A CONTRIBUTION TO THE HEMATOLOGY OF PUERPERAL FEVER WITH SOME OBSERVATIONS ON THE INFLUENCE OF THE INTRAVENOUS INJECTION OF ANTISTREPTOCOCCIC SERUM

------oOo------

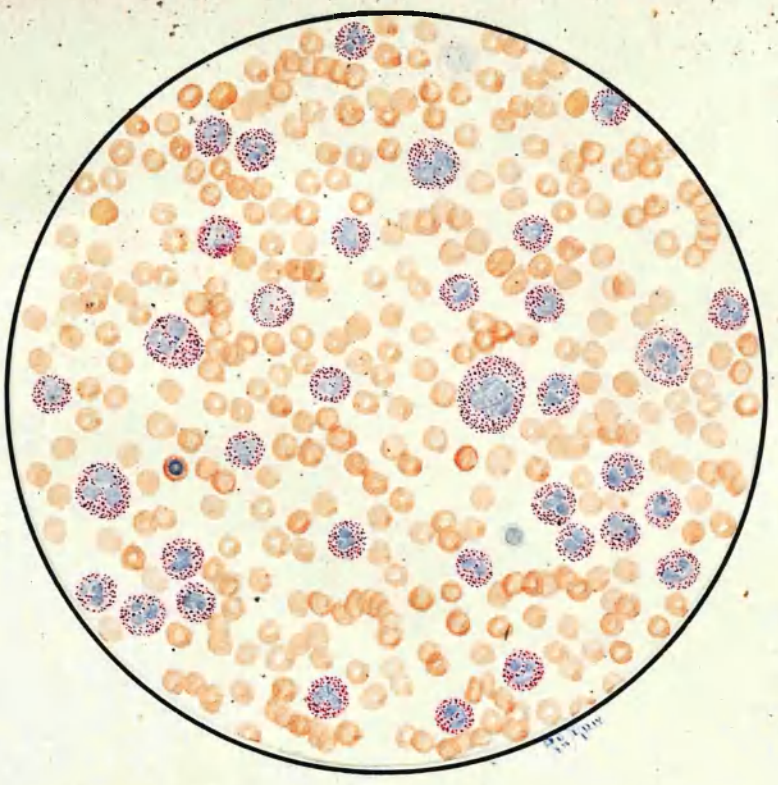
BEING A THESIS FOR THE DEGREE OF DOCTOR OF MEDICINE, PRESENTED TO THE UNIVERSITY OF GLASGOW

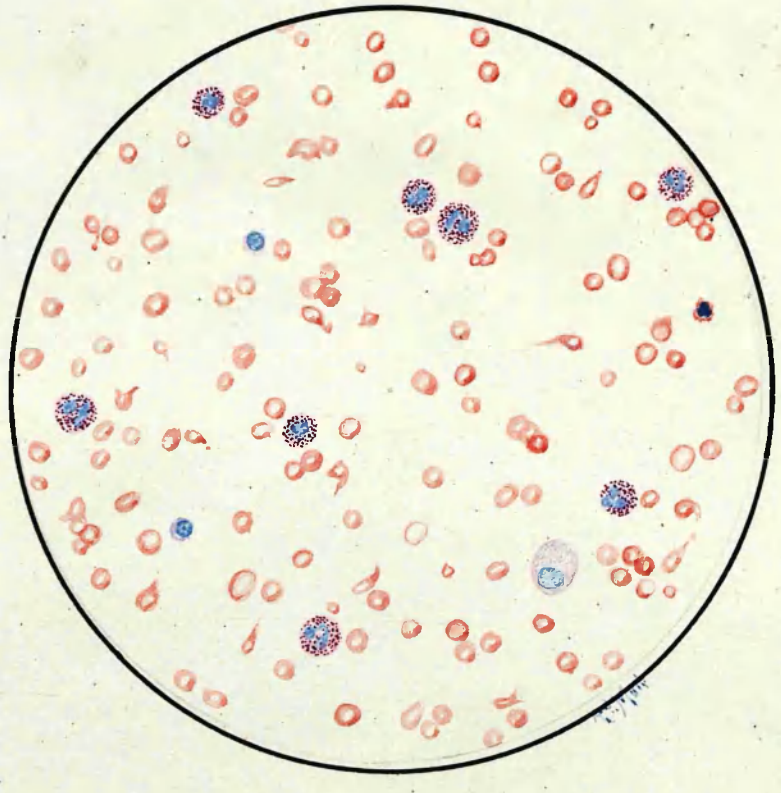
By

ARTHUR ROBIN, M.B., Ch.B.

1st October, 1903

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346





B L O O D P R E P A R A T I O N S

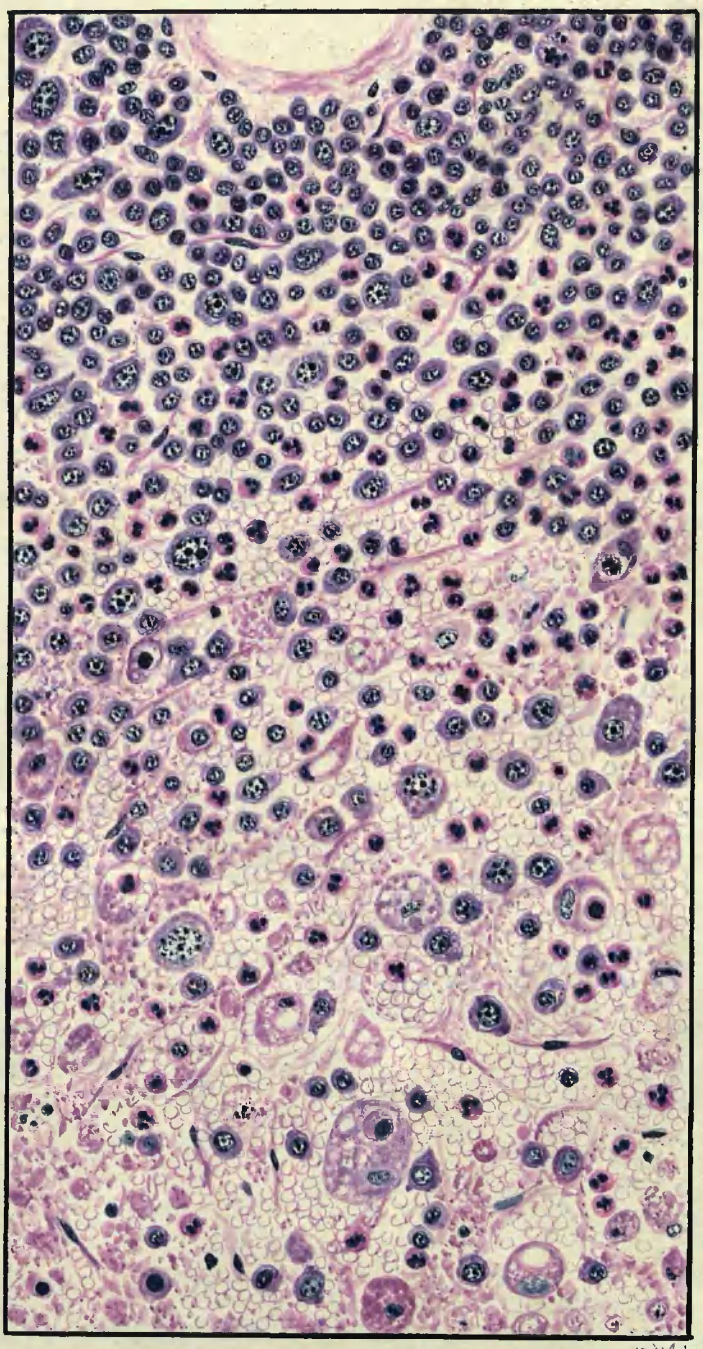
CASE XVII (See page 163)

EHRLICH'S TRIACID STAIN

Arthur Robin. M.B., Ch.B.

------oOo------

CASE XII (See page 162)



S E C T I O N .O F S P L E E N

CASE NO. XII

---o---

STAIN POLYCHROM-METHYLENE BLUE AND TANNIC ACID FUCHSINE

(See Page 161)

---o---

A CONTRIBUTION to the Hematology of Puerperal Fever, with Some Observations on the Influence of the Intravenous Injection of Antistreptococcic Serum.

--------o--------

Clinical hematology is a subject which, within recent years, has grown greatly in importance, and numerous observers have lately entered this field of research, stimulated by the significance and the interest of the results already obtained in a large variety of morbid conditions.

In septic diseases, as a branch of this subject, much work has been done upon the blood, with a view to ascertain, if possible, changes in its constituents which might help in the diagnosis and prognosis, or serve to suggest indications for surgical interference in certain conditions.

On referring to the literature on the hematology of Puerperal Fever, this disease appears, for the most part, to be classed along with many other septic conditions resulting from various causes other than childbirth, and including such diseases as osteomyelitis, malignant endocarditis, infected wounds, septic joints, and the like. Observations made upon the blood in septicemia following the puerperal

state are limited in number, and for this reason I have ventured to present the result of work done in the Puerperal Ward of the City of Glasgow Fever Hospital at Belvidere.

Since the introduction of antiseptics, and with a fuller knowledge of the causation of Puerperal Fever, this disease ought theoretically to be seldom seen, but the paucity of observations made in this disease is probably due more to the fact that only a comparatively small percentage of such cases are admitted into hospital, rather than to an actual diminution in the number of cases occurring after childbirth.

In puerperal septicemia there are complicating conditions present not found in other forms of sepsis, and these, in conjunction with certain complications and sequelae, add greatly to the difficulties which surround the study of the hematology of this disease.

These we shall now discuss briefly.

Both during pregnancy and immediately after parturition marked physiological changes occur in the maternal blood, and the majority of observers agree that a leucocytosis is normally present, both before labour and for

some time during the puerperium.

Hubbard and White (Jour. Exper. Med., 1898, Vol. III), in an examination of the blood in fifty-five pregnant women, found that a leucocytosis occurred in 84% of primiparae and in 75% of multiparae, averaging about fifteen thousand in the former and eleven thousand seven hundred in the latter. In differential counts the increase in the number of white cells was found to depend upon an increase of the polymorphonuclear variety, though Björkman (Am. Med. Surg. Bull., 1894, Vol. VII) attributed the leucocytosis to an increase of the mononuclear cells, while Rieder maintained that the relative numbers of the different cells remained normal.

After parturition a considerable leucocytosis has been found by numerous observers - (Kosina and Eckert, Malassez, Fouassier, Rieder and Cabot). Henderson, in his series of cases, found the average leucocytosis about twenty-one thousand upon the first day of puerperium, and this, by the eighth day, had fallen gradually to below eleven thousand - a slight leucocytosis continuing thereafter is explained by the changes in the breasts during

lactation.

There are also to be considered the physiological changes in the other constituents of the blood. A reduction in the amount of hemoglobin (according to Spiegelberg, Becquerel, and others) constantly occurs, partly as a result of the increased quantity of the fluid portion of the blood necessary to fill both maternal and fetal blood vessels, and partly as a result of the increased production of waste material, which leads to either a diminution in the output of red corpuscles, or to a reduction in the hemoglobin value of the red corpuscles individually. According to Schroeder, however, who bases his opinion upon numerous observations summarized by himself, there is reason to believe that if anemia exists in pregnancy, it is to be referred to unhygienic surroundings rather than to any special influence that condition may have upon the hemoglobin.

Ewing and others state that during the puerperium a leucocytosis may occur apart from any definite septic infection consequent upon postpartum bleeding. Huhnerfauth (Virchow Archiv., Bd. 76) investigated the effects of hem-

orrhage upon the blood of dogs. He found that immediately after bleeding the animal the leucocytes were often slightly diminished in number, but that a marked leucocytosis, as high as forty-five thousand per cb.mm., occurred upon the following day, and that this increase persisted more or less for two or three weeks. In the human subject Lyon (Virchow Archiv., Bd. 84) counted forty-one thousand six hundred and twenty-five leucocytes in a cb.mm. in a patient who had a dangerous hemorrhage after an operation.

Several of the patients included in the following series of cases were admitted with symptoms of having lost a considerable quantity of blood. To these saline fluid was administered, either subcutaneously or per rectum. This operation is held by Ewing and Cabot to bring about of itself a leucocytosis, though the former does not quote any specific case in support of this opinion. Cabot, however, enumerates the blood counts in a patient who was given Oi saline fluid intravenously on account of severe hemorrhage following traumatic rupture of the urethra. Here the white cells rose from ten thousand four

hundred to thirty-one thousand nine hundred, four hours later, while the next day there was a leucocytosis of thirty-four thousand six hundred. This is decidedly different from the results obtained by myself where similar treatment was adopted, and it is probable that the increase was not altogether independent of the hemorrhage itself, but this subject will be referred to later. It would occupy unnecessary space to discuss in detail the various causes of physiological leucocytoses, except in so far as these may have a distinct bearing upon the results obtained in the individual cases under observation, but it is nevertheless important to note the opinions expressed by one or two observers who have devoted attention to this subject.

It is known that an increase in the number of white cells is not a constant result of digestion, but when it does occur, the increase affects all the varieties alike - in other words, it is a mixed leucocytosis, but with a decrease in the number of eosinophile cells. Ewing states that this digestion leucocytosis is usually suppressed in late pregnancy. These facts must be borne in mind, for

in hospital when a number of patients are under observation, and unexpected interruptions are so apt to occur in the regular sequence of blood counts, it is extremely difficult to make daily counts at a definite hour when the influence of digestion, however slight, upon the blood may be wholly eliminated. In addition to this it must be remembered that, when patients are admitted acutely ill and the temperature is high, the administration of milk in small repeated doses is apt to determine a more or less constant digestion leucocytosis.

Different observers have published various estimates of the number of leucocytes present in cases of septicemia, and it will be of interest to consider briefly the causes of these differences.

In some cases marked leucocytosis has been observed, while in others from beginning to end of the disease a distinct leucopenia was present. Da Costa gives the details of a case of puerperal septicemia where blood counts were made at intervals over a period of four months. During this time the maximum leucocytosis was thirty-three thousand one hundred per cb.mm., while the

minimum was six thousand. In a list of twenty-one septic cases of various origin, in two only did the leucocytes rise above twenty thousand, while in four cases they fell below five thousand. Ewing holds that, though a considerable number of cases of asthenic septicemia run their course without a leucocytosis or with a distinct reduction of white cells, the majority of cases shew a pronounced leucocytosis, which is usually in proportion to the severity of the disease. On the other hand Maragliano believes that in acute infectious diseases there exists no connection between the severity of the attack and the degree of leucocytosis. Grawitz agrees with this, but believes that in septic pyemic cases in which there is a localisation of the process, and in those where there is exudation into the tissues, the leucocytosis is more marked than in uncomplicated cases.

Cabot gives a list of nine cases of puerperal septicemia occurring in the Massachusett's General Hospital. In some of these, however, only one count was made. The maximum leucocytosis in this list is twenty-six thousand, while the minimum count was five thousand six hundred in

a fatal case where only one count was made. Von Limbeck and Krebs found no leucocytosis in persons suffering from puerperal septicemia, but these cases Cabot holds to have been either malignant or very mild in character. Von Limbeck also quotes a case (Pathol. of Blood, 1901) of puerperal septic endometritis where a rigor occurred on the eleventh day of puerperium, and death ensued six days later. Here the maximum count was six thousand, and the minimum three thousand. In contrast to these results Rieder, Sadler, Roscher, Kanthack, and Grawitz found leucocytoses.

It is extremely difficult at times to account for such vastly different results in various septic conditions. One explanation which appears to be pretty generally accepted is that this variation depends upon the reaction of the hemogenic glands or tissues to the toxines of the infecting organisms. Muir (B. M. J., 1898) pointed out that a leucccytosis in inflammatory conditions is associated with marked changes in the bone marrow brought about by the chemiotactic or stimulating influence of bacterial products. The results of this stimulus will de-

pend upon at least two factors, viz., the virulence of the toxines, and the power of resistance on the part of the tissues infected. If the infection be very slight or exceedingly virulent there may be little or no increase in the number of leucocytes, for in the former case little or no reaction on the part of the hemogenic tissues is necessary to protect the organism, while in the latter such a reaction is prevented by death ensuing before it can be brought about. If, however, the toxemia is only moderately severe or the resistance of the tissues is very active, a well marked leucocytosis is to be expected.

Von Limbeck likewise suggests that the difference between his results and those of Rieder depended upon the virulence of the infecting organism. Tschistovitch experimentally came to a similar conclusion. He injected a culture of staphylococcus pyogenes aureus (which is always followed by an increase in the number of white cells) into the ear of a rabbit, and at the same time he injected a very virulent culture of dipplococci. The result was that no evident reaction followed, no leucocytosis occurred, for in this observer's opinion the hemogenic tissues had been paralysed, so to speak, by the intensity

of the toxines. It must, however, be borne in mind that a temporary leucopenia may occur quite independently of cell destruction or cell production. This may be due to a temporary change in the distribution of the blood in the body, and to an accumulation of leucocytes in the vessels of the lungs or peritoneum. This fact was pointed out by Bruce, Goldscheider, and Muir, and will be again referred to later when the influence of intravenous injection of serum upon the behaviour of the leucocytes is considered. In the great majority of cases the presence or absence of a leucocytosis is satisfactorily explained by these facts, but in a few a series of blood counts may be made, which are not thus sufficiently accounted for.

It is well known that in certain diseases, such as enteric fever, early uncomplicated tubercular disease, and malaria, no increase in the number of white cells occurs; indeed an actual leucopenia may be found, whether the infection be comparatively mild or of a distinctly malignant type. It would appear, therefore, that certain infective organisms, whether virulent or otherwise, have no power of stimulating the hemogenic tissues and of

bringing about an increased production of leucocytes; in other words, they exert no positive chemiotactic influence upon the bone marrow or other blood-forming tissues.

This fact should be kept in view in considering the results of blood counts found in certain puerperal cases, for a large variety of organisms have been found in this form of sepsis. Much work has been done in the bacteriology of this subject by Krönig, Doderlein, Ahlfeld, Wedal, and others, and as an example of the results found on bacteriological examination I shall here quote Whitridge Williams, who gives details of fifty-seven cases of puerperal septicemia, observed by himself, in which cultures of the organisms were made. He found:-

Streptococci	in	14
Gonococci		2
Staphylococci		5
Bacillus Coli		1
Bacillus Typhosus		1
Bacillus Diphtheria		1
Gas producing bacilli		1
Anaerobic bacteria unidentified		6
Aerobic bacteria unidentified		3
Bacteria which did not grow in media but seen in coverslip preps.		14
Absolutely sterile		14

Such a variety of organisms found in puerperal septicemia,

taken in conjunction with the fact that organisms do not all exercise the same influence on the hemogenic tissues, make it "a priori" probable that the number and character of the leucocytes will vary, and this variation will appear further complicated when it is remembered that, in a certain proportion of septic cases, the infection is a mixed one. The organisms isolated in cases of puerperal sepsis have been found, for the most part, in cultures made from the blood, from abscesses, from the cavity of the uterus during life, or from the tissues post mortem.

Some careful observers in bacteriological investigations on the blood have found uniformly negative results, while others have found organisms in a large proportion of cases. Ewing suggests as an explanation of this that the technique of many has been unreliable, and Williams admits his results to have been different according to the method he adopted in obtaining cultures from the uterus cavity. In his earlier observations his method was to pass a pipette with great care through the cervix, but his results were more reliable in subsequent observations, in which a sterilized wire was passed into the uterine

cavity through a sterilized glass tube, previously introduced into the cervix. By this means the danger of contamination from the outer parts was greatly diminished.

Those cases where leucocytosis is absent, but where other symptoms, such as rigors and an abnormal temperature, occur shewing that the infection is an acute process, are possibly explained by the theory that a mixed infection may produce negative chemiotaxis. The explanation that such a condition is due to the virulence of the organism being so great as to cause a blood destruction, or a leucopenia by paralysing the hemogenic tissues, does not appear compatible with a patient's recovery, or even the disease being prolonged over a period of several weeks. The case of Mrs. C., No. VII illustrates this point.

