrow and perhaps also by changes in the viscera. Normally, the lymphocytes are derived from three sources: the spleen, the lymphoid tissue throughout the body, and the marrow. In lymphocythæmia these three sources of origin may all be involved or one only, that one, which appears most important and the only one indeed the involvement of which seems absolutely necessary in the production of the disease, being the bone marrow. Ewing[11] has found that the distribution of the lesion in the marrow in cases of lymphæmia is very irregular and in the early stage appears to be focal rather than diffuse. In one acute case he found the marrow of the ribs and femur to be normal, while that of the bodies of the vertebræ showed the usual lymphoid hyperplasia. We think it highly probable that the condition of the blood bears a much more direct relation to the extent and degree of the marrow change than to the hyperplasia of the lymphoid structures. Another point in favour of this view is the fact that in chronic lymphæmia the cellular hyperplasia of the glands is found to be largely replaced by an increase of connective tissue, such change not being accompanied by any decrease in the number of lymphocytes in the blood.

The great lymphocytosis in the cases here reported was out of all proportion to that found in childhood and in the secondary anæmias common thereto. It will be remembered that at birth the mononuclear elements constitute from 50 to 75 per cent. of the total leucocytes and that at the third year the mononuclears and the polymorphonuclears are present in about equal numbers; from the eighth to tenth years and onwards the proportions assume the adult type. The blood changes in these cases were also more marked than those found in lymphadenoma, for in this disease there is frequently but little change from the normal. In the later stages it is true there may be anæmia and a relative lymphocytosis but the red cells do not as a rule fall below 3,000,000 nor does the lymphocytosis reach 50 per cent. It has been stated that occasionally the leucocytes and the characters of the blood in lymphadenoma become those of a lymphatic leukæmia, though Ewing maintains that "the statement that pseudo-leukæmia may pass into leukæmia rests upon rather uncertain observations." With this we agree and we incline to the belief that those cases in which such a change is said to have occurred were in reality instances of lymphæmia from the beginning, it not having been fully realised that lymphæmia may occur without any marked increase in the number of white corpuscles.

Anæmia infantum pseudo-leukæmica (von Jaksch), a disease which must not be confounded with lymphadenoma, or Hodgkin's disease, on account of the similarity of the name with pseudo-leukæmia, a synonym of the latter, likewise differs from the cases which we now record. In von Jaksch's anæmia the spleen is much enlarged and the liver moderately so, while the lymph glands do not show an increase in size comparable to that in leukæmia. The red cells are much diminished and show variations in size and shape and the deficiency in hæmoglobin common to other anæmias, but characteristic features are an excessive number of nucleated red cells and in the graver stages the presence of megaloblasts. The leucocytes number from 20,000 to 50,000 or more, the mononuclear cells forming a slight majority, while the eosinophiles may be increased up to 6 per cent.

Such diseases as scurvy and purpura hæmorrhagica can be passed over. Clinically the cases did not resemble these affections and the blood showed greater changes than are found in them. In purpura hæmorrhagica the red corpuscles are as a rule only slightly, if at all, diminished and scarcely ever fall below two and a half millions unless there is very severe hæmorrhage, while the leucocytes generally show a distinct increase, the polymorphonuclear variety greatly predominating.[12] In scurvy likewise the blood changes are those of a secondary anæmia and present no definite characteristics.

CASE 3.—A girl, aged six years, first attended the out-patient department in June, 1903, with a history of having recently become pale and being very liable to vomiting, though since an attack of measles two years previously, which was immediately followed by severe diarrhœa, she had been getting thinner and weaker and had been very excitable. She had always been a "delicate" child and attended the hospital for wasting when seven weeks old and subsequently for rickets till the age of 18 months. For the next one and a half years her health was good but at the end of that time she had an attack of pneumonia; this was followed about a year later by the measles above referred to which confined her to bed for four weeks. In the family there were three younger children, two of whom had attended for wasting but all were then well except the youngest but one who suffered with a chronic cough. The mother was anæmic but otherwise healthy and the father enjoyed good health. There was no history of any disease in the family. When first seen the child was of small physique and delicate-looking, though by no means ill nourished and showed a slight grade of anæmia. The abdomen was "large and podgy" but no visceral abnormality was discovered either there or in the chest. The bowels were constipated. She was put on a course of cod-liver oil and malt but the former had to be omitted as it induced vomiting. In December, 1903, a slight attack of bronchitis supervened. The abdomen was still large but the child's colour was good and she was said to be getting thinner. Her weight at that time was 31 pounds 2 ounces and during the next two months she was proved to lose a few ounces. During the spring of 1904 she had some return of the cough but shortly after ceased to attend until September. Her general condition had then considerably deteriorated. She was markedly anæmic and thinner than before, having gained only 4 pounds in weight during the previous eight months. A loud hæmic bruit was audible all over the cardiac area; neither the abdominal viscera nor the lymphatic structures were enlarged. The patient complained of pain in the eyes at night and occasional headache. Mr. Sydney Stephenson was accordingly asked to examine her and he reported: "Refraction = 1·25 D. of hypermetropia; fundus normal. The pallor of the fundi and of the blood in the retinal arteries and veins recalls that of some cases of leukæmia I have

[11] Ewing: Clinical Pathology of the Blood, second edition, p. 235.