This patient had repeated rigors, with typically septic temperatures, and though her illness lasted for several months, it ended in complete recovery. Leucocyte counts made from her blood while rigors were present and the temperature ran high were as low as three thousand per cb.mm.; the differential count at times shewed the reduction was relatively equal, no predominance of the

polymorphonuclear variety, such as is almost always found in septic leucocytosis, being seen. The leucopenia, however, and the presence of myelocytes pointed to a pathological condition of the blood. A culture made from the contents of a deep abscess which formed in the thigh shewed small isolated colonies on an agar medium, but these did not stain sufficiently to allow of their identification, while a subculture proved sterile, and none of the familiar streptococci or staphylococci were found.

Leucocytes have been found in practically physiological numbers shortly before death, as in one case in whom eight thousand eight hundred were found, and in a case "A. B." of very acute phlegmonous erysipelas where the leucocytes numbered nine thousand four hundred, but, on making differential counts, the polymorphonuclear variety was found in as high a percentage as 93 and 93.3 respectively. These are the more usual examples of the condition of the blood in acute septic poisoning, with little or no increase in the number of leucocytes, a condition which, if preceded by a leucocytosis at the inception of the disease, is termed a "preagonal decline".

Thus far the remarks have referred chiefly to the results found by other observers with reference to the increase or decrease in the number of the leucocytes as a whole in puerperal sepsis. But the varieties and fluctuations in their relative numbers must also be considered. If a leucocytosis is present, it is necessary to find whether the increase depends upon a "mixed leucocytosis", or whether it is due to an increased production of some single variety of white cell. If a leucopenia exists it is important to note whether it results from a relative diminution of all the varieties of white cells, or from a decrease in the number, or the complete disappearance of a single variety. We must also consider briefly the occurrence of abnormal elements in the blood stream, and the changes, if any, in the red corpuscles, and in the liquor sanguinis.

Before proceeding to discuss these details, as illustrated by the cases investigated, it will be best to give in this place a clinical sketch of the history and course of each case during the residence of the patient in hospital, along with a detailed account of the daily observations made upon the blood.

Min. Eosin.	Myels.	Red Nuc. Corp.	Remarks
None			Mild, readmitted, Phlegmasia
None			Semicoma, nephritis, mania, abscess of breast, convulsion
None			Mild
None	.3%		Thrombosis of veins
None			Thrombosis of leg veins, perimetritis
None			Pneumonia, serum intravenously
None	6%		Pneumonia, abscess of thigh, serum, rigors
None	5%		Pneumonia, fecal fistula abscess, serum
None		537	Melancholia, pus tube, cystitis, perimetritis
None			Abortion, perimetritis
40			No complications
None	.2%	62	Scarlet fever, serum intravenously
None	551		Abscess of breast, perimetritis
208			Ruptured perineum, stitches sloughed
None	160		Acute Tuberculosis
None	183	61	Peritonitis, septic pleurisy etc.
None	247	721	Hemoglobin 15%, reds 1,456,000
None	305	566	Complete rupture per., convulsion

	Case	Delivery	Admitted	Dismissed	Result	Age	Curetted	Rigors		
1	B. H.	Oct. 24	Nov. 5	Dec. 13	Well	19	Yes	One		
2	Mrs. McF.	Nov. 25	" 28	Jan. 10	Asylum	26	Yes	No		
3	L. McG.	" 28	Dec. 10	" 10	Well	18	Yes	No		
4	Mrs. R.	Dec. 8	" 16	Feb. 14	Well	39	Yes	No		
5	Mrs. H.	" 8	" 18	Jan. 28	Well	29	Yes	One		
6	A. R.	Dec. 29	Dec. 30	Feb. 14	Well	19	Yes	One		
7	Mrs. O.	" 28	Jan. 2	Apr. 26	Well	25	No	19		
8	Mrs. S.	" 19	" 9	" 14	Death	30	No	None		
9	Mrs. McA.	Jan. 10	" 16	" 25	Well	26	Yes	No		
10	Mrs. McG.	" 9	" 16	Feb. 14	Well	29	Yes	3		
11	Mrs. W.	" 12	" 21	" 14	Well	26	Yes	One		
12	Mrs. D.	" 18	" 21	" 1	Death	23	Yes	6		
13	Mrs. M.	" 17	" 22	Mar. 7	Well	20	Yes	One		
14	Mrs. D.	" 21	Feb. 2	" 18	Well	21	Yes	No		
15	Mrs. H.	" 24	" 3	Feb. 26	Death	25	Yes	One		
16	Mrs. D.	" 25	" 4	" 6	Death	22	Yes	One		
17	Mrs. M.	" 31	" 17	" 23	Death	29	Yes	2		
18	Mrs. McC.	Feb. 16	" 21	" 26	Death	30	No	No		

T A B L E O F C A S E S

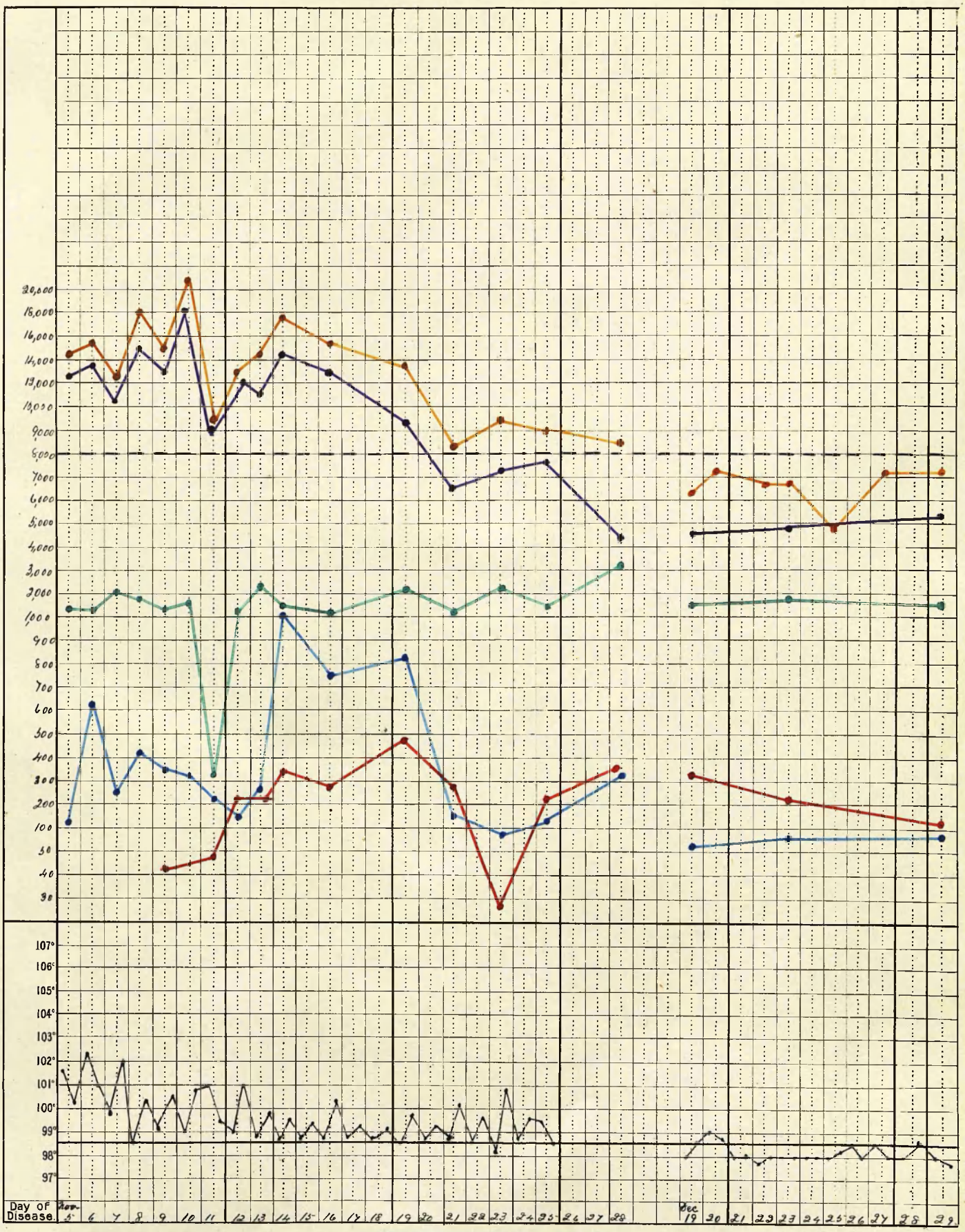
-------oOo-------

Case	Delivery	Admitted	Dismissed	Result	Age	Curetted	Rigors	Max. Temp.	Max. Wet Count	Min. Wet Count	Max. No. Polyms.	Min. Polyms.	Max. Lymphs.	Min. Lymphs.	Max. Large Mons.	Min. Large Mons.	Max. Eosin.	Min. Eosin.	Myels.	Red Nuc. Corp.	Remarks
1 B. H.	Oct. 24	Nov. 5	Dec. 13	Well	19	Yes	One	105°	20,800	4,800	18,865	4.410	3,308	316	1,085	58	488	None			Mild, readmitted, Phlegmasia
2 Mrs. McF.	Nov. 25	" 28	Jan. 10	Asylum	26	Yes	No	100.6	19,200	5,800	15,674	5,299	2,640	816	728	None	231	None			Semicoma, nephritis, mania, abscess of breast, convulsion
3 L. McC.	" 28	Dec. 10	" 10	Well	18	Yes	No	104.6	15,000	6,000	13,875	6,105	3,077	930	259	57	37	None			Mild
4 Mrs. R.	Dec. 8	" 16	Feb. 14	Well	39	Yes	No	104	23,000	8,200	19,090	5,822	3,276	1,020	1,150	57	345	None	.3%		Thrombosis of veins
5 Mrs. H.	" 8	" 18	Jan. 28	Well	29	Yes	One	103.4	14,600	4,600	12,060	4,222	2,240	776	584	124	154	None			Thrombosis of leg veins, perimetritis
6 A. R.	Dec. 29	Dec. 30	Feb. 14	Well	19	Yes	One	105.6	40,800	8,800	36,270	4,608	6,636	558	1,049	121	376	None			Pneumonia, serum intravenously
7 Mrs. C.	" 28	Jan. 2	Apr. 26	Well	25	No	19	105	22,000	3,000	17,483	2,358	2,719	421	910	198	57	None	6%		Pneumonia, abscess of thigh, serum, rigors
8 Mrs. S.	" 19	" 9	" 14	Death	30	No	None	104	39,000	5,000	37,674	3,430	2,940	675	1,287	134	100	None	5%		Pneumonia, fecal fistula abscess, serum
9 Mrs. McA.	Jan. 10	" 16	" 25	Well	26	Yes	No	105.6	18,600	3,600	13,075	4,544	4,464	547	985	270	98	None		537	Melancholia, pus tube, cystitis, perimetritis
10 Mrs. McG.	" 9	" 16	Feb. 14	Well	29	Yes	3	101.8	30,000	3,800	26,580	1,987	2,260	1,356	1,680	163	400	None			Abortion, perimetritis
11 Mrs. W.	" 12	" 21	" 14	Well	26	Yes	One	104.8	20,200	7,200	17,473	6,110	2,312	928	1,151	160	376	40			No complications
12 Mrs. D.	" 18	" 21	" 1	Death	23	Yes	6	108	31,000	5,400	29,667	4,914	372	95	930	99	264	None	.2%	62	Scarlet fever, serum intravenously
13 Mrs. M.	" 17	" 22	Mar. 7	Well	20	Yes	One	104.8	30,200	7,000	24,764	3,752	3,552	869	1,691	392	392	None	551		Abscess of breast, perimetritis
14 Mrs. D.	" 21	Feb. 2	" 18	Well	21	Yes	No	104.4	36,800	7,800	33,745	4,446	2,386	993	2,224	647	312	208			Ruptured perineum, stitches sloughed
15 Mrs. H.	" 24	" 3	Feb. 26	Death	25	Yes	One	104.4	26,800	14,600	23,664	15,834	1,044	606	1,366	522	None	None	160		Acute Tuberculosis
16 Mrs. D.	" 25	" 4	" 6	Death	22	Yes	One	106	61,000 ½ hour before death	38,600	58,743	36,129	915	694	1,312	99	None	None	183	61	Peritonitis, septic pleurisy etc.
17 Mrs. M.	" 31	" 17	" 23	Death	29	Yes	2	106.4	20,600	5,800	15,553	4,790	2,925	788	1,071	17	None	None	247	721	Hemoglobin 15%, reds 1,456,000
18 Mrs. McC.	Feb. 16	" 21	" 26	Death	30	No	No	104.8	25,600	11,800	19,532	9,947	2,816	1,451	1,689	389	None	None	305	566	Complete rupture per., convulsion

CASE NO. I. B. H., Aet. 19 years.

Date	Wet Count	Polyms. %	Absolute Number	Lymphs. %	Absolute Number	Large Mons. %	Absolute Number	Eosin. %	Absolute Number
Nov. 5	14,400	86.7	12,484	12.4	1,785	.8	115		
6	15,000	87.5	13,125	8.2	1,230	4.1	615		
7	12,600	81.7	10,294	15.9	2,003	2.3	289		
8	18,000	86.7	15,606	10.8	1,944	2.3	414		
9	15,000	86.9	13,035	10.1	1,515	2.5	375	.3	45
10	20,800	90.7	18,865	7.7	1,601	1.6	332		
11	9,600	93.8	9,004	3.3	316	2.2	211	.5	48
12	13,600	88.7	12,063	8.7	1,183	.9	122	1.5	204
13	14,200	80.4	11,416	1.5	2,130	2.7	283	1.7	241
14	17,800	82.4	14,667	9.5	1,691	6.1	1,085	1.8	320
16	15,600	85.1	13,275	8.3	1,294	4.9	764	1.6	249
19	13,200	71.9	9,490	17.9	2,362	6.3	831	3.7	488
21	8,400	80	6,720	14.7	1,234	2	168	3.1	260
23	9,800	73.3	7,183	25.6	2,508	.6	58	.3	29
25	9,200	79.5	7,314	16.1	1,481	1.7	156	2.4	220
28	8,400	52.5	4.410	39.3	3,301	3.9	327	3.7	310
Dec. 13	Dismissed								
19	Readmitted suffering from Phlegmasia alba dolens								
19	6,600	69	4,554	24.5	1,617	.9	59	5.4	356
20	7,400								
22	6,800								
23	6,800	67	4,556	29	1,972	1	68	3	204
25	4,800								
27	7,200								
29	7,200	72	5,184	25	1,800	1	72	2	144

CASE I


20,000
18,000
16,000
14,000
13,000
12,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
50
40
30
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Nov. 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
Dec. 19 30 21 23 23 24 25 26 27 28 29
Total number in blood-counts
Absol. number of Polymorphs
Absol. number of Lymphocytes
Absol. number of Mononuclears
Absol. number of Eosinophiles

CASE I, B. H., Aet. 19 years.

Admitted 5th November 1902 with the following history from the Maternity Hospital:- primipara, delivered on 24th October, vertex presentation, labour natural, but some doubt entertained whether or no a portion of the membranes had been retained.

On 29th October the temperature rose to 102°.4 and the pulse to 108 in the minute, and the lochial discharge became "heavy".

On 30th October her temperature was normal on the morning, but in the evening a rigor occurred, and the temperature rose to 105°. An intrauterine douche was given, when a small portion of chorion came away. She was allowed up on 4th November, but, on the following day, her temperature again rose to 103°.

On admission to the puerperal ward her temperature registered 101°.4. She was a well nourished woman, the tongue fairly clean, and she did not appear acutely ill. The pulse numbered 100 in the minute, was regular, but

easily compressible.

Examination of the chest negative.

There was no tenderness on palpating the abdomen, and the fundus uteri could not be felt above the pubis.

On vaginal examination the body of the uterus found freely moveable, the os patulous admitting the tip of a finger. Nothing abnormal in the region of the broad ligaments. The uterine sound passed $4\frac{1}{4}$".

The cavity of the uterus was curetted, and a small quantity of membrane and debris removed.

Quin. sulph. grs. V given 4 hourly, and a daily intrauterine douche of lysol 30 m. to Oi, while a vaginal douche was given thrice daily.

By 10th November lochial discharge ceased, and she appeared practically well, though temperature continued to oscillate between 98°6 and 101° until 25th November, and she was dismissed on 13th December.

This case was one of mild infection throughout, and presented moderate leucocytosis. Anemia was never a prominent symptom. The increase in the number of leucocytes depended almost entirely upon an increase of the poly-

morphonuclear cells, although for the first few days in counts of over 500 no eosinophiles were found. The increase in the number of neutrophile cells was at the expense of the mononuclear variety, especially the small lymphocytes, but as the number of leucocytes decreased towards the normal limit, these latter increased absolutely and relatively in number.

The temperature and leucocytosis curves appear to correspond to a certain degree, though the correspondence was not a marked one. The maximum estimate of 20,800 on 10th November was not accompanied by any increase of fever, nor did the pulse on that day rise above 98 in the minute, and there was nothing clinically to account for the increased leucocytosis.

The number of large mononuclear cells was found to vary considerably, both absolutely and in relation to other varieties of cells. This is partly explained by the difficulty at times in differentiating certain large cells from the smaller lymphocytes or from transitional forms, but, allowing for this, it is difficult to arrive at a satisfactory conclusion as to the significance of

fluctuation in the number of this variety of cell. As the patient approached convalescence the eosinophile cells were constantly found.

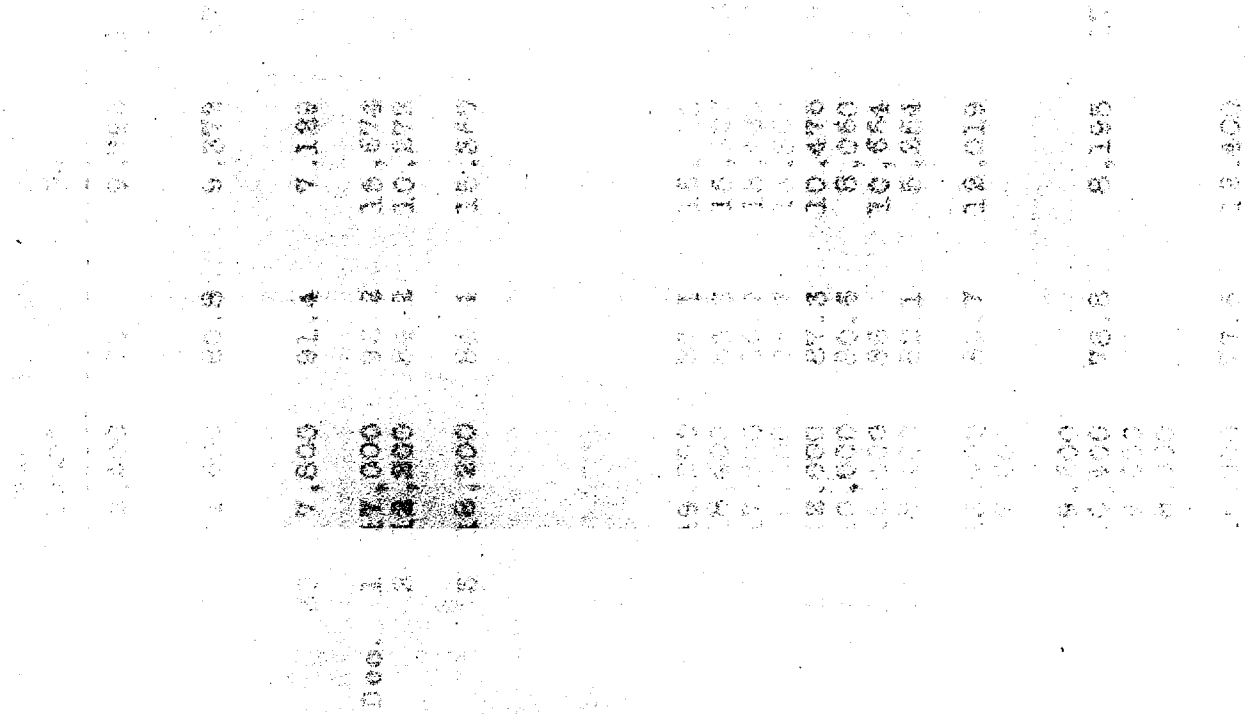
On 19th December she was readmitted (with marked swelling of the left leg), having in the meantime been on duty in the hospital as a ward maid. This was first noticed by the patient about the calf of the leg, but on admission it extended from the foot as high as Poupart's ligament. There was little or no pain along the course of the veins, and she otherwise felt well. A calico bandage was firmly applied, and the leg elevated.

By 21st December the swelling had markedly decreased. There was no pain, and no rise in temperature. There was, however, a painful swelling on the inner side of right knee, apparently thrombosed veins.

The condition rapidly improved, and she was allowed up on the 31st December, and dismissed on 10th January.

The true explanation of this condition was somewhat uncertain, as it might have resulted from either an extension of the septic infection from the uterus, or simply coagulation of the blood in the vessel favoured by

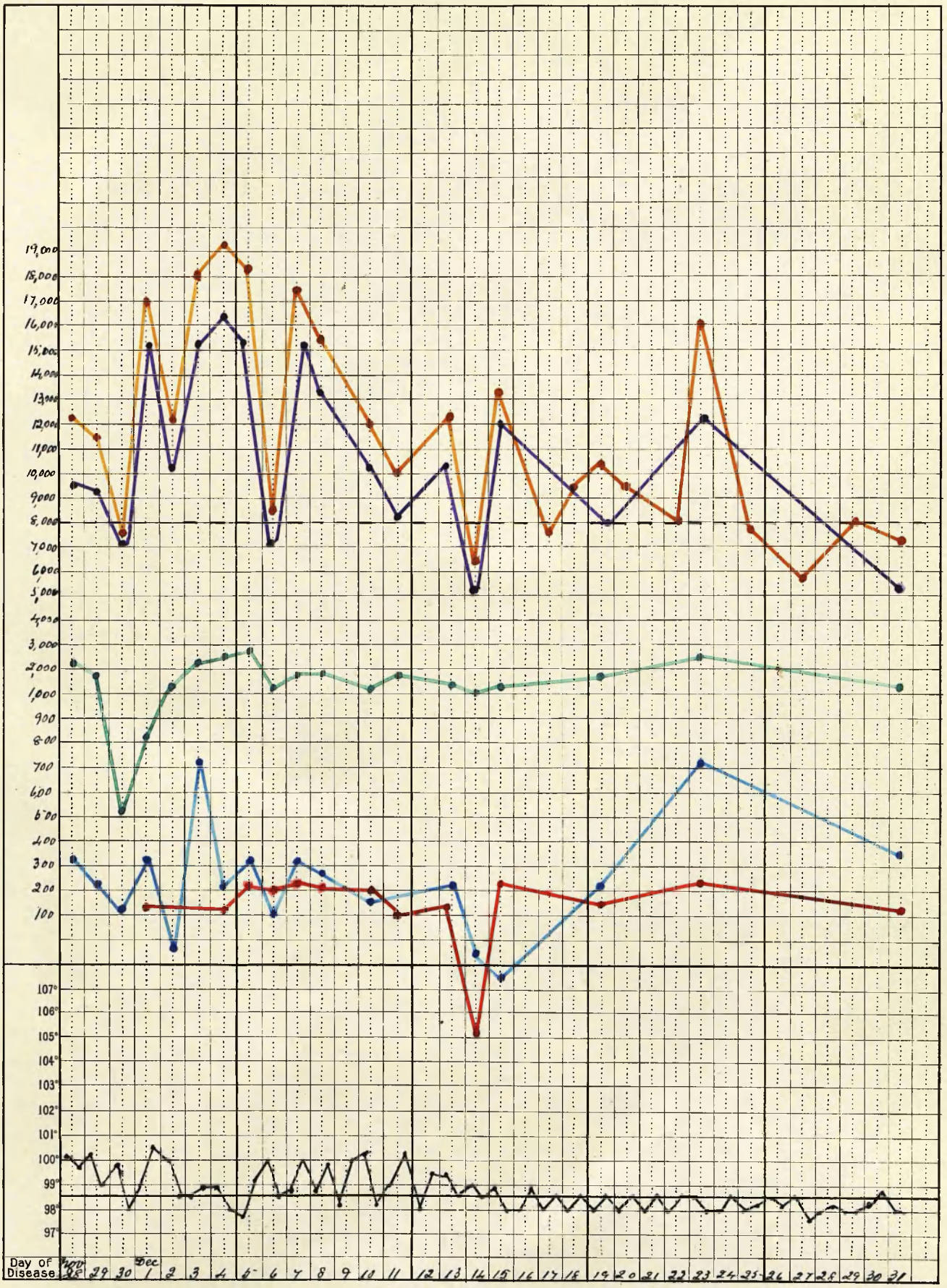
the general condition of the patient. In this case, therefore, a careful examination of the blood promised results of unusual interest, for while a leucocytosis might have been expected in a case of septic infection, its absence where the thrombosis was not of septic origin would appear probable. The latter theory was largely verified, for the blood condition proved to be practically normal, the only note-worthy feature being an increase in the eosinophiles, which shewed a steady decline in numbers during convalescence. The temperature remained normal throughout.



CASE NO. II. Mrs. McF., Aet. 26.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Max. Temp.	Remarks
Nov. 28	12,400	79	9,796	18	2,232	3	372			100.4°	Curetted, albuminuria, comatose
29	11,600	80.8	9,372	17.1	1,983	2	232			100.2	Croton oil mii and saline infusion
30	7,800	91.4	7,129	7.1	553	1.4	109			99.8	Strychnine gr. 1/15 hypoderm.
Dec. 1	17,000	92.2	15,674	4.8	816	1.9	323	.9	153	100.6	
2	12,200	84.2	10,272	14.9	1,817	.7	85			100	Strchnine gr. 1/15 hypoderm.
3	18,200	84.4	15,360	11.4	2,074	4	728			99.8	Strychnine gr. 1/15 hypoderm., jalap and calomel, semi-comatose, clonic spasm of left forearm
4	19,200	87.1	16,723	10.9	2,092	1.1	211	.7	134	98.8	
5	18,400	83.3	15,327	13.6	2,502	1.8	331	1.2	220	99.2	
7	17,800	86.7	15,429	10	1,780	1.9	338	1.3	231	100	
8	15,600	85.7	13,369	10.9	1,700	1.9	296	1.4	218	99.8	
10	12,000	87.3	10,476	9.7	1,164	1.2	144	1.6	192	99.2	
11	10,000	80.6	8,060	18.3	1.830			1	100	100.2	
13	12,400	86	10,664	10.9	1,351	1.7	210	1.2	148	99.4	
14	6,400	82.1	5,254	16	1,024	1.3	83	.4	25	99	Screaming and very restless
15	13,400	89.7	12,019	7.9	1,058	.5	67	1.7	227	98.4	
17	7,600									98.4	Small abscess in left breast
18	9,600									98.4	
19	10,400	78.8	8,195	17.1	1,778	2.3	239	1.5	156	98.4	
20	9,600									98.4	
22	8,000									98.4	Shouting. laughing and crying
23	16,000	77.5	12,400	16.5	2,640	4.5	720	1.5	240	98.4	Extremely noisy
25	7,800									98.2	
27	5,800									98.4	
29	8,000									98	Shouting and singing, incontinence
31	7,200	73.6	5,299	19.3	1,389	5.3	381	1.6	115	98.4	Extremely noisy
Jan. 10											Dementia, removed to asylum

CASE II


19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
Nov 28 29 30
Dec 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Total number in Wet counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears
Absol. number of Eosinophiles

CASE II, Mrs. McF., Aet. 26 years.

Admitted 28th November 1902 in a semicomatose condition, but the following indefinite history was obtained by the nurse from her friends. She had been delivered of a female child on 15th November. A midwife was in attendance. There was no history of any abnormality, and the after birth, as far as was known, had been expelled entire. The lochial discharge from the first had been scanty, and ceased on 24th November, when she became acutely ill, and apparently delirious. Her previous two labours were normal, and there was no history of former ill health.

When first seen she appeared almost unconscious, and lay with open eyes and a vacant expression. There was no muscular rigidity. The pupils were equal and moderately contracted. Conjunctival reflex was only partially present. The tongue was dry, and the teeth loose. The skin had a somewhat sallow tint, and was dry to the touch.

The pulse numbered 80 in the minute, was regular,

but easily compressible.

The respirations numbered 24 in the minute, and tended to be irregular, though not definitely Cheyne-Stokes in character. The temperature was 100°.4.

Examination of the chest was negative, except that the second heart sound appeared somewhat accentuated.

The abdomen was not distended, and was painless on palpation. Liver and spleen were not apparently enlarged.

The fundus uteri could not be felt above the pubis.

Urine - catheter specimen - was found to contain distinct albumen (.25 Esbachs), acid, S.G. 1,025.

With freshly made Fehling's solution a reaction extremely suggestive of presence of sugar occurred a few seconds after boiling.

Fermentation test, however, made later was negative.

The deposit contained amorphous urates, and hyaline and granular tube casts in fair number.

Owing to her condition no further physical examination was made. Whisky was administered per rectum, and 1/15 gr. strychnine hypodermically.

29th November. Uterus, per vaginam, apparently in-

voluted satisfactorily, freely moveable, os patulous but scarcely admitting a finger. Little or no foetid odour, and nothing abnormal made out in region of broad ligaments. Leucocyte count 11,600.

Cavity curetted. A small amount of membrane brought away along with some debris and bloodclot about size of a walnut. Temperature 100° Pulse 102. Respirations 24. Still unconscious. Urine ozXX by catheter, besides some passed at time of enema. In the evening ozXXVIII of saline fluid were injected under the breasts, and croton oil mi followed by another mi 1½ hours later were administered.

30th November. Patient still unconscious. Bowels moved freely (6), at first constipated, and later fluid in character. Leucocyte count 7,800.

1st December. Pulse feeble, and breathing Cheyne-Stokes in character. Slight internal strabismus. Leucocyte count 17,000.

3rd December. Still unconscious, though she could be got to swallow fluid nourishment. Clonic spasm of right forearm lasting for an hour.

5th December. Strabismus no longer evident, and conjunctival reflex is more active. Leucocyte count 18,400.

6th December. Repeated the word "father" several times, and appeared to recognise her relations, the sight of whom made her cry.

7th December. Respirations irregular in rhythm, varying in number from 9 to over 20 in the minute. Leucocyte count 17,800.

8th December. General convulsive movements occurred during the night, and attempted to get out of bed. Leucocyte count 15,600.

10th December. Answered some questions intelligently, and cried a good deal, wiping her eyes with her handkerchief, but refuses to put out her tongue. No evidence of paralysis. Leucocyte count 12,000.

13th December. When left to herself commences to sob violently. Leucocyte count 12,400. Slight albuminuria and hyaline tube casts still present in fair number.

14th December. Screaming and restless, and apparently unable to understand what is said to her. Leucocyte count 6,400.

17th December. Small abscess in left breast found. Apparently no subjective symptoms. Temperature normal. Leucocyte count 7,600. Abscess incised and ℥III pus evacuated. Operation apparently caused little pain even though a finger was introduced into the cavity, and no anesthetic was used.

18th December. Leucocyte count 9,600.

19th December. Leucocyte count 10,400.

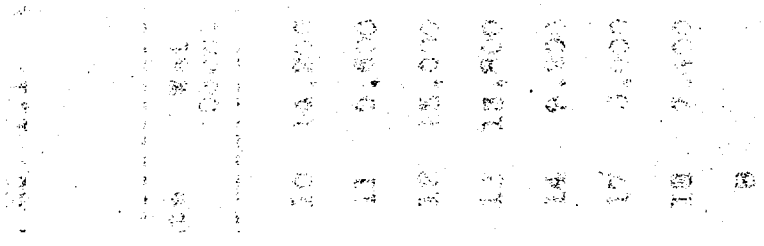
From this date to the beginning of January she was at varying intervals exceedingly noisy, screaming, laughing and singing.

During her last week in hospital the condition of melancholia became more evident, and on 10th January, having been certified as "of unsound mind", she was removed to an asylum.

Considerable difficulty was felt in arriving at a definite diagnosis of this patient's condition on her admission to hospital, but the unconsciousness at the outset, which lasted for nearly a week, and the subsequent course of the case, would at least suggest thrombosis of some of the cerebral vessels possibly preceded by embolism.

It is of interest to note that a leucocytosis when present was never of high degree. In this respect the case may be compared with that of Mrs. Mc A. in whom puerperal melancholia also occurred. The leucocyte count remaining practically normal while well marked symptoms of melancholia exist is a result which agrees with the observations of others. Somers (Am. Journ. of Insan., 1892, Vol. 49) gives leucocyte counts of nineteen cases of melancholia, and found they averaged 7,947 per cb.mm.

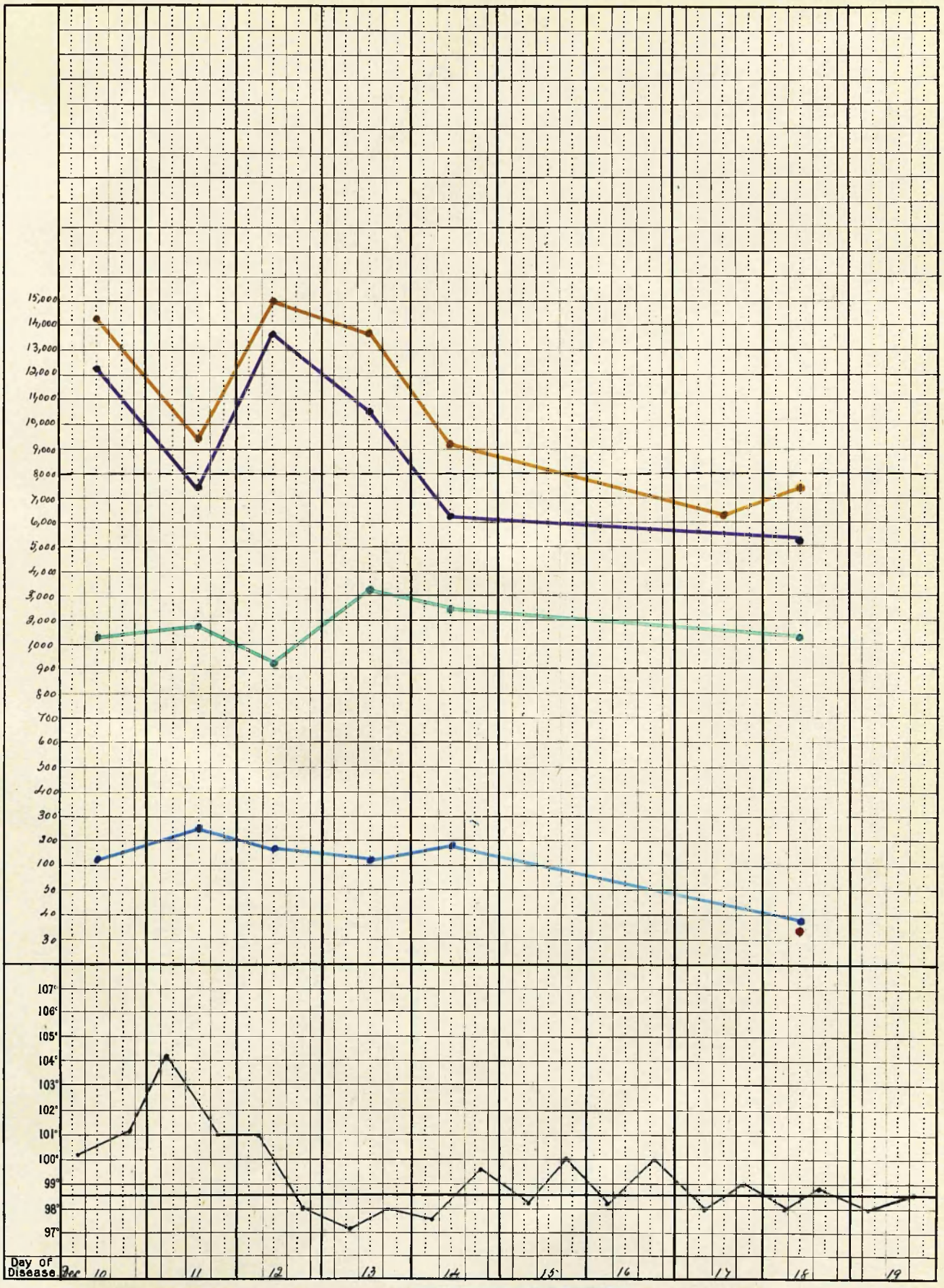
In the case under discussion even when a definite septic focus existed in the breast there was no rise of temperature, and little or no increase in the number of white cells. This abscess formation without rise of temperature has also been noted at times in postscarlatinal adenitis.



CASE NO. III. L. McC., Aet. 18 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	L. M. %	Abs. No.	Eosins. %	Abs. No.	Red Count
Dec. 10	14,200	86.8	12,325	12.4	1,760	.8	113			
11	9,600	80.2	7,699	17	1,632	2.7	259			
12	15,000	92.5	13,875	6.2	930	1.2	180			2,681,600
13	13,800	76.6	10,570	22.3	3,077	1	138			
14	9,200	69.6	6,403	28.2	2,594	2	184			
17	6,000									
18	7,400	82.5	6,105	16.5	1,221	.5	57	.5	37	
Jan. 8										3,690,666

CASE III


15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1000
900
800
700
600
500
400
300
200
100
50
40
30
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
Dec 10
11
12
13
14
15
16
17
18
19
Total number in wet counts
Absol. number of Poly morphs.
Absol. number of Ly mphocytes
Absol. number of L. mononuclears
Absol. number of Eosinophiles

CASE III, L. McC., Aet. 18 years.

Was admitted 10th December, 1903. She was confined a fortnight before admission, a midwife attending. Labour was considered normal, though the patient thought she had lost a good deal of blood at the time.

She appeared fairly well nourished, but pale. The tongue was furred and rather dry. The pulse numbered 100 in the minute, but was regular and of fairly good quality. Examination of chest was negative.

On palpation of the abdomen the fundus uteri was found about 3" above the level of the pubes, and there was slight tenderness in the iliac region on both sides.

The body of the uterus was freely moveable on vaginal examination. The os uteri was patulous, admitting a finger. There was no resistance, and little or no tenderness in the region of the broad ligaments. The cavity of the uterus contained some debris in small quantity, and this was removed with a flushing curette. There was no foetor.

The temperature rose to 104°2 on the following even-

ing, and she became so excitable 1/6 gr. morphine was injected hypodermically.

On the third day after admission her temperature had fallen to normal, and it never again rose above 100º She continued well until dismissal.

This case was an extremely mild type of puerperal fever, as evidenced both from the condition of the patient herself and from the fact that the leucocytosis was throughout a moderate one, though the percentage of polymorphonuclears rose as high as 92. There was here apparently no relation between the leucocyte and temperature curves, for a sudden drop in the number of leucocytes occurred on the second day when the fever was highest. The administration of quinine salicylate appeared to have no influence upon the leucocytes, for it was administered 4 hourly in 5 grain doses on 11th December, stopped on 14th December, recommenced on 16th December, and again stopped on the 18th. This remittent administration was due to the discomfort in the ears caused by the drug. On the first occasion of its administration a slight increase in white cells was noted, viz., 15,000 and 13,800, while dur-

ing the second period of administration of the drug the estimate of leucocytes was practically normal.

The absence of eosinophiles in a mild case is a noticeable feature, but these appeared on the eighth day after admission.

The infective organism was apparently one of low virulence, possibly saphrophytic in habit. This would account for the rapid fall of the temperature, though by no means a certain sign, for Williams states he has had cases which had no fever, and yet he was able to isolate virulent cultures of streptococci from the uterine cavity.