[12] Ewing (Clinical Pathology of the Blood) describes a non-infectious idiopathic purpura hæmorrhagica which is probably identical with hæmophilia. In this condition the lymphocytes may rise to 90 per cent. (Engel), 80 per cent. (Ehrlich).

examined. No neuritis. No tubercles of the choroid." A blood count on Oct. 4th showed 1,200,000 red cells and 6400 leucocytes to the cubic millimetre and hæmoglobin 30 per cent.

As the child was losing weight she was admitted into the hospital on Oct. 10th. All the mucous membranes were blanched and she was very pale. The temperature was 103·6° F. and the pulse-rate was 160 and of good quality. The tongue was very furred. Nothing beyond the hæmic bruit was found in the chest but the abdomen was very distended and the spleen could be just felt. The temperature fell to normal in two days but rose irregularly to about 100° for another fortnight, after which it settled down. The pulse also became slower and averaged 100 beats a minute. The blood a week after admission showed only 816,000 red cells and 3400 white to the cubic millimetre, with hæmoglobin 20 per cent., but 11 days later it had improved to 1,695,000 erythrocytes and 6800 leucocytes, with hæmoglobin 42 per cent. Vomiting frequently occurred in spite of all treatment and proved unconnected with the administration of arsenic which was tried, as it did not cease when iron was substituted for a time or increase when the arsenic was resumed. At the end of a six weeks' stay in hospital she was slightly improved and had gained 2¼ pounds, her weight 10 ounces. As it was thought that she was not doing very well in hospital she was sent home and kept under observation as an out-patient, being sent again to Brighton a little later. After she had been there for a few weeks her mother was telegraphed for as the child was very ill and the vomiting was severe and brought her straight back to the Evelina Hospital. The patient was a good deal collapsed after the journey and intensely anæmic. Her lips were bluish-white in colour and the hands and ears were of a dead waxy appearance. She was admitted again (Sept. 15th, 1905) and the anæmia was found to be of such an extreme grade that there were only 827,500 erythrocytes to the cubic millimetre, the hæmoglobin being 15 per cent.; the leucocytes, on the other hand, were abundant, numbering 9200. Her condition improved, so that by Oct. 6th the red corpuscles and percentage of hæmoglobin were nearly doubled. The patient was bright and cheerful in herself but was frequently very sick without any feeling of nausea. The vomiting occurred quite suddenly and was generally preceded by a cough. The spleen was not palpable but the lower edge of the liver could be just felt. Both ears were discharging. The bowels, as was generally the case, required aperients. The urine was normal. The vomiting was intractable though for a time it seemed better after lavage

TABLE III.—GIVING DETAILS OF THE BLOOD EXAMINATION IN CASE 3.

Date.	Red cells per c.mm.	White cells per c.mm.	Hæmoglobin per cent.	Polymorphonuclears per cent.	Small lymphocytes per cent.	Large lymphocytes per cent.	Large mononuclears per cent.	Transitionals per cent.	Eosinophiles per cent.	Myelocytes per cent.	Basophiles per cent.	Nucleated red cells per 100 leucocytes.	Remarks.
1904.													
Oct. 4th ...	1,200,000	6400	30·0	—	—	—	—	—	—	—	—	—	Colour index = 1·25.
Oct. 18th ...	816,000	3400	20 0	55 0	37·0		3·0	—	0·5	—	4·5	—	Colour index = 1·22.
Oct. 29th ...	1,696,000	6800	42 0	—	—	—	—	—	—	—	—	—	Colour index = 1·23.
Dec. 30th ...	1,576,000	7600	36 0	55·5	24 5	10·0	6·0	—	0·5	2 5	0·5	0·5	Colour index = 1·17.
1905.													
Feb. 21st ...	3,760,000	8600	72·0	—	—	—	—	—	—	—	—	—	Colour index = 0·95.
April 20th ...	2,048,000	7500	32·0	—	—	—	—	—	—	—	—	—	Colour index = 0 78.
June 14th ...	2,000,000	6000	40 0	—	—	—	—	—	—	—	—	—	Colour index = 1·0. Microcytes and megalocytes. Poikilocytosis.
Sept. 21st ...	827,500	9200	15·0	61	21·6	7·0	7·0	0·6	1·0	1·6	—	2·0	Colour index = 0·906. Microcytes and megalocytes. Poikilocytosis and polychromasia.
Oct. 6th ...	1,600,000	5020	28 0	—	—	—	—	—	—	—	—	—	Colour index = 0·87.
Oct. 18th ...	1,480,000	4000	28·0	—	—	—	—	—	—	—	—	—	Colour index = 0·94.
Nov. 26th ...	774,000	4370	18·0	59	7 6	22·2	3·4	3·4	2·8	1·0	0·6	0·5	Colour index = 1·16. One megaloblast seen.