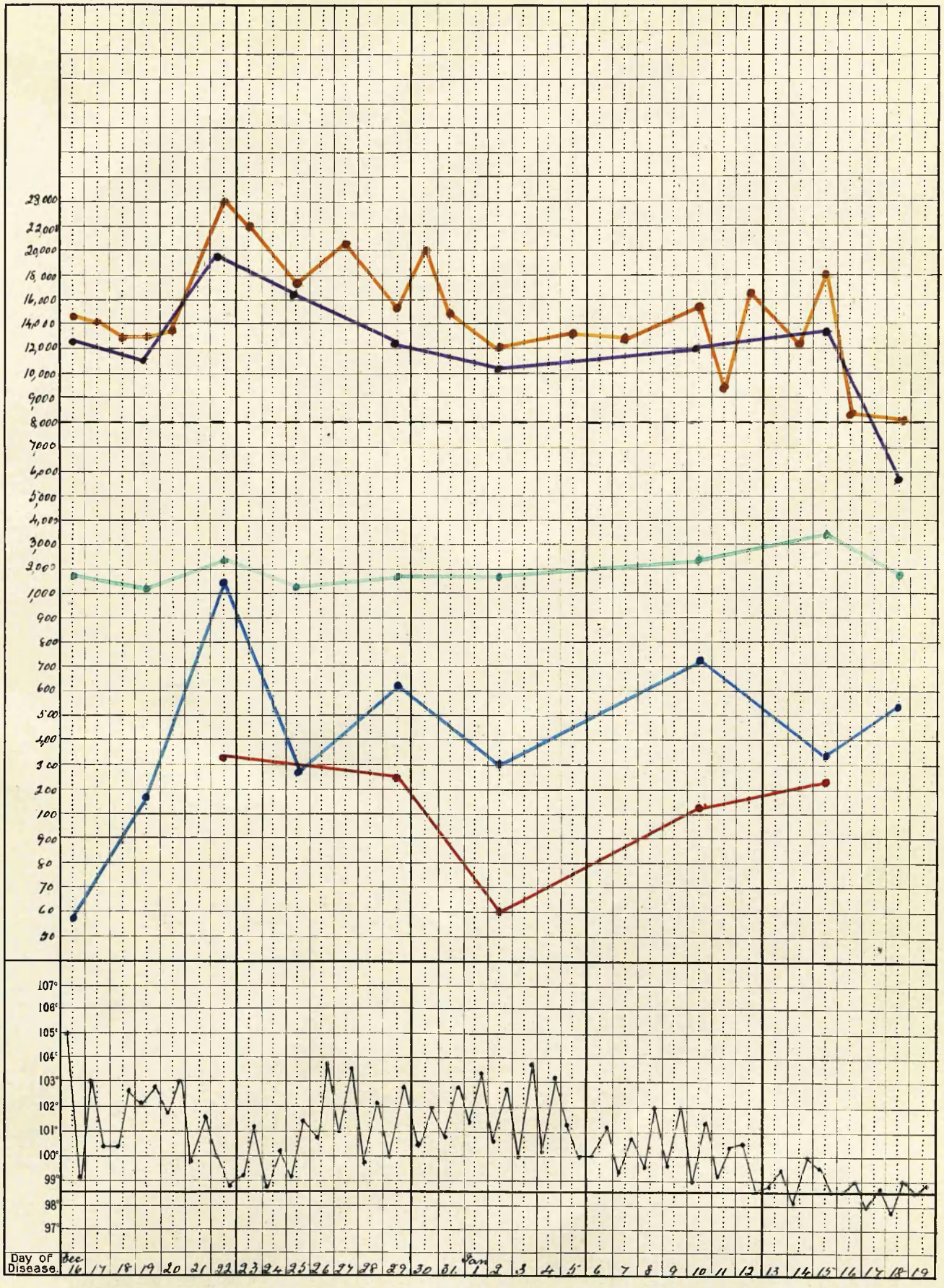
The anemia was well marked, but there was satisfactory improvement before dismissal, for the red cells increased from 2,680,000 on 13th December to 3,690,000 on 8th January.

She was dismissed on 10th January.

CASE NO. IV. Mrs. R., Aet. 39 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	L. M. %	Abs. No.	Eosin. %	Abs. No.	
Dec. 16	14,400	87.5	12,490	12	1,728	.4	57			Curetted, temp. 105°. rigor 15 m.
17	14,200									
18	12,600									Foetid lochia
19	12,600	89.7	11,302	8.7	1,096	1.5	189			
20	13,800									
22	23,000	83	19,090	10.5	2,415	5	1,150	1.5	345	Pain in thigh
23	22,000									Lochia sweet
25	17,600	92.4	16,262	5.8	1,020	1.7	299			
27	20,800									Thrombosis of veins of left thigh
29	15,000	81.8	12,270	12.1	1,815	4.3	645	1.5	225	
30	20,000									Pain in right leg, thrombosis of veins
31	15,200									
Jan. 2	12,000	84	10,080	12	1,920	2.5	300	.5	60	
5	13,500									
7	13,000									
10	15,800	76.3	12,055	17.3	2,733	5	740	1	158	1 Myelocyte in 300
11	9,600									Pain in left groin
12	16,600									
14	12,400									
15	18,200	78.6	13,305	18	3,276	2	364	1.3	236	
16	8,400									
18	8,200	71	5,822	22.3	1,828	6.6	541			No complaint, 1 myelocyte in 300

CASE IV


23,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
9000
8,000
7000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Dec 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Jan 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

CASE IV, Mrs. R., Aet. 39 years.

Was admitted on 16th December, 1902.

She had been confined on 8th December. Presentation normal. Labour lasted from 7 a.m. to 12 noon, and appeared normal, no examination being considered necessary by the medical man attending.

Lochial discharge became foetid on the fourth day of puerperium, and ceased on the day previous to admission. Douches of Hydrarg. Perchlor. had been given daily since 12th December.

Previous history. She had had three miscarriages during the last four years - the first two at the 6th month, and the last at the 3rd month 11 months ago.

She appeared a well nourished woman of fairly good colour. The face flushed, the eyes bright, pupils moderately contracted, and the tongue furred and rather dry. Temperature on admission was 101º

The pulse numbered 96 in the minute, was regular, and of fairly good quality. Respirations numbered 20 in the minute.

Examination of the chest was negative.

There was some rigidity of the abdominal muscles, and slight pain in both iliac regions.

On vaginal examination there was a superficial tear of the posterior vaginal wall.

The os was patulous. The uterine cavity measured 4", and contained little debris. The endometrium appeared thickened and rough, but nothing definitely abnormal was made out in the region of the broad ligaments.

The cavity was curetted, and douched with creolin lotion, after which the temperature rose from 103°.8 to 105°., and a rigor lasting 15 minutes occurred.

Treatment - daily douching, stimulant and strychnine, and quinine salicylate, grs. V, 4 hourly.

Her fever ran a moderate course, oscillating between normal and 103°.8 until 15th January. For several days there was marked foetor of the lochial discharge.

Thrombosis occurred in the veins of both legs, but was more marked in the left. This was accompanied by pain, and the temperature continued to be erratic. Here the thigh was affected before the leg, and there was an

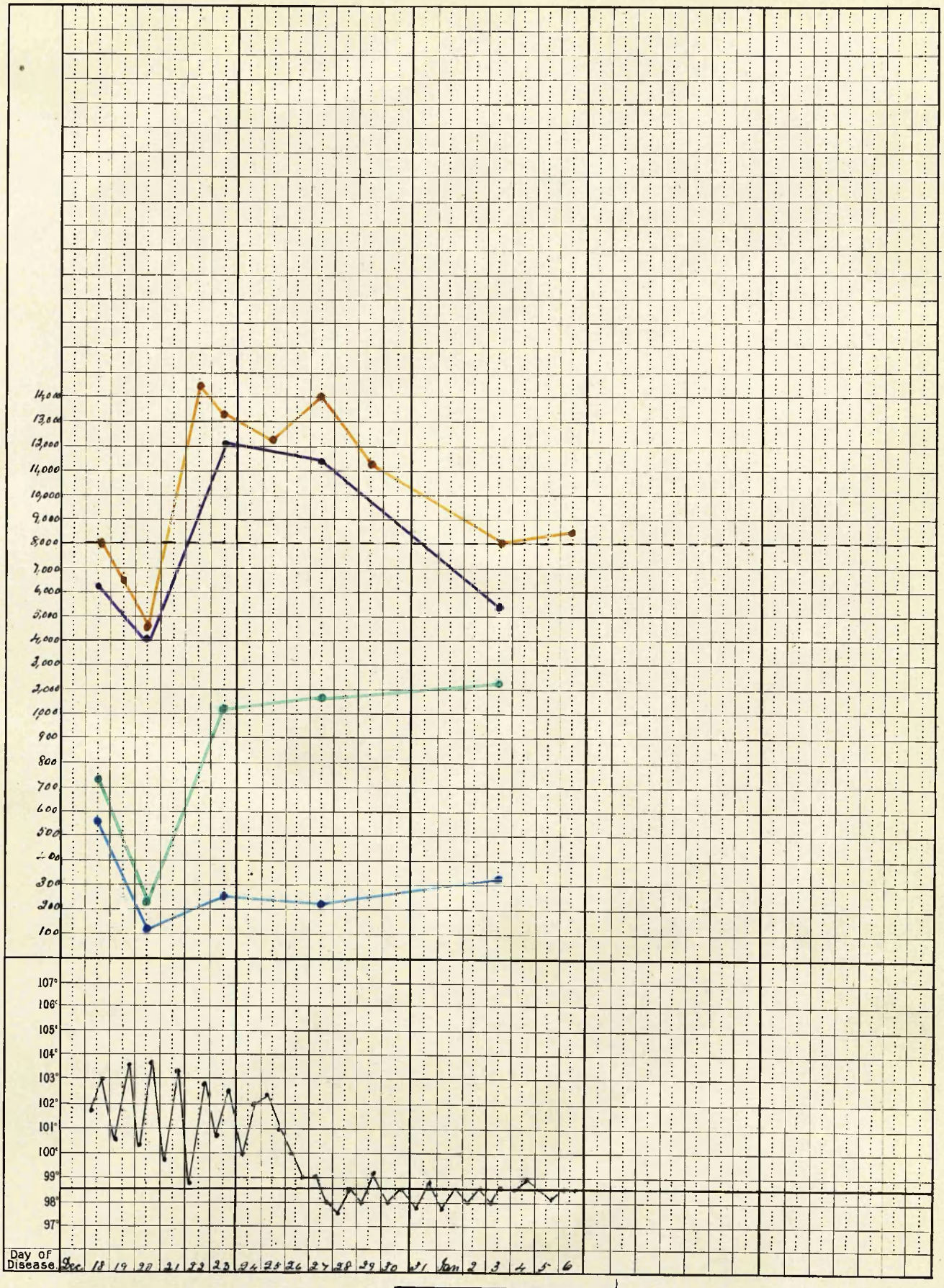
accompanying increase in the number of the leucocytes due to a rise in the polymorphonuclear cells. This condition therefore differs from that in Case I, B. H., and appears to depend upon the septic infection.

The patient was dismissed on 14th February.

CASE NO. V. Mrs. H., Aet. 29 years.

Date	Total Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.
Dec. 18	8,000	82.9	6,632	9.7	776	7.3	594		
19	6,800								
20	4,600	91.8	4,222	5.4	248	2.7	124		
22	14,600								
23	13,400	90	12,060	8	1,072	2	268		
25	12,400								
27	14,000	83.9	11,746	13.2	1,848	1.7	228	1.1	154
29	11,400								
Jan. 3	8,000	68	5,440	28	2,240	4	320		
6	8,800								

CASE V


14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Dec 18 19 20 21 22 23 24 25 26 27 28 29 30 31 Jan 2 3 4 5 6
Total number in Wet Counts
Absol: number of Polymorphs
Absol: number of Lymphocytes
Absol: number of Mononuclears.

CASE V, Mrs. H., Aet. 29 years.

Admitted 18th December, 1902; dismissed 28th January, 1903.

Delivered of a healthy male child 10 days previous to admission, when a midwife was in attendance. Labour lasted three hours. The patient was seized with a rigor eight days later, and the lochial discharge disappeared on the day before admission. Medical advice was sought on the 17th, when the temperature was found to be 103°. She was sent, therefore, into hospital. On admission her temperature was 101°6, the face was flushed, the pulse regular, but easily compressible, numbering 106 in the minute.

An examination of chest was negative.

The abdomen was slightly distended, and rigidity of the abdominal muscles prevented a thorough examination. Pressure in right iliac region caused some pain. Well marked varicosity of the veins of the left leg was present. On pelvic examination the os uteri was found patulous, and the body of the organ moveable, but its cavity

contained a considerable quantity of decomposing placental tissue and membrane.

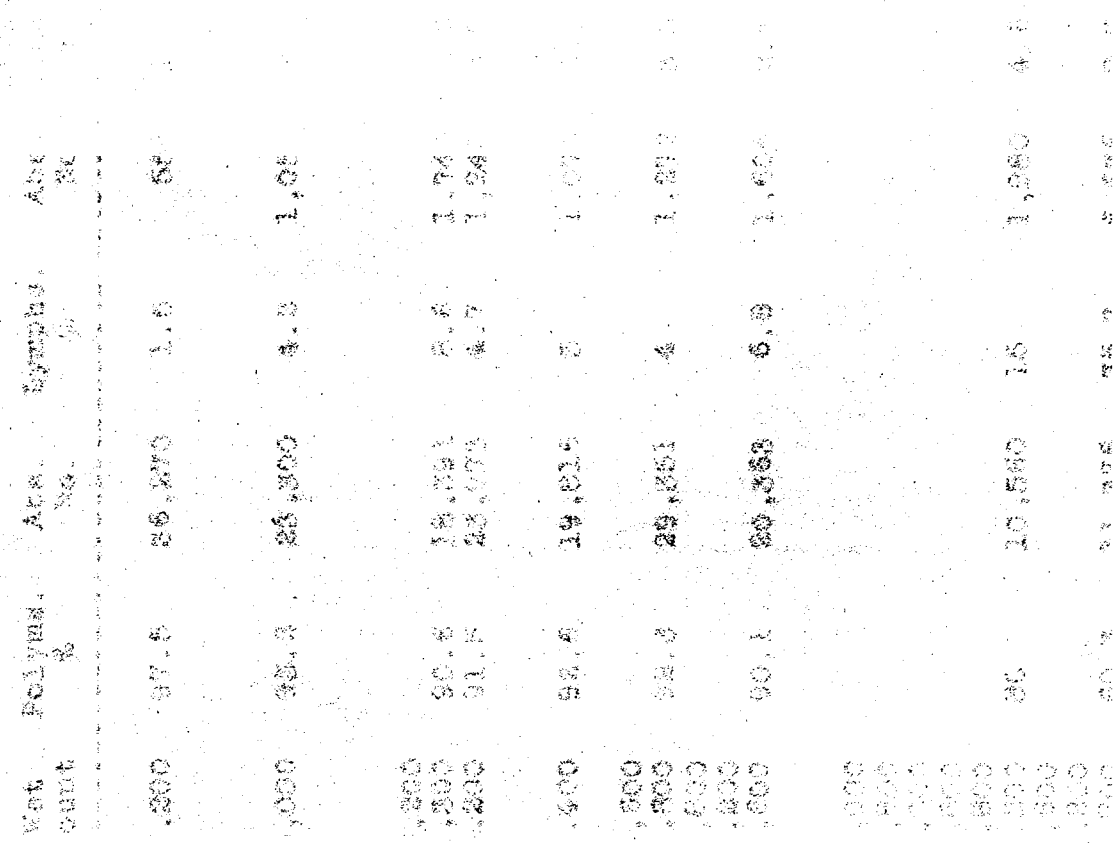
There was also a swelling smaller than a walnut in size in the region of the right lateral fornix, which was doughy in consistence, but neither painful on pressure nor easily moveable.

Cavity of uterus cleared out with flushing curette and creolin douche. The temperature continued to oscillate between the normal and 103°.4 until 27th December, when it remained normal.

The leucocytosis never reached a high degree, the maximum being 14,600 on 22nd December, and by 3rd January the number of leucocytes was practically normal. Considering the erratic temperature, the induration, and gradual fixation which occurred about the uterus, and the breaking down of some of the varicose veins of the leg, this moderate increase in the number of white cells is worthy of note. It will be seen, however, that though the total number of leucocytes was low, the polymorphonuclear cells on several days were relatively numerous, e.g., 20th December the leucocytes numbered 4,600, while

91.8% of these were polynuclear neutrophiles. This is possibly explained by the variety of the infective organism present, and the action of its toxines upon the hemogenic tissues.

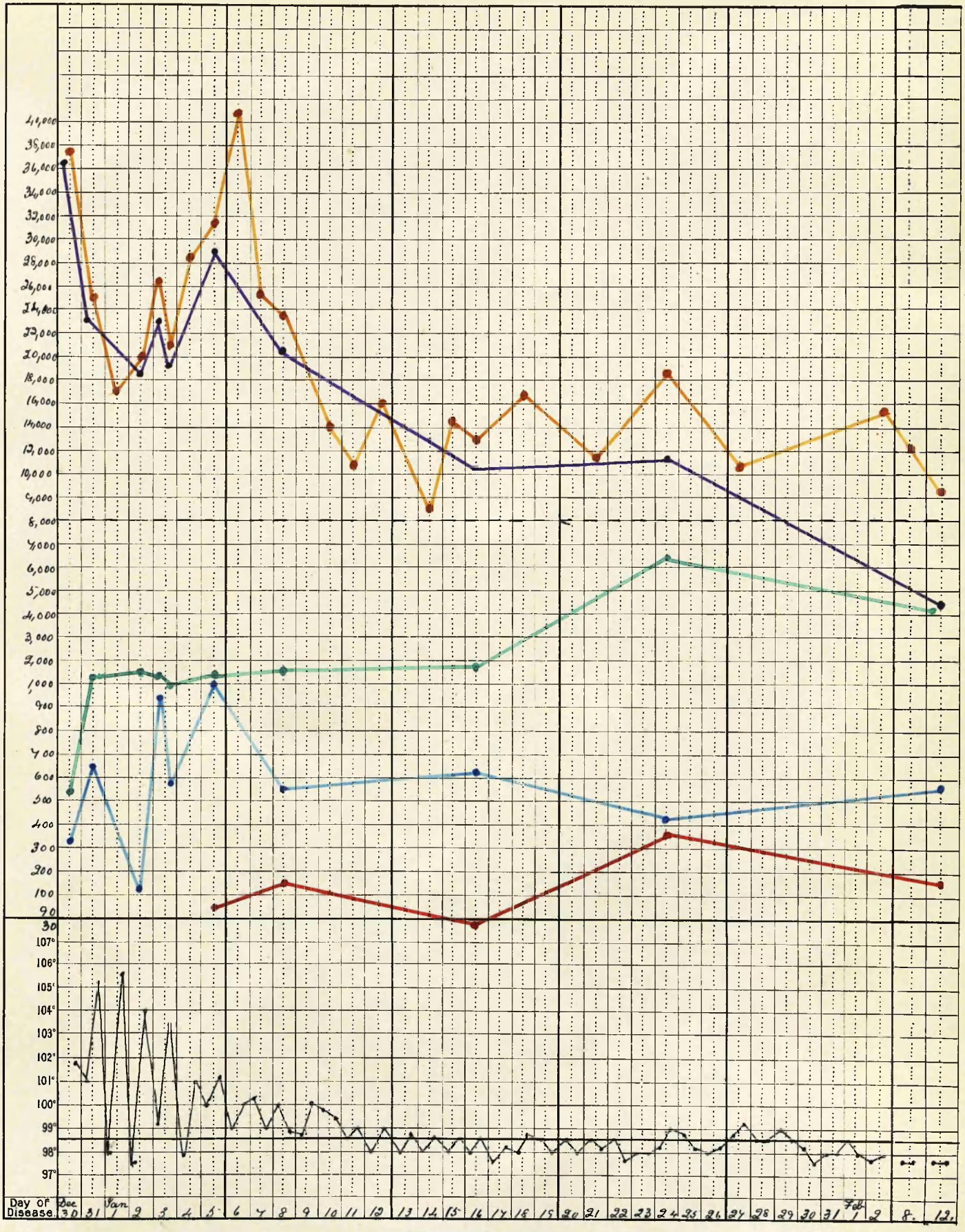
The patient made a satisfactory recovery, and was dismissed on 28th January, 1903.