Average colour index = 1·043.

then being 29¾ pounds. She was sent away to Brighton on Nov. 21st but the vomiting became worse and on Dec. 28th she was readmitted, having lost three-quarters of a pound in weight. The abdomen was still distended but there was no evidence of fluid and the spleen could not then be felt. The blood count showed only a slight inferiority to that made on Oct. 29th. The temperature was unsettled, rising quite irregularly at intervals, and occasionally reaching 103°. No cause was found for these rises and they apparently did not cause the patient any inconvenience. A seven weeks' course of hæmatogen, iron, and arsenic brought about some improvement and an increase in weight of nearly 3 pounds. The blood on Feb. 21st, 1905, showed 3,760,000 red cells and 8600 white per cubic millimetre and hæmoglobin 72 per cent.

The patient was sent home but three weeks later returned with increased vomiting and was readmitted on April 14th. The general condition was much the same but the blood had deteriorated to 2 048,000 red cells and 7500 white per cubic millimetre; hæmoglobin 32 per cent. The temperature continued very irregular and the vomiting persisted at intervals in spite of treatment. In June the spleen was palpable again, two inches below the ribs, and the blood elements had further slightly diminished in number, though the colour index had improved and the weight had risen to 31 pounds of the stomach, a proceeding which the child greatly resented. Towards the end of October the red cells had again begun to diminish in number so she was once more sent home. She weighed 29½ pounds. During November the vomiting was rather less frequent but she became more anæmic and dropped to 28¼ pounds in weight. On Dec. 1st she was much worse and very lethargic and was admitted for the last time. The face and lips were almost white; the eyelids were puffy, and the hands and feet were œdematous. The respirations were laboured and 30 to the minute, the pulse was 104, and the temperature ranged from 101·4° to 102°. The blood count showed only 774,000 red cells and 4370 white per cubic millimetre and hæmoglobin 18 per cent. (See Table III.) The temperature dropped to normal but the child died on Dec. 5th, 1905, having complained of pain in the abdomen and back during the previous day.

Necropsy.—At the post-mortem examination the body was found to be fairly well nourished. Rigor mortis was slight and post-mortem staining was not present. The muscles were brownish-red and the fat was a deep yellow. The lungs were very œdematous. Both pleural cavities contained a large quantity of clear fluid. There were some recent adhesions about the base of the left lung. The bronchial glands were large and pigmented. The pericardium contained nearly three ounces of clear fluid. In

both sides of the heart there were small quantities of pale watery blood; there were no clots. The heart muscle was pale and flabby, with well-marked tabby-cat striation on the musculi papillares. The right ventricle was moderately dilated. The valves were normal. The mucous membrane of the stomach was coated with tenacious mucus but otherwise the stomach wall appeared normal. The small intestine contained a considerable amount of rather thick bile-stained mucus. The mucous membrane was reddened, especially the edges of the valvulæ conniventes. In the large intestine the mucous membrane was reddened in patches. The opening of the appendix into the cæcum was plugged with a small mass of inspissated fæcal matter. The wall of the appendix was in a state of catarrhal inflammation, the proximal half of the appendix being distended with very foul-smelling mucus. The mesenteric glands were slightly enlarged and red. The liver weighed 26 ounces and was very pale in colour. The gall-bladder was distended with dark-coloured bile. The spleen weighed five ounces and was of firm consistence. The kidneys were large, each weighing three and a half ounces; the cortices were not enlarged and the capsules stripped easily. The connective tissue throughout the body was decidedly œdematous. The blood was pale and watery and its coagulability was considerably diminished. Films were made from the bone marrow of a rib. The cells showed a considerable amount of degeneration, many of them staining badly and being difficult to identify. The proportion of non-granular to granular cells appeared to be normal. Nucleated red cells were fairly, but not excessively, numerous, the majority of them being megaloblasts. Of the non-nucleated red cells many were macrocytes. Corpuscle-carrying cells were not present.

This case presents many points suggestive of pernicious anæmia, though the occurrence of this disease so early in life is very unusual, for out of 240 cases collected by Ehrlich only one, or 0·4 per cent., occurred below the age of ten years. The patient was intensely anæmic and during the 14 months that the blood was under observation the red corpuscles were above 2,000,000 for only one period of five months and towards the end they showed considerable variations in size and shape. Nucleated red cells were present in small numbers and in the last count one definite megaloblast was seen. As in pernicious anæmia, rapid changes in the quality of the blood and in the general condition of the patient were marked features. On two occasions the number of erythrocytes fell considerably below 1,000.000 and in the last count of all to 774,000. On the two earlier occasions the numbers were doubled in such short periods as 11 and 15 days, the general condition at the same time noticeably improving after the patient had seemed to be in a very bad way. The hæmoglobin value throughout was high, the average of all the estimations being 1·043. The leucocyte count, on the whole, was low and showed no correspondence with the number of red corpuscles, the highest number, 9200, being found at one of the periods of most marked diminution in the red cells.

An alternative diagnosis which was at one time put forward was that of splenic anæmia, but the spleen was never at any time very large and frequently it could not be felt at all. In splenic anæmia, also, the red corpuscles very rarely show the same marked diminution as in pernicious anæmia and the poikilocytosis is much less marked. Erythroblasts are rare and when present are of normal size and above all the colour index is low. The leucocytes are diminished in number with a slight relative increase in the lymphocytes, and basophiles are very scanty. Taken altogether the blood of this case conforms much more closely to the type of pernicious than to that of splenic anæmia.

The child was shown at a meeting of the Society for the Study of Disease in Children on Oct. 20th, 1905, when it was suggested that the anæmia was due to abdominal tuberculosis, but the necropsy showed no sign of tubercle anywhere.

It is possible that the anæmia supervened upon the chronic gastro enteritis, and if this be so is it to be considered as merely of a secondary nature? It seems to us that the blood changes were too severe to be accounted for in this way, and for the reasons given above we incline to the belief that the case was one of primary anæmia presenting many characteristics of the pernicious type.

A CONTRIBUTION TO THE PLASTIC SURGERY OF THE RENAL PELVIS.

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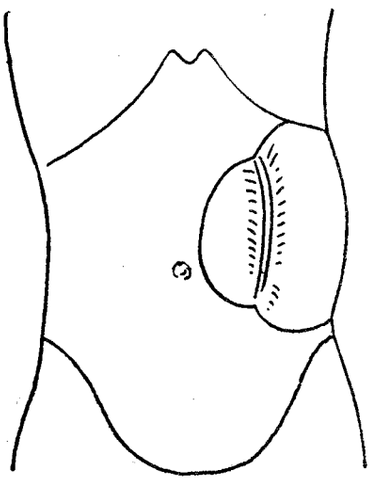
CONSERVATISM in renal surgery has succeeded a somewhat prodigal tendency in regard to the renal tissue. This is partly the result of increased experience in the surgery of renal disease but above all to a wider knowledge of the pathology and of the recuperative power of the renal tissue after apparently irreparable damage. Plastic operations upon the ureter and the kidney pelvis are performed with greater frequency with the object of saving the kidney, even if it be damaged. The plastic surgery of the renal pelvis has not yet emerged from the earlier stages of its development and I have therefore ventured to give publicity to the following case, which appears to me to possess some points of interest.

The patient, an active young woman accustomed to the muscular exertion of massaging patients, was under the care of Dr. H. Stanley of St. Leonards and Dr. A. M. Ross Sinclair, and was referred to me on account of a moveable tumour on the left side of the abdomen. She related the following history. Seven months before I saw her she had a sudden attack of pain in the left side of the abdomen and indicated a spot above, and to the left of, the umbilicus a little below the margin of the ribs (anterior renal pain region). The pain was severe and shooting through to the back at the angle of the last rib and the erector spinæ muscle and caused sickness. She stated that just before the pain came on she had carried a heavy box downstairs. The pain was relieved by rest in bed and she remained perfectly well for about three months, when she had an attack of influenza and the same pain returned. This was followed by another attack four months later and the last attack came on four days before I saw her. These attacks of pain were all similar in their course. The first attack had some apparent connexion with lifting a heavy weight, the second had no such preliminary exertion, and the third attack came on at night when the patient was in bed. The pain always commenced in front and passed through to the back. It did not track along the ureter. The kidney region was tender during and after the last two attacks. There were no

FIG. 1.



increased frequency of micturition and no change in the urine during or after the attacks. Dr. Stanley discovered a tumour in the left loin. This did not increase in size nor was there any history of its sudden disappearance.

On examining the abdomen the left side was seen to be more prominent than the right and was firmer and more resistant. There was some bulging at the side of the left loin with the patient lying on the back, but none posteriorly. On palpation a large smooth mass of the size of a child's