CASE NO. VI. A. R., Aet. 19 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Max. Temp.	
Dec. 30	37,200	97.5	36,270	1.5	558	1	372			101°	Curetted, chloroform and douching, pneumonia, saline infusion
31	25,000	93.2	23,300	4.2	1,050	2.5	625			105.2	Quin. salicyl. gr. V 4 hourly, antistrept. serum subcutaneously
Jan. 1	17,200									105.6	Rigor
2	20,300	90.6	18,391	8.6	1,745	.6	121			104	
3	26,200	91.5	23,973	4.7	1,243	3.7	969			103.4	Antistrept. Serum 10 c.c.s. intravenously 3.45 p.m.
(4 p.m.)											
3	21.400	92.6	19,816	5	1,070	2.3	592				
(9.45 p.m.)											
4	28,600									101	Ichthyol pessaries
5	31,800	92.3	29,351	4	1,272	3.3	1,049	.3	95	101.2	
6	40,800									101	
7	25,200									100.4	
8	23,600	90.1	20,363	6.8	1,604	2.4	566	.6	141	100	Crepitations no longer audible at right base
10	14,000									99.8	
11	11,800									99.4	
12	16,000									99	
14	8,800									98	
15	14,800									98.4	
16	13,200	80	10,560	15	1,980	4.6	607	.3	39	98.4	
18	16,600									98.6	
21	11,200									98.4	
24	18,800	60.3	11,336	35.3	6,636	2.3	432	2	376	98.6	Allowed up
27	11,800									99.2	
Feb. 2	15,400									98	
8	12,200									97.8	
12	9,600	48	4,608	44.3	4,252	6	576	1.6	153	97.8	
14	Dismissed									97.6	

CASE VI


Day of Disease.
Dec 30 31 Jan 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 Feb 1 2 8. 12.
Total number in wet counts
absol. number of Polymorphs
Absol. number of Lymphocytes
Absol. number of L. Mononuclears
Absol. number of Eosinophiles

CASE VI, A. R., Aet. 19 years.

Admitted 30th December, 1902; dismissed 14th February, 1903.

Owing to her condition she was unable to give any history of her illness, but it was said that she gave birth to a child on the previous day at 6.30 p.m., though she had continued at her work until 4 p.m. on the same day.

The temperature was 101°.8. She was very pallid, and looked extremely ill. The pupils were dilated, the tongue dry and furred. The pulse numbered 152 in the minute, was regular, but small and easily compressible. Respirations numbered 36 in the minute. She had the appearance of having lost a large quantity of blood. The chest in front was negative to examination, but on percussion over the back there was decided dulness over the lower lobe of the right lung. Fine crepitation was audible on auscultation over this area, but the breath sounds were not tubular in character, and there was little, if any, decrease in the intensity of the respiratory murmur.

There was considerable tenderness on palpating the abdomen, and the fundus of the uterus could be felt almost on a level with the umbilicus.

Owing to her highly excitable condition it was found impossible to make a thorough examination without an anesthetic, and therefore chloroform was administered. The os uteri was dilated, and the cavity was found filled with foetid blood clot and a small amount of membrane and debris.

As much as possible was removed with the fingers, and the cavity was then curetted and douched with lysol lotion. A pint of saline fluid was then injected under the left breast, and two hours later her pulse had fallen to 124 in the minute, and the temperature to 101°.

On the following day, 31st December, 10 c.cs. antestreptococcic serum (Parke, Davis & Co.) was injected subcutaneously into the abdominal wall, and on the morning of January 1st the temperature fell to 98°, while the pulse and respiration numbered 100 and 28 respectively. In the evening, however, the temperature again rose to 105°6 when a rigor occurred.

On 3rd January, owing to the erratic temperature and

the apparent improvement derived from the first injection, 10 c.cs. antistreptococcic serum were again injected, but on this occasion directly into the median cephalic vein.

On the following day the temperature remained normal from 6 a.m. to 6 p.m., at which hour was registered the lowest evening temperature since admission, but it again rose to 101°2 on the following day, 5th January. From that date, however, it steadily fell, and became practically normal on 11th January, remaining so until dismissal on 12th February.

By 5th January the tongue was moist, the pulse numbered 100 in the minute, and respirations 28. The dulness, however, at the right base persisted, and on making an exploratory puncture a small quantity of blood stained fluid was withdrawn. This on examination was found to contain diplococci and indefinite micrococci, but an agar culture was negative. By 8th January crepitation was no longer audible, the lochial discharge had ceased, and she was found reading a magazine in bed. She was allowed up on the 23rd of January, and dismissed on 14th February.

In considering the leucocytitic curve as a whole it

will be seen that a decided leucocytosis was present on admission, being 37,200, and that six weeks elapsed before the curve with varying fluctuations reached the normal line.

As she was admitted on the second day of the puerperium a physiological leucocytosis was to be expected at this time, but the increase was much more marked than what would occur after a normal labour. The uterine and pulmonary conditions would account for this increase. The hemogenic tissues (especially the bone marrow) reacting powerfully to the stimulating toxines, with the result that a high polymorphonuclear leucocytosis was found present. The polymorphonuclear cells make up 97.5% of the whole, and this was associated with a reduction of the lymphocytes and eosinophiles. Not until three weeks after admission did the polynuclear cells stand in normal relation to the other white blood cells, while the eosinophiles entirely disappeared during the acute stage of the first week.

The decrease in the blood count on the second day might be the result of the saline infusion, and a further

decrease upon the following day the effect of the serum injected, for this was also noticeable on two occasions in Case VIII, though not so in Case VII.

It appears doubtful if there was any relation between the rigor and the blood count.

The serum intravenously was followed by a temporary decrease in the white cells, but a steady increase occurred during the next three days. Little relative change, however, occurred in the proportion of one variety of cell to another.

With reference to the relation of chloroform to the leucocytosis in this case it must be pointed out that Henderson, in three cases, found that a rise took place in the number of white cells, the leucocytosis reaching its maximum within 10 hours and returning to normal again within 24 hours.

On the other hand in two cases he found that a rapid though slight fall occurred for the first few hours, and then a steady though moderate increase in the number of white cells.

In the present case it is difficult to estimate what

influence, if any, the chloroform had upon the leucocytosis, and it appears impossible to distinguish its effect, if there were any, from the action of the saline infusion, or from the leucocytosis dependent upon the pulmonary condition and the septic infection.

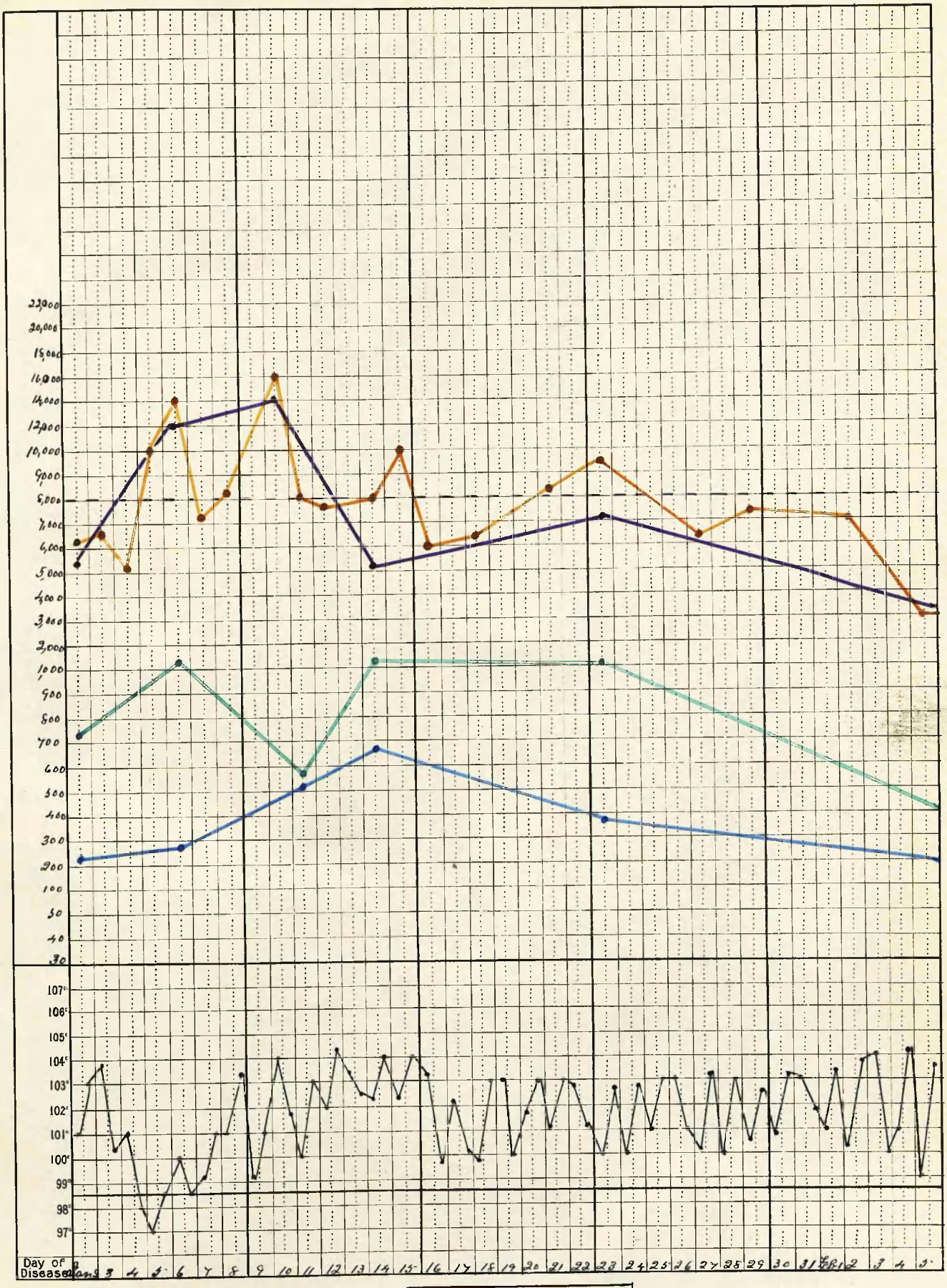
With regard to the action of saline infusions Winternitz (Arch. of Exp. Path. and Pharm., Vol. 35 - Cabot) holds that the degree of leucocytosis following an infusion of neutral salt solution depends upon the local reaction excited. Yet, if ordinary aseptic precautions are taken no local inflammation, however slight, should be seen at the sight of injection.

In the case under discussion there was no local reaction, and the number of leucocytes fell on the first and second days following the injection to the extent of 36% and 50% on the two days named.

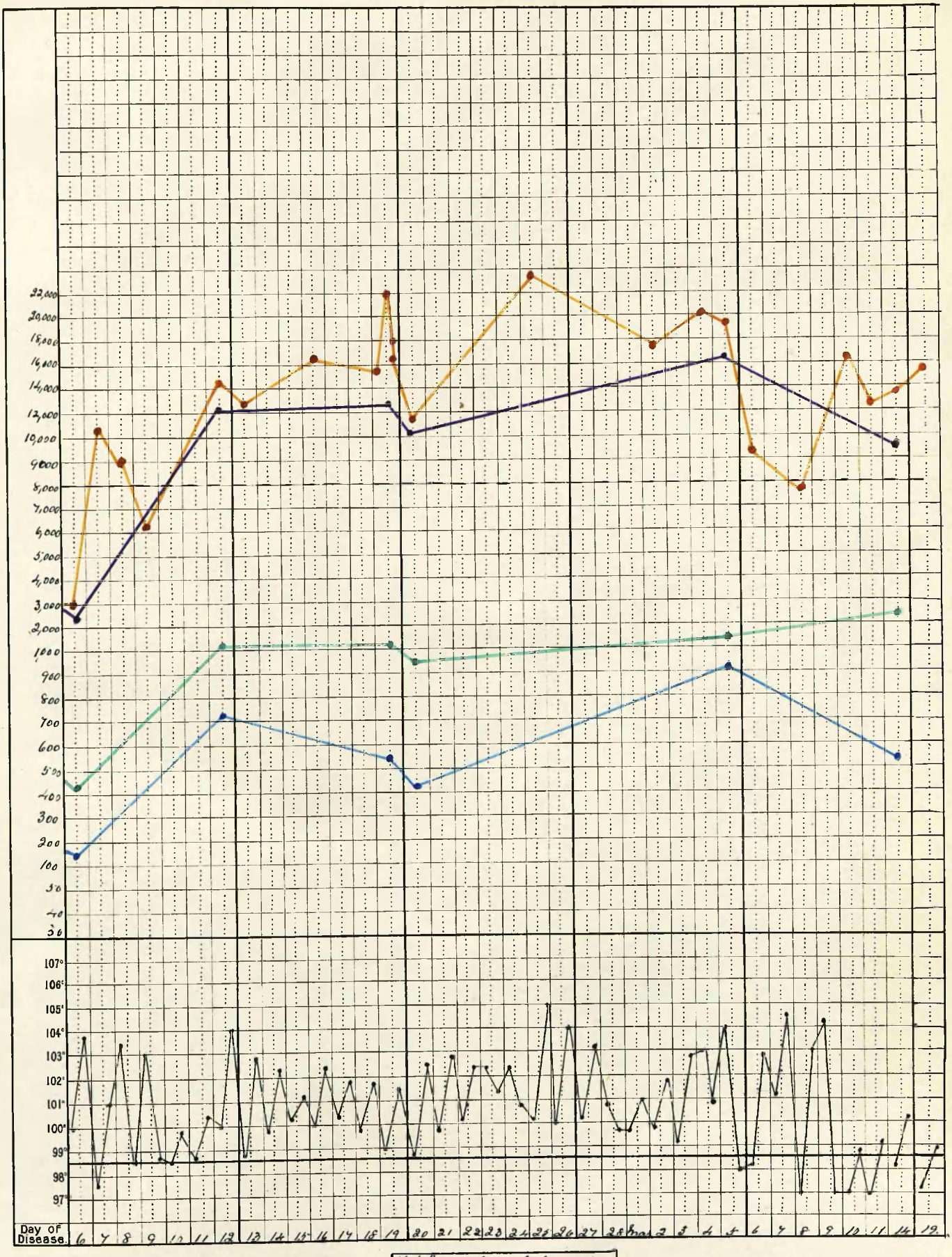
CASE VII. Mrs. C., Aet. 25 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Myels. %	Remarks
Jan. 2	6,200	84	5,208	11.5	713	4.5	279				Curetted, douched, temp. 101°
3	6,400										Quin. salicyl. grs v 4 hourly, temp. 103°8
4	5,400										
5	10,000										Temp. normal
6	14,000	87	12,180	11	1,540	2	280				
7	7,600										
8	8,200										Temp. 103°4
10	16,200	94.6	15,325	2.6	421	2.6	421				" 104
11	8,000										" 103
12	7,800										" 104.4 Pain in right groin, quinine stopped
14	8,000	72.5	5,800	19	1,520	8.5	680				Swelling in right groin and slight oedema of leg
15	10,000										Temp. 104°
16	6,000										Douche stopped
18	6,200										Feeling better
21	8,400										
23	9,600	76	7,296	14.3	1,372	4	384	.6	57	.6	
27	6,600										Rigor also on 26th 105°, 104°6
29	7,400										2 rigors on 28th
Feb. 2	7,000										2 rigors at 3 p.m., 103°8, and 11.15 p.m.
5	3,000										Rigor 6.10 a.m., serum intravenously 10 c.cs.
6	3,000	78.6	2,358	14.6	438	6.6	198			.6	Rigor 4.30 p.m., 103°8
7	10,600										
8	9,000										2 rigors 103°4 1 a.m. and 3 p.m.
9	6,400										Quin. Hydr. and salol powders 4 hourly
10											Red Count 4,277,000
12	14,200	87	12,354	7.3	1,036	5.3	752	.3	42	.3	Rigor 11.30 a.m., 104°
13	12,800										
16	16,800										Pain in left leg and in right leg on 18th
19											
3.30 p.m.	14,800										Antistaphylococcic serum 20 c.cs. subcutaneously
5 p.m.	22,000										
6 p.m.	18,000										
8.30 p.m.	16,800										
20											
2.30 p.m.	11,600	87.3	10,126	8.6	997	4	466				Quin. Hydr. stopped
25	21,800										Rigor 20 mins., temp. 105°
Mar. 2	17,800										Rigor on 26th Feb. temp. 104°, lasting 104°
4	20,200										
5	19,800	88.3	17,483	7	1,386	4.6	910				3 rigors 104°, lasting 30 mins., 25 and 25 mins.
6	9,600										Rigor on 7th, 30 mins.
8	7,800										Last rigor, abscess of right thigh incised under chol.3 on 9th
10	16,400										
11	12,400										
14	13,200	74.6	9,847	20.6	2,719	4.3	567	.3	39		
19	15,800										
Apr. 10											Abscess almost healed, no further rigors

CASE VII


22,000
20,000
18,000
16,000
14,000
12,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
50
40
30
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
Jan. 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 Feb. 2 3 4 5
Total number in wet counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears.

CASE VII Continued



CASE VII, Mrs. C., Aet. 25 years.

Admitted 2nd January, 1903; dismissed 26th April, 1903.

The patient was delivered of a female child on 27th December, 1902, i.e., six days previously. Labour was precipitate, the child being born on the floor.

The placents and membranes were considered to have been expelled entire.

On the third day her temperature rose to 101.° and her pulse numbered 104 in the minute. (A maternity nurse was attending her.)

On the fifth day the lochial discharge became foetid, and her temperature registered 102.°4. She experienced severe headache, sickness with vomiting, and sweating was profuse. Several rigors also occurred, and she had well marked delusions.

On admission to hospital she appeared a fairly well nourished woman. The face was somewhat flushed, the tongue was red and flabby in appearance. Her temperature was 101º Her pulse numbered 120 in the minute, was regu-

lar, and of fair quality.

Her respirations were 26 in the minute.

An examination of the chest was negative.

There was no pain on palpating the abdomen, and the fundus of the uterus could be felt about 2" below the level of the umbilicus.

On pelvic examination the uterus was freely moveable. The os uteri was patulous, and admitted a finger, but nothing abnormal could be detected. An intrauterine douche of lysol was given daily.

On the fourth day after admission her temperature had fallen to normal, and remained so throughout the day, and she appeared to be making satisfactory progress. Her temperature, however, again rose, reaching 104º on 10th January, and on the following night she began to complain of pain in the right groin, and in the calf of the right leg. On the following day there was some slight but firm swelling, apparently glandular in character, on the painful groin. It was situated in the region of the femoral vein, but there was little or no swelling of the leg. Two days later, however (14th January), slight oedema was

found of the right leg, and tenderness on the inner side of the right knee. This condition persisted, and the temperature continued to oscillate between 100° and 103°, and sweating was at times profuse.

On 23rd January she began to complain of a troublesome cough, and three days later, on auscultating the chest, some crackling rales were audible at the base of the right lung, and accompanying inspiration. Percussion note over this area was, if anything, slightly impaired, but there was no perceptible difference between the vocal fremitus and vocal resonance of the two sides, and there was no increase in the frequency of the respirations.

The sputum was examined for tubercle bacilli, but with negative results.

By 5th February her condition had not improved, and she was losing flesh. The sweating was profuse, her temperature continued to be erratic, and her cough persisted. She was seized with frequent rigors, three occurring on 2nd February, each lasting for about half an hour.

As the situation of the septic focus was undetermined, and her state appeared to be becoming critical, treat-

ment by the intravenous injection of antistreptococcic serum was considered worthy of trial. With the usual precautions 10 c.cs. of this serum (Parke, Davis & Co.) were injected into a vein at the bend of the right elbow at 3 p.m. (5th February). No marked effect, definitely attributable to the serum, was produced upon the temperature or pulse by this injection.

At 2 p.m. the pulse and respirations numbered respectively 132 and 26. The injection was made at 3 p.m., and three hours later the pulse and respirations numbered 118 and 26, and the temperature had also fallen a fraction of a degree, but reached 103°.6 by 10 p.m. But all three again rose upon the following day, and another rigor occurred in the afternoon, though in the morning she appeared brighter, and felt better than upon preceding day.

The blood estimate upon both days remained the same, viz., 3,000 leucocytes per cb.mm.

Little improvement occurred, and, in addition to the previous symptoms, on 13th February she complained of rather severe pain in the region of the left costal margin, which was aggravated by deep inspiration.

Physical examination, however, was negative, but a blood estimate shewed a decided rise compared to former observations in the number of leucocytes, viz., 18,800.

On 19th February she complained of pain in both groins, and there was very slight oedema of the left leg.

As her condition appeared to be becoming worse it was decided to try the effects of antistaphylococcic serum, and 20 c.cs., therefore, of this serum (Burroughs & Wellcome) were injected subdutaneously into the abdomen. No change was brought about in the pulse or temperature, nor was there any apparent amelioration in her symptoms.

The blood estimate shewed an increase of 33% in the white cells in 1½ hours after injection, rising from 14,800 to 22,000, but an hour later fell to 18,000, and 2½ hours after to 11,800, while, on the following afternoon, the leucocytosis numbered 11,600 per cb.mm.

By 3rd March the swelling about the right groin had become more marked, involving the upper part of the thigh, and there was a suspicion of deep fluctuation.

Six days later signs of abscess were unequivocal. Chcl. 3 was therefore administered, and a large abscess

evacuated. The pus which was slightly greenish and of a foetid odour had burrowed below the muscles of the thigh, and laid bare several inches of the upper half of femur. The periosteum, however, was intact.

Marked improvement followed this operation. The temperature fell to normal. No further rigors occurred, and by the 10th April the wound had almost healed.

She was dismissed some days later.

A noticeable feature of this case was that the number of the leucocytes, throughout the greater part of the patient's illness, remained practically normal in spite of acute symptoms supervening. This fact is discussed more fully upon another page.

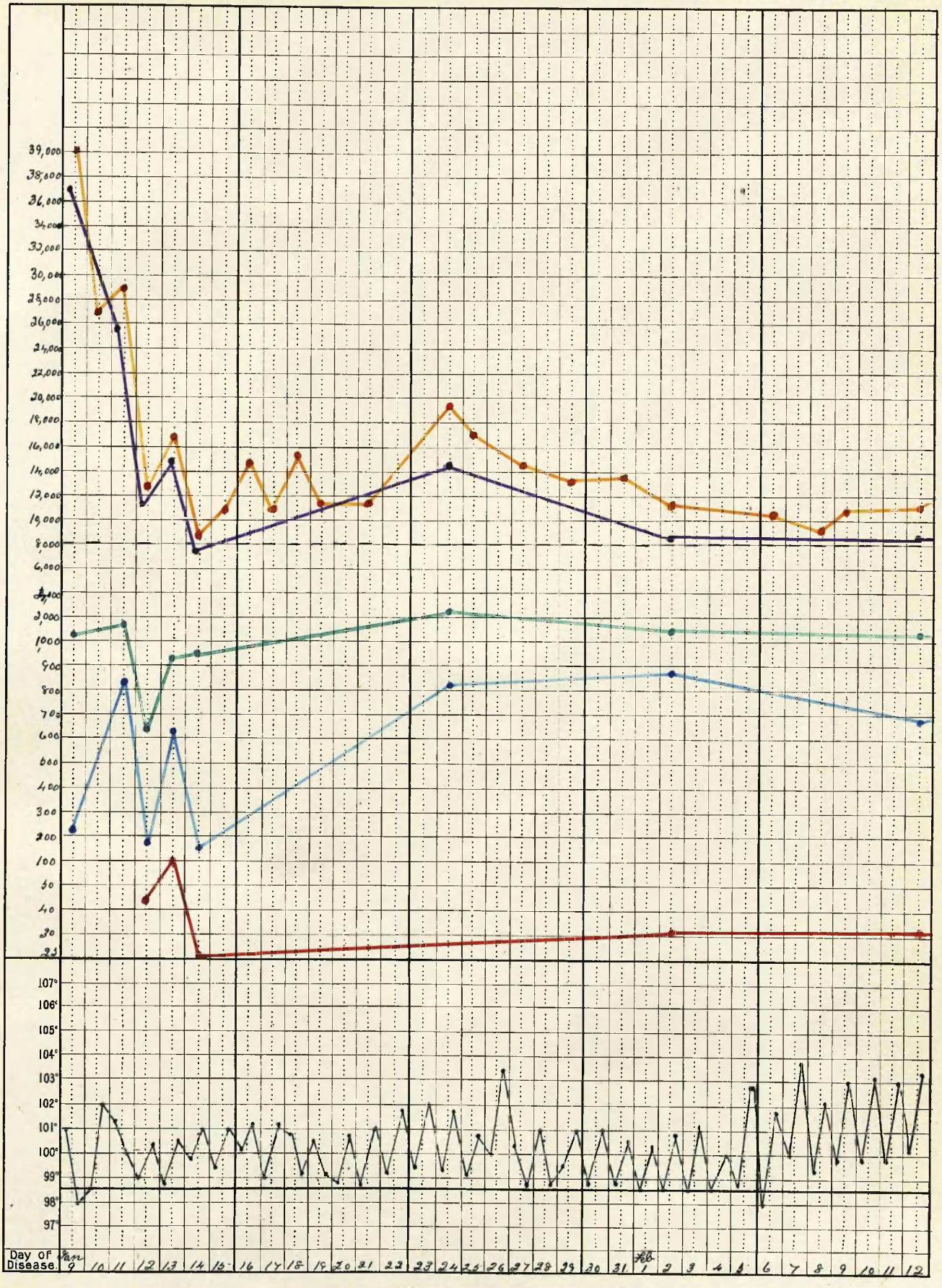
The leucocyte and temperature curves shewed no relation to one another, and the occurrence of rigors had no definite influence upon the blood estimate.

The subcutaneous injection of antistaphylococcic serum had a decided though temporary influence upon the number of the leucocytes, the leucocyte curve reaching its maximum in 1½ hours.

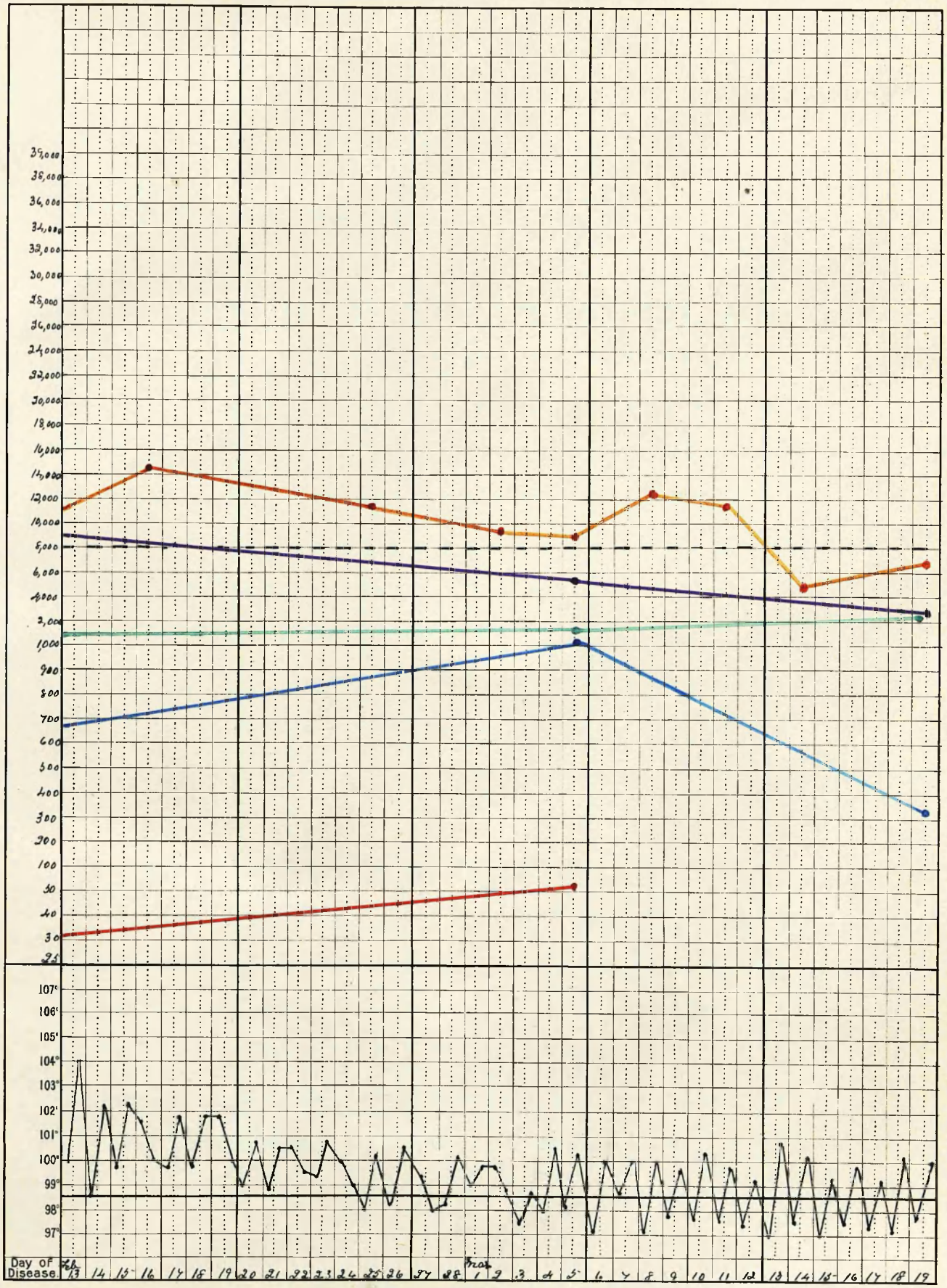
CASE VIII. Mrs. S., Aet. 30 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Myels.	
Jan. 9	39,000	96.6	37,674	2.6	1,014	.6	234				Consolidation at bases of both lungs $\frac{P}{R} = \frac{100}{28}$, Temp. = 100°4 mod.
10	27,200										
11	28,600	90.6	25,911	6.3	1,801	3	858				Antistrept. serum 9 c.cs. intravenously
12	12,400	90	11,160	7.5	675	2	180	.5	45		
13	16,800	90	15,120	5.6	940	3.6	604	.6	100		Antistrept. serum 20 c.cs. intravenously
14	8,400	86.6	7,274	11.3	949	1.6	134	.3	25		Rash on arms and face
15	10,600										
16	14,800										
17	11,400										
18	15,800										
19	11,400										
21	11,800										
24	19,600	79	15,484	15	2,940	4.3	842			1.6	Perimetritis
25	17,000										
27	14,400										
29	13,000										
31	13,400										Rigidity of abd. muscles, increased fixation of uterus
Feb. 2	11,200	73.3	8,309	13.3	1,489	8	896	.3	33	5	Tumour masses in abd., sickness and vomiting
6	10,600										
8	9,200										
9	10,600										Red count 3,200,000
10											
12	11,600	76.3	8,850	12.3	1,426	6	696	.3	34	5	
16	14,400										
25	11,800										Stomach washed out on 1st, rectal feeding commenced on 28th
Mar. 2	9,600										
5	9,000	64	5,760	20.3	1,827	14.3	1,287	.6	54	.6	
8	12,400										
11	11,800										Faecal fistula (umbilical)
14	5,000										
19	6,400	53.6	3,430	40.6	2,578	5	320			.6	Death
Apr. 10	8,400										

CASE VIII


39,000
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
3,000
1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
Mar 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Feb 1 2 3 4 5 6 7 8 9 10 11 12
Total number in Wet counts
Absol. number of Polymorpho
Absol. number of Lymphocytes
Absol. number of Lg. Mononuclears
Absol. number of Eosinophiles

CASE VIII Continued



CASE VIII, Mrs. S., Aet. 30 years.

Admitted 9th January, 1903; died 10th April, 1903.

She was confined three weeks previous to admission, when twins were born. Ten minutes elapsed between the birth of the children. The placenta was expelled immediately upon the birth of the second child. A midwife had attended, but there was no history of undue manipulation.

Lochial discharge ceased three days after labour occurred.

She left her bed on the tenth day, when she experienced pain and noticed swelling of the abdomen. She sought medical advice, when she was told that she had only a short time to live, and a few days later was certified as puerperal fever, and sent into hospital. This was her eighth confinement. The others had been normal. There was a history of her having been "out of sorts" for the previous six months. She had been troubled with breathlessness, and a slight cough accompanied by a "dirty spit". She had also been subject to indigestion and "wind". There was no history of tuberculosis in the

family.

On admission to hospital she looked extremely ill. She was fairly well nourished, but pale in colour. The pupils were moderately contracted, and the tongue was moist and fairly clean. Her pulse was regular, though rather easily compressible, and numbered 100 in the minute, and the respirations 28.

Examination of the heart revealed nothing abnormal.

The lungs were resonant to percussion in front, but the respiratory murmur was harsh, and expiration was prolonged over the right side, where vocal fremitus and vocal resonance were somewhat increased. Some crepitant rales were audible about the region of the right nipple. Behind the percussion note was dull over the right base, and crepitant rales were audible over this area.

Abdominal examination was negative.

On pelvic examination the uterus was freely moveable. The cavity measured $2\frac{1}{2}$", and nothing abnormal could be made out there, or in region of the broad ligaments.

The urine contained some albumen, but the chlorides

were not appreciably diminished.

By 11th January, though her highest temperature was 101°4, falling to 100° by night-time, her condition shewed no sign of improvement. Sweating was profuse, and her pulse and respirations respectively rose in number to 118 and 42. She was prevented from sleeping by a persistent cough, accompanied by profuse mucopurulent expectoration. The sputum was examined for tubercle bacilli with negative results, but abundant microorganisms were present, diplococci, cocci, bacilli, and streptobacilli.

The physical signs in the chest were found to have changed, for dulness and percussion were now present over both bases, more marked upon the right side. On auscultation moist and coarse crepitant rales were audible on both sides, though the respiratory murmur was decreased upon the right. There was no distinct tubularity in the character of the breathsounds, and the signs were not those of a typical lobar pneumonia, but rather one of acute septic origin.

Owing to her critical condition I injected 9 c.cs. of antistreptococcic serum into a superficial vein of the

left arm.

On the following day at 2 p.m. her temperature registered 99°., though respirations still numbered 40 and the pulse 116 in the minute. She looked much better, and expressed the desire for more food.

The cough was much less troublesome, and expectoration markedly diminished in quantity. Percussion note was much more resonant on the left side, though still decidedly flat upon the right where crepitant rales were still audible. The left base, however, was almost free from rale. There was also a marked fall in the number of leucocytes.

Next day (13th January) the morning temperature registered 99°, but the patient did not appear so well as on the previous day. The respirations numbered 40 in the minute, and the pulse was regular and numbered 116, but was easily compressible. The cough had again become troublesome, and expectoration fairly abundant in quantity.

Marked dulness now persisted at the right base, and the respiratory murmur was somewhat tubular in character,

accompanied by numerous coarse crepitant rales. The physical signs at the left base remained unchanged. Owing to the apparent temporary improvement following the first injection of serum it was decided to repeat the treatment, and accordingly 20 c.cs. Parke, Davis & Company's antistreptococcic serum were injected into a superficial vein of the right arm at 1.30 p.m.

By 10 p.m. her temperature registered 100°4, the pulse was feeble in quality, and numbered 128 in the minute, and the respirations 52. She complained of epigastric pain, and a choking sensation in her throat. The abdomen appeared distended, and tympanitic to percussion. Considerable relief was obtained by carminative treatment and a turpentine enema.

For the following twelve days her chief complaint referred to gastric disturbance. Her temperature oscillated between normal and 102°, averaging about 100°5. The frequency of respirations varied between 32 and 52, and her pulse between 108 and 128.

By 26th January her chest condition had improved, and rale was no longer audible, though dulness persisted

at both bases.

Exploratory punctures on two occasions, 23rd and 26th, proved negative, and the condition was apparently one of thickened pleura.

In the meantime, physical signs had appeared in the abdomen and pelvis. The former was somewhat distended. The percussion note was dull, and the abdominal muscles so rigid as to make a thorough examination impossible.

Per vaginam it was found that the uterus had become fixed, especially on the left side, where there was thickening and resistance.

On 2nd February nodular masses could be made out on abdominal palpation, situated below the left costal margin, and these appeared to have origin from the omentum. There was also a suggestion of free fluid in the abdominal cavity, but there was no oedema of the legs. She was noticeably losing flesh.

By the 11th February her temperature had become more erratic, rising as high as 103°2, the pulse 126, and respirations 36 in the minute. Her chief complaints all along referred to the stomach, and sickness and vomiting persisted in spite of dietetic treatment. On that day

she also complained of pain in the region of the left costal margin, and some fine scanty crackling rales were audible at the left base. There was marked fixation of the uterus, and resistance all around the cervix, and the abdomen remained rigid and difficult to examine.

By 3rd March vomiting and epigastric pain had become so persistent a tube was passed, and the stomach washed out, and rectal feeding commenced. This treatment was followed by temporary relief, but gastric pain soon recurred, and, on 13th March, a fecal fistula suddenly made its appearance at the umbilicus.

During the following month the discharge, which was fluid, semipurulent, and fecal in character, increased in quantity.

Emaciation became more and more marked, the eyes became sunken in appearance, and the face pinched and grey in colour. The pulse rate continued to be about 120 in the minute, and the temperature for the most part oscillated between 97° and 100°, while respirations scarcely varied from 28 in the minute.

Death occurred upon 10th April.

AT THE AUTOPSY the following was found. There was

nothing worthy of note in the chest except for some hypostatic congestion and oedema of the lungs.

On opening into the abdomen, however, the great omentum was found adherent all round its margin, and apparently forming the posterior wall of an abscess, of which the abdominal parietes formed its anterior wall. Its anterior surface presented a greyish appearance covered with debris and grumous material, while the contents of the cavity were a thin semipurulent fecal fluid.

There was no general peritonitis and no glueing of the coils of bowel together, except on the left flank, where part of the small intestine had been involved, and formed a portion of the abscess wall.

A perforation of the gut had occurred in the region of the sigmoid flexure about the size of a threepenny piece, apparently the result of the septic process from without.

The pelvic contents were completely matted together, and the relation of the parts obliterated.

The uterine cavity contained apparently no debris, and involution was complete. No evidence of tuberculosis or malignant disease was found.

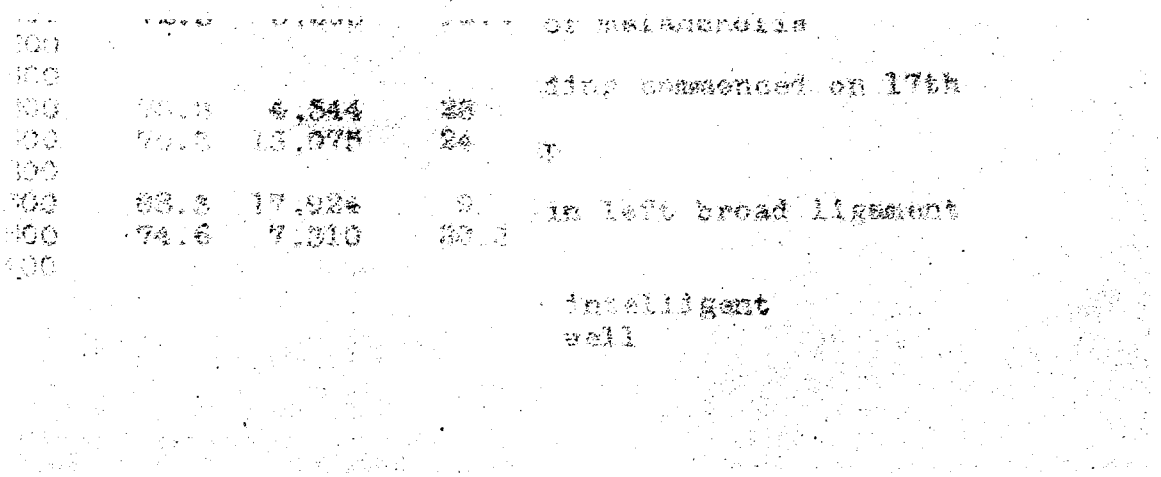
OBSERVATIONS ON CASE OF Mrs. S. As she was admitted three weeks after confinement the normal leucocytosis following labour should have practically disappeared. The first blood count, therefore, of 39,000 must be looked upon as a purely pathological condition, especially when the polymorphs were present in the high percentage of 96.6, and this increase absolute and relative was associated with a decrease in the number of the lymphocytes. The chest, looked at as a whole and irrespective of the patient's clinical history, might readily be taken to represent the blood condition of a moderately mild case of puerperal septicemia.

After the first three days the leucocytosis was only moderate in degree, and this existed more or less for nearly three months. It also shews a steady fall in the percentage of polymorphs with a corresponding rise in the percentage of lymphocytes. The eosinophiles were also found fairly constantly. One abnormal feature, however. was the constant presence of myelocytes.

This case was one of considerable interest in point

of view of diagnosis. The moderate leucocytosis or normal blood estimates, together with the tumour masses in the abdomen, and progressive emaciation, strongly suggested some tubercular or malignant disease as a complication.

This anticipation, however, was in no way verified by the autopsy, when all the physical signs were found referrable to septic infection and inflammatory indurations of the tissues.



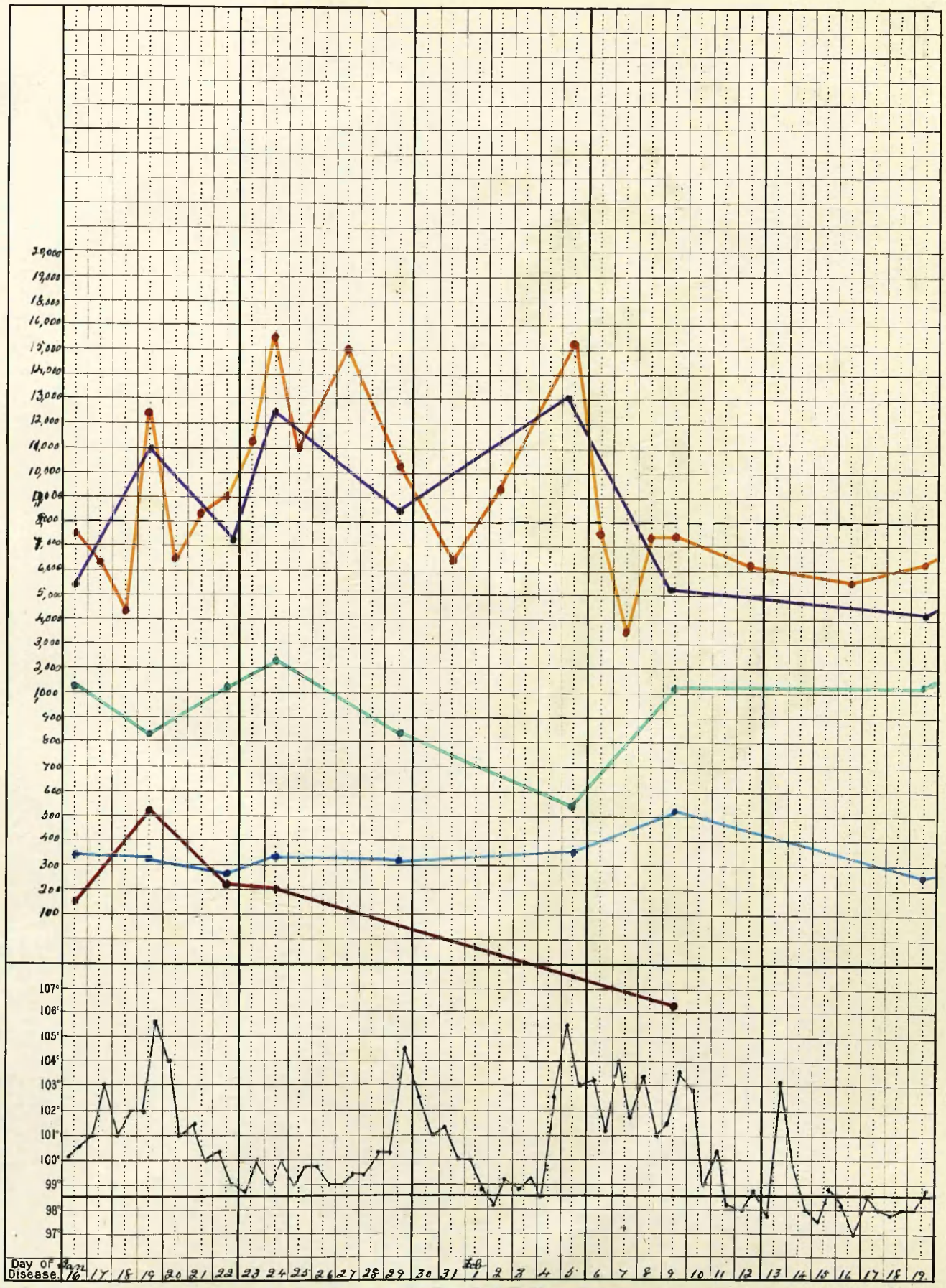
CASE IX. Mrs. McA., Aet. 26 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Red Nuc. Corp.	Abs. No.	Myels. %	Max. Temp.	
Jan. 16	7,600	75	5,700	17.6	1,337	4.6	349			2.6	197		100.6°	Curetted and douched
17	6,400												103	Quin. salicyl grs. v 4 hourly
18	4,600												102	Quin. Sulph. grs. v 4 hourly
19	12,800	86.5	11,072	6.5	832	2.7	345			4.2	537		105.8	Rigor
20	6,600												104	Quinine stopped
21	8,400												101.4	Perimetritis
22	9,000	80	7,200	14.3	1,287	3	270			2.3	207		100.4	Ichthyol pessaries
23	11,200												100	Saline fluid per rectum daily
24	15,800	81.6	12,892	14.3	2,259	2	316			1.3	205	.6	100	
25	11,000												99.8	
27	15,000												100	Pessaries stopped
29	10,400	88.6	9,214	8.3	863	3	312						104.6	Cystitis, saline stopped
31	6,800												101	Right pyosalpinx
Feb. 2	9,600												99.2	Bladder irrigated on 3rd
5	15,200	94	14,288	3.6	547	2.3	349						105.6	Pus-tube discharging (cervix dilated)
6	7,600												103.2	
7	3,600												104	
8	7,200												103.4	
9	7,200	72.3	5,205	19.6	1,411	7.6	547					.3	103.6	Symptoms of melancholia
12	6,200											21	98.6	
16	5,800												98.2	Nasal feeding commenced on 17th
19	6,200	73.3	4,544	23	1,426	3.6	223						98.8	
Mar. 2	18,600	70.3	13,075	24	4,464	5.3	985	.3	55				98.2	Allowed up
5	14,200												97.6	
11	20,300	88.3	17,924	9	1,827	2.6	527						99.8	Swelling in left broad ligament
14	9,800	74.6	7,310	20.3	1,989	4	392	1	98				98.2	
19	10,400												98.4	
Apr. 10														Much more intelligent
25														Dismissed well

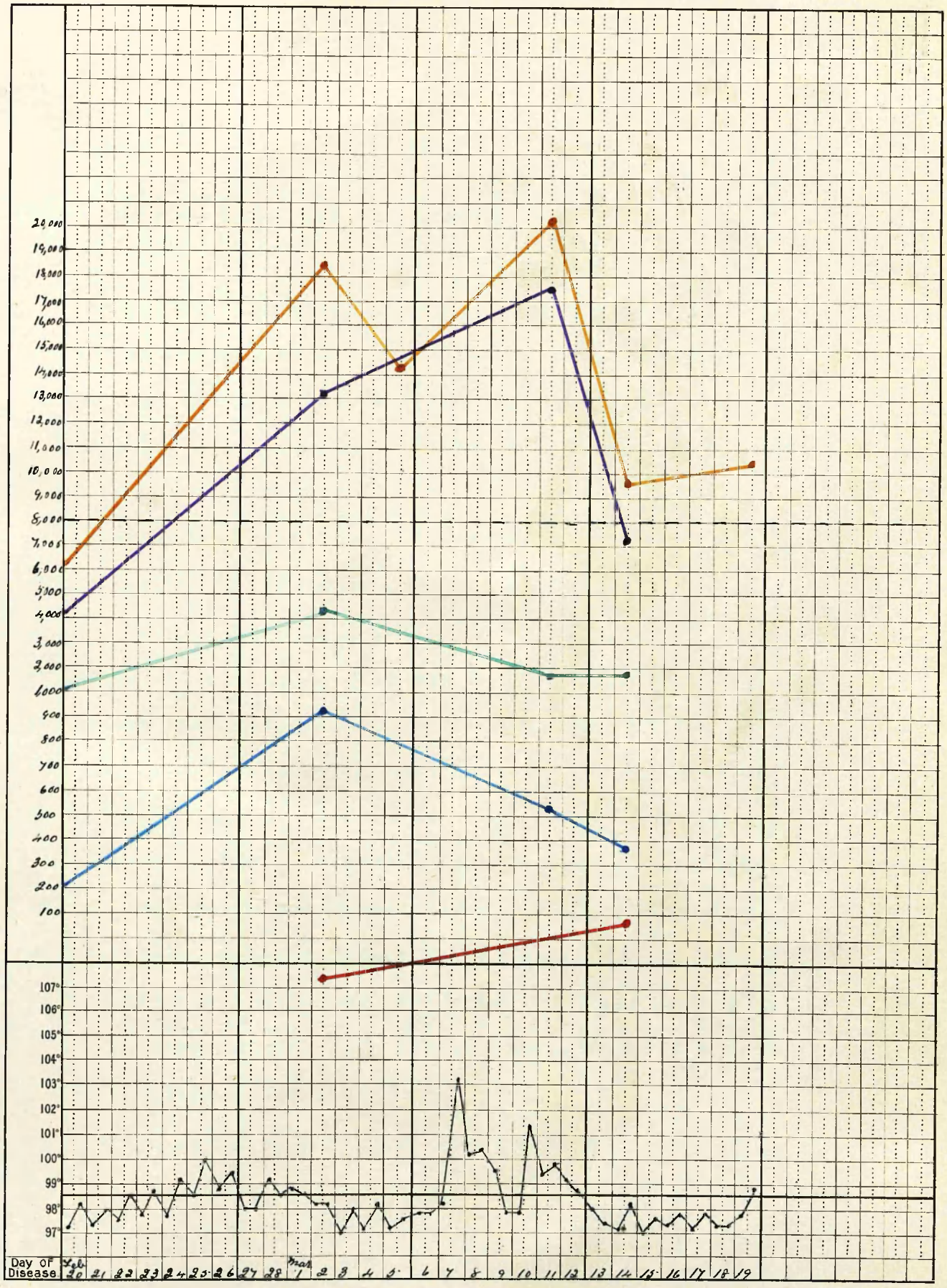
RED COUNT

Jan.	17	2,264,000
	20	1,712,000
Feb.	7	2,468,000
Mar.	14	4,272,000

CASE IX


20,000
19,000
18,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Jan 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Feb 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Total number in wet counts
Absol. number of Polymorpho.
Absol. number of Lymphocytes
Absol. number of Monomuclears
Absol. number of Eosinophiles
Absol. number of Red Nucleated Corpuscles

CASE IX Continued



Total number in Wet-counts
Absol. number of Polymorpho.
Absol. number of Lymphocytes
Absol. number of L. mononucleosa
Absol. number of Eosinophiles
Absol. number of Red nucleated Corpuscles.

CASE IX, Mrs. McA., Aet. 26 years.

Admitted 16th January, 1903. She was confined six days previously, when a still-born child was delivered. Labour had lasted about 18 hours, and the midwife attending was said to have removed the placenta manually immediately after the child was born.

Three days later the patient was seized with a rigor, which lasted for ten minutes. Since then the lochial discharge had been scanty and offensive, and she had experienced abdominal pain. This was her first child. Menstruation had last occurred in March 1902, and she maintained she had experienced fetal movements on the day previous to her confinement. Her former health had been good.

On admission to hospital her temperature registered 100°2. Her pulse and respirations numbered 108 and 24 respectively, and the former was regular, and of fair tension. She was fairly well nourished, but markedly pale. The eyes were bright, with the pupils moderately contracted. The tongue was moist.

Examination of the chest was negative.

The abdomen was not distended, and not painful to pressure. The fundus uteri was on a level with the umbilicus, and was firm, but no pain was elicited on palpation.

On pelvic examination the cervix was soft in consistence, and the uterus was mobile. The os was patulous, and readily admitted of examination. The surface of the cavity was rough, and the quantity of debris was slight, but a small amount of membrane was removed and the cavity curetted. Nothing abnormal was made out in the region of the broad ligaments. The uterine cavity was douched out daily with a lysol lotion, and she was given quinine, and a mixture containing nux vomica and port.

In two days the fetor had practically disappeared from the lochial discharge, but she complained of weakness and "as if the breath was leaving her", and on the morning of the 19th a rigor occurred which lasted for 25 minutes.

She thought she was dying, and had to be propped up in bed, and stimulant administered.

By 21st January considerable induration could be

made out in the region of the anterior fornix, and there was some fixation of the uterus. There was also audible on auscultation of the chest a soft systolic murmur at the base of the heart.

Owing to her continued complaint of weakness and dyspnea Oi of saline fluid was slowly injected daily into the rectum, and this was apparently followed by good result, for, by the 26th, the heart sounds were of fair quality, and no murmur was audible. Three days later there was a marked rise in temperature to 104°6 accompanied by a moderate leucocytosis (10,400). This was apparently due to a developing cystitis. The urine had a marked ammoniacal odour, and the sediment consisted of stringy mucus and pus, but no tube casts. Along with this a swelling was found in the region of right broad ligament, which appeared to move along with body of the uterus, and was somewhat painful to pressure. The origin of the cystitis was subsequently found in the discharge of pus, from the cervix having infected the bladder. The condition was one of right pyosalpinx, which was discharging its contents through the uterine cavity.

On 5th February the swelling in the right broad ligament appeared somewhat larger, and there was tenderness on pressure. The cervix was therefore dilated to allow of freer discharge.

During the following week the leucocyte count continued to be low, though the temperature continued to be erratic, probably due to the condition in the left broad ligament where there was pain and induration.

About 9th February, however, it was noticed that her manner towards others in the ward was becoming peculiar. She was frequently found in tears. Her face, which was thin and white, began to wear an expression of distrust towards those around her, and upon anyone approaching to inquire what was the matter she would exclaim, "Don't touch me". She would also hold conversations with imaginary people about her bed. Added to this she steadily refused to take any nourishment, and on 17th February nasal feeding had to be resorted to.

By the beginning of March she was sitting up in bed, and taking her food, though still refusing to answer questions.

On 11th March a swelling was found on the left broad ligament, firm, rounded, and rather painful to pressure. She had, however, improved in general condition, and would answer questions, though her face still wore a dull vacant expression. This gradually improved, however, until by the 10th April she was much more intelligent, and the swelling in the broad ligament had subsided.

She was dismissed 25th April, 1903, well.

Admitted as she was upon the sixth day of the puerperium and with a rise of temperature, a leucocytosis would naturally be expected in the blood estimate, on account of the physiological increase in white cells having had scarcely time to fall to normal, or on account of the evidence of septic infection. There was no history of postpartum hemorrhage, though the conditions of the blood would suggest that having occurred, by the presence of transitional forms of polymorphonuclear cells, myelocytes, and a fairly high percentage of red nucleated corpuscles, while the red cells varied in shape and size, and on 20th January only numbered 1;712,000 in the cb.mm.

The blood estimate, however, revealed no leucocytosis; indeed, on the third day after admission, as will be seen

from the table, a distinct leucopenia existed, viz., 4,600. This condition continued more or less for the first week, when a moderate leucocytosis (between 11,000 and 16,000) occurring, apparently due to the collection of pus in the right tube, but as soon as this had found an outlet, the white cells returned to their normal number. It is noticeable that, considering the complications, the estimate of the total blood cells was throughout decidedly low. That this might have been due to the virulence of the pyogenic organism being such as to prevent a reaction on the part of the hemogenic tissues, or to a direct destruction of blood cells, appears scarcely tenable, for under these circumstances a fatal issue would seem inevitable. Instead of which, though a low blood count of white cells was still found at the end of the first month, yet the red cells had decidedly increased in number, and the patient was dismissed well two months later.

It would appear as if the variety of organism had an important bearing upon the reaction of the leucocytes. The number of leucocytes remaining normal during the

symptoms of well marked melancholia is a result which agrees with the observations of others, and may be compared with Case II of this series.

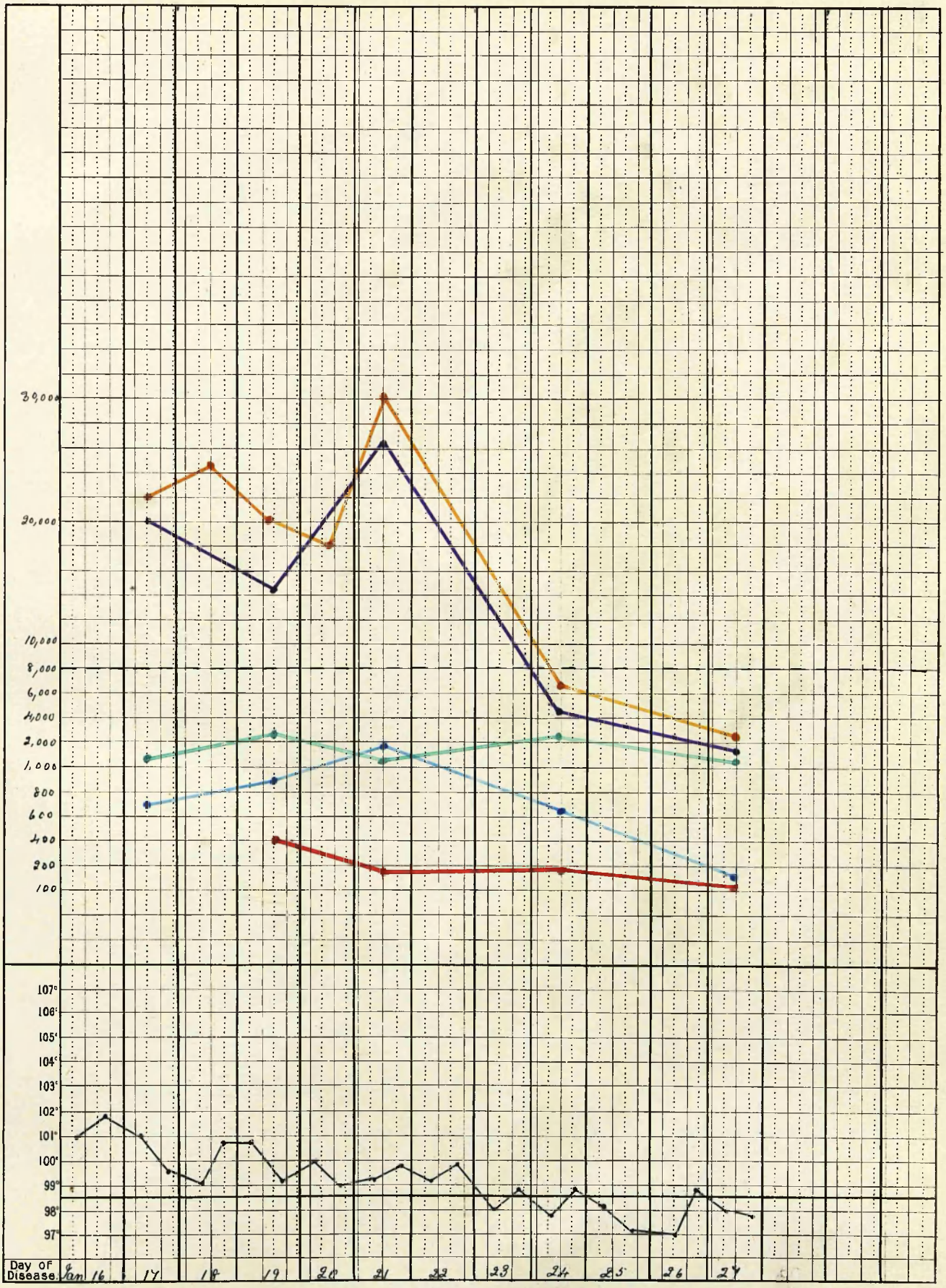
Smyth (Am. Journ. of Med. Sc., 1899, Vol. 107) states the average number of erythrocytes in ten cases of melancholia to be 4,684,000, while Steele (Am. Journ. of Insanity, 1892) in 35 cases of this disease estimates the average at 3,000,000, which is markedly lower, and corresponds more to the present case, which was 2,468,000.

McPhail (Journal of Ment. Sc., 1884) is of the opinion that mental diseases are in many cases closely associated with more or less decided anemia, although in no sense can blood deterioration be regarded as a factor of insanity.

CASE X. Mrs. McG., Aet. 29 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.
Jan. 17	22,600	90.6	20,475	6	1,356	3.3	745		
18	25,400								
19	20,000	82.3	16,460	11.3	2,260	4.3	860	2	400
20	18,000								
21	30,000	88.6	26,580	5	1,500	5.6	1,680	.6	180
24	7,400	58	4,292	30	2,220	9.3	688	2.6	192
27	3,800	52.3	1,987	40.3	1,531	4.3	163	3	114

CASE X


30,000
20,000
10,000
8,000
6,000
4,000
2,000
1,000
800
600
400
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Jan 16
17
18
19
20
21
22
23
24
25
26
27
Total number in wet counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of L. mononuclears.
Absol. number of Eosinophiles

CASE X, Mrs. McG., Aet. 29 years.

Was admitted on 16th January, 1903, with the history that abortion ($3\frac{1}{2}$ months) had occurred seven days previously. It was her fourth pregnancy. She had experienced pains for ten and a half hours before the fetus was expelled. The doctor who was in attendance removed the placenta in a broken condition, and 17 hours later he curetted the uterus under chloroform.

Bleeding was said to have been profuse. Four days previous to admission three rigors had occurred, each lasting from 10 to 15 minutes followed by severe pain, chiefly in the lower part of the abdomen. Since that time the discharge had been scanty and offensive. She had been sick and vomiting, and diarrhoea had been profuse.

On admission to the ward the patient appeared moderately well nourished, though somewhat pale. The temperature was $101^{\circ}.2$. The pulse numbered 118, was regular, and of fair quality. Respirations were 26.

Examination of the chest was negative, and nothing

abnormal was detected on palpation of the abdomen.

On pelvic examination the cervix was low down, very firm with considerable induration of the tissues posteriorly. The os uteri did not admit a finger. Nothing abnormal was detected in the region of the broad ligaments.

The cervix was gradually dilated with Hegar's dilators to permit of examination and freer drainage. The cavity was then curetted and douched, and an ichthyol and gelatine pessary introduced into the posterior fornix.

The patient made satisfactory progress. The highest temperature registered was 101.8° on the day of admission (16th January), and this gradually fell to normal seven days later, accompanied by a corresponding fall in the pulse rate from 120 to 88.

There was a decided leucocytosis for the first six days, fluctuating from 18,000 per cb.mm. to 30,000. The blood estimate, however, by 24th January had fallen to 7,400 per cb.mm., while the percentage of the polymorphonuclear cells fell from 90.6 to 58. The last observation made on 27th January shewed a rise in the proportion of the lymphocytes from 6% to 40.3%. There was, however,

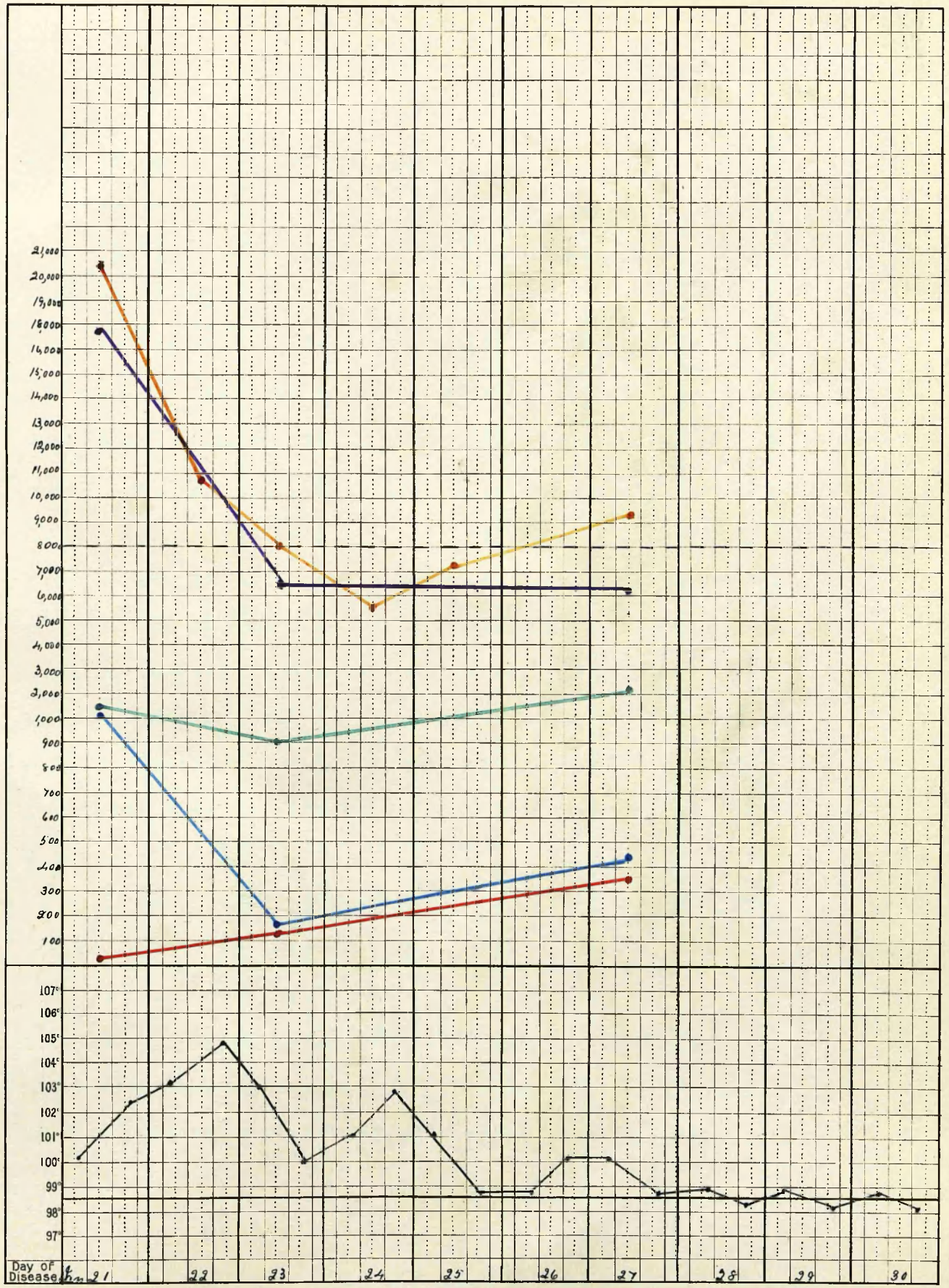
little change in the absolute numbers of this variety, ranging as it did from 1,356 to 2,260 per cb.mm. The number of the large mononuclear cells fluctuated between 163 to 1,680 per cb.mm. Eosinophile cells were constantly present in the later observations.

She was dismissed well on 13th February, 1903.

CASE XI. Mrs. W., Aet. 26 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.
Jan. 21	20,200	86.5	17,473	7.5	1,515	5.7	1,151	.2	40
22	10,800								
23	8,000	84.6	6,768	11.6	928	2	160	1.6	128
24	5,700								
25	7,200								
27	9,400	65	6,110	24.6	2,312	6.3	592	4	376

CASE XI


21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
21
22
23
24
25
26
27
28
29
30
Total number in c.c. counts
Absol. number of Poly morphs.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears.
Absol. number of Eosinophiles

CASE XI, Mrs. W., Aet. 26 years.

Admitted 21st January, 1903; dismissed well 14th February, 1903.

Delivered nine days previously at term of a living child. This was her third pregnancy. A maternity nurse was in attendance. The placenta was expelled immediately after the birth of the child. The lochial discharge was normal for the first four days; on the fifth the patient was seized with a rigor, and experienced pain in the left side of the abdomen, and thereafter the discharge became scanty, ceasing on seventh day of the puerperium. The patient had had several rigors with sickness and vomiting before admission. She was said to have suffered from puerperal fever 16 months before with "abscess of the womb".

On admission the temperature was 100°2. The pulse numbered 116, was regular, and of fair tension, while the respirations were 26.

She appeared well nourished, and not acutely ill. The tongue was moist, but slightly furred. The breasts were distended, and the right painful on pressure. A

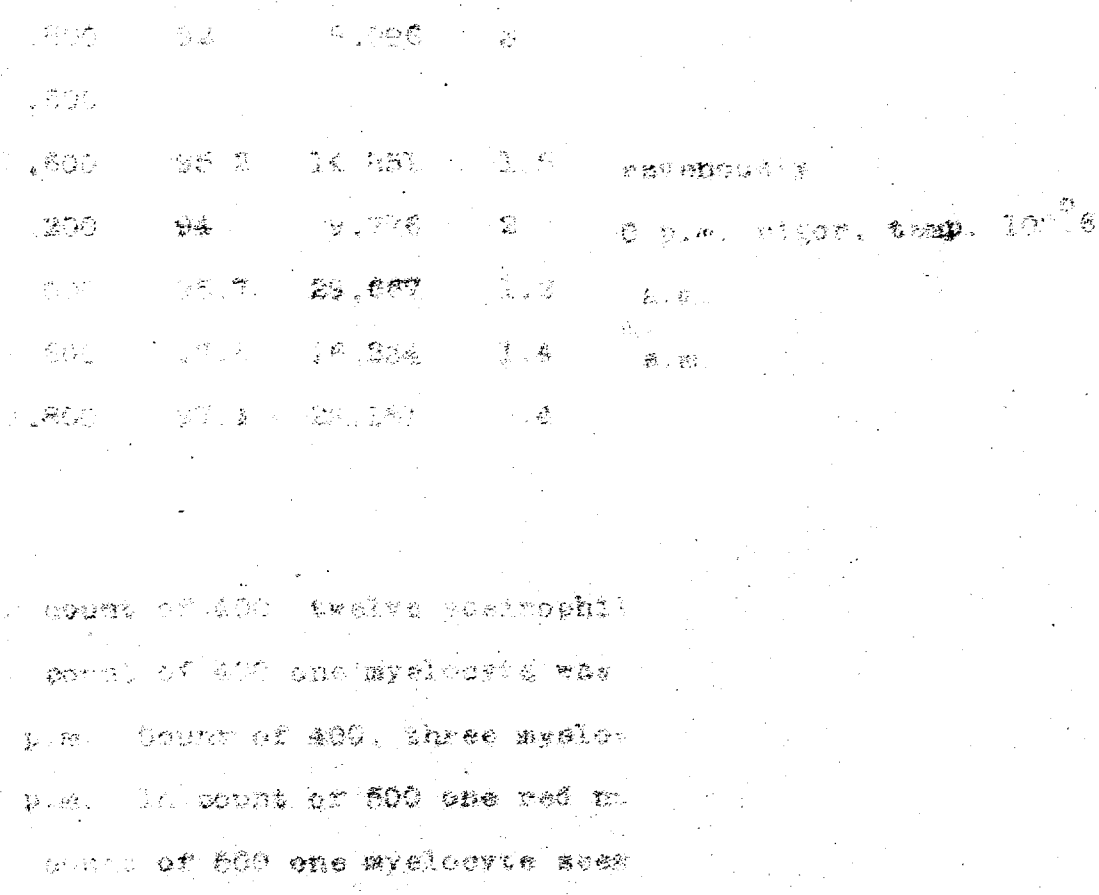
soft systolic murmur was audible over the precordium, but the lungs were negative to examination. The liver and spleen were not enlarged. The abdomen was slightly prominent, and somewhat tender, and the fundus uteri was about 4" above the pubis. The os scarcely admitted a finger, and the cervix in the region of the anterior fornix was firm and resistant. The os was dilated with the finger and Hegar's dilators, curetted, and a mass of placental tissue and membrane removed.

Lysol douche was given daily.

The case ran a rapid and satisfactory course. The temperature fell from 104°.8 on the second day to normal on the fifth day, though there was a slight rise to 100° two days later.

The leucocyte estimate corresponded closely to the favourable progress made by the patient, falling from 20,200 on day of admission to 10,800 upon following day; while, by the fifth day, the leucocyte estimate was 7,200. The polymorphonuclear cells fell from 86.5% to 65% of the whole. There was a corresponding rise in the percentage of the lymphocytes, and this was also well marked

in the case of eosinophile cells, which increased from 2% to 4%. The blood observations alone in this case indicate a mild septicemia with a healthy reaction on the part of the patient.



CASE XII. Mrs. D., Aet. 23.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Myels. %	Abs. No.	
Jan. 21	5,400	91	4,914	3	162	2.5	135	3.5	189			Curetted, rigor 10[9]
22	16,400	95	15,580	2	328	2.5	410	.5	82			
23	13,000											
24	7,600											
25	8,800	92	8,096	3	264	2	176	3	264			
27	14,600											
29	15,600	95.2	14,851	1.5	234	3	468	.2	31			Serum 20 c.cs. intravenously
30	10,200	94	9,776	2	204	4	408					7.30 a.m. and 11.30 p.m. rigor, temp. $107.^{o}6$
31	31,000	95.7	29,667	1.2	372	3	930					3 p.m. (1.30 a.m. Rigor (7.p.m.
31	16,600	97.8	16,234	1.4	232	.6	99					8 p.m. (3.30 a.m.
Feb. 1	23,800	97.4	23,181	.4	95	2	476			.2	47	

Jan. 25 In count of 400 twelve eosinophiles seen

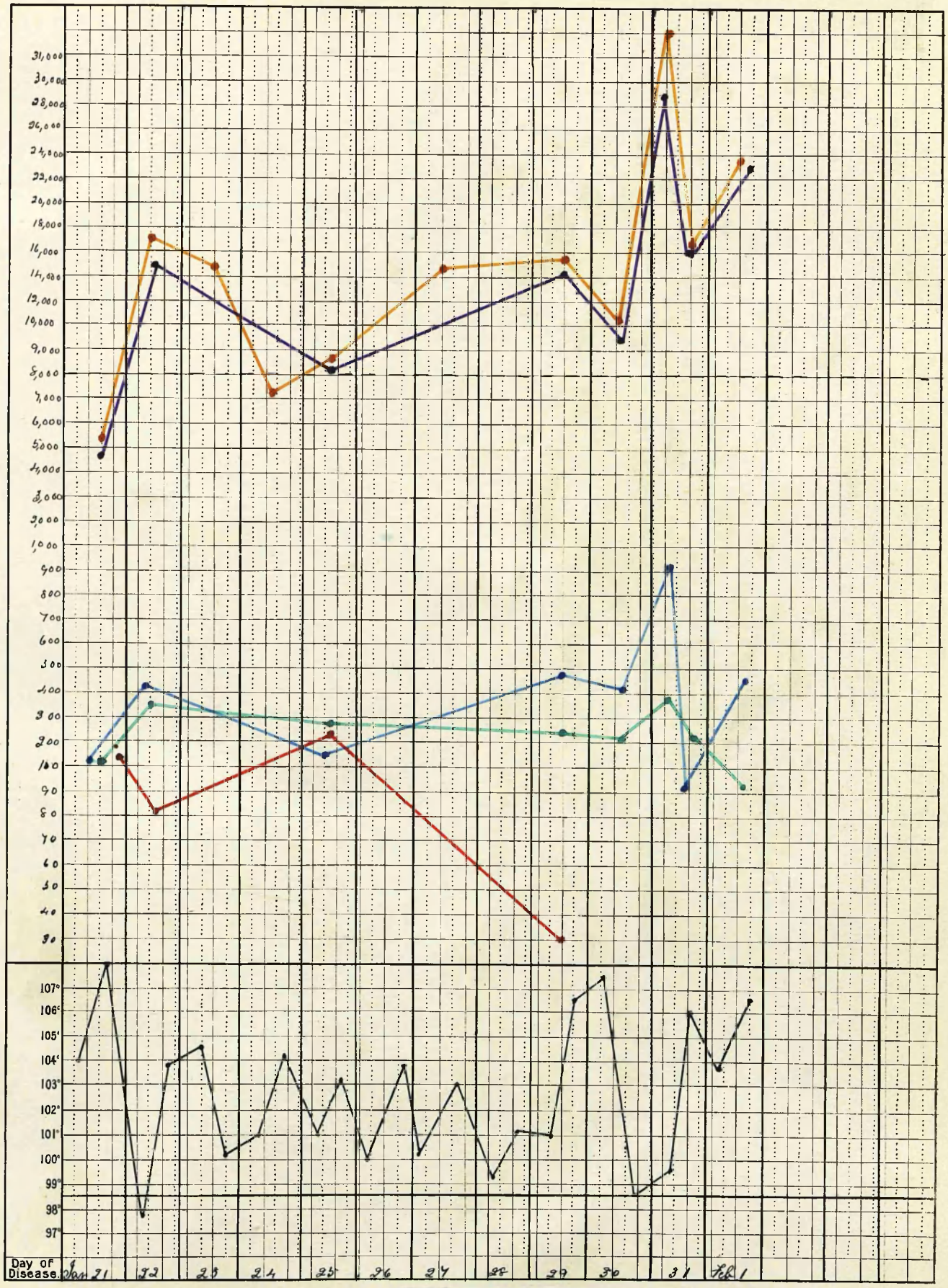
29 In count of 400 one myelocyte was seen

31 3 p.m. Count of 400, three myelocytes and one red nucleated corpuscle and several transitional forms

31 8 p.m. In count of 500 one red nucleated corpuscle found

Feb. 1 In count of 500 one myelocyte seen and only two lymphocytes

CASE XII


31,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Jan 21
22
23
24
25
26
27
28
29
30
31
Feb 1
Total number in Wet-counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears
Absol. number of Eosinophiles

CASE XII, Mrs. D., Aet. 23 years.

Admitted 21st January, 1903; died 1st February.

She was delivered of her first child on 18th January, when labour was considered normal.

On the morning of the 20th she noticed that the lochial discharge had a foetid odour, and later in the day a rash appeared over the whole body.

On admission to hospital her temperature was 104°, pulse and respiration 132 and 28 respectively. She appeared a fairly well nourished woman. Over the face, trunk, and limbs there was a vivid scarlatinal rash.

The palate and fauces were congested, but the tonsils were little enlarged, and there was no exudate. The tongue was moist and furred, and tending to desquamate.

The breasts were distended and painful on pressure, especially the left, which was filled with firm nodules, each about the size of a pigeon's egg. These she stated were recurrent, and disappeared altogether at times. There was some glandular swelling in the right axilla.

Examination of the chest was negative.

The abdomen was not distended, but somewhat tender.

The fundus uteri could be felt almost on a level with the umbilicus.

On pelvic examination the os was somewhat contracted, and owing to her condition, the cavity of the uterus could not be thoroughly examined with the finger. It was, therefore, gently curetted, and a piece of membrane removed. The body of the uterus was moveable, and nothing abnormal was found in the region of the broad ligaments.

A rigor occurred a few minutes after the operation, and her temperature rose to 108°, but by noon of the following day it had fallen to normal after frequent sponging.

On the 22nd the fetus of the lochia had disappeared, the abdomen was less tender, and she felt somewhat better. The rash had also faded considerably.

On the 23rd her temperature again rose to 104°6, while her pulse and respirations numbered 156 and 38 respectively. These, however, gradually fell until by the 28th the temperature for the day averaged 100°3, and pulse and respirations numbered 98 and 19 respectively. The rash had somewhat faded; the throat was still con-

gested. The tongue had desquamated, was rather dry centrally, and its papillae were markedly prominent, the whole typically scarlatinal in character. Owing to deafness and headache the quinine, of which grs. V had been taken 4 hourly since the previous day, had to be stopped.

On 29th January her temperature again rose to 104°6, her face was sallow in colour, the skin dry, and the tongue furred. It was deemed advisable to try the effect of antistreptococcic serum. 20 c.cs. were therefore slowly injected into the right median vein at the elbow at 5 p.m. By 8.30 p.m. the temperature registered 106°6, while the pulse was feeble and rapid. Strychnine gr. 1/30 was injected subcutaneously, and she was placed in a cold pack, but this had little effect upon the temperature. At 10.15 p.m., therefore, antipyrin and phenacetin aa grs. V were given.

By the morning of the 31st her temperature had fallen to 100°4 when it again rose, registering 107°6, and she was seized with a rigor. The pulse became very feeble, and numbered 160 in the minute. Champagne and whisky were given, but the pulse did not react, and could scarcely be counted. Her colour was sallow, and slightly

cyanosed. She felt extremely weak, and had an intense feeling of nausea, but was perfectly conscious, and expressed the desire to sign her will, which she succeeded in doing.

Three rigors occurred in the morning, one of which lasted 20 minutes. She became restless and talkative, and the sickness persisted.

On 1st February the symptoms became more marked, the pulse was uncountable, and she appeared to experience intense cardiac pain. Death occurred at 9.45 a.m.

AT THE AUTOPSY there was little to be made out. The lungs and heart appeared practically normal. The spleen, however, was diffluent.

The uterus contained a small amount of thick blood-stained fluid, but no solid debris, and there was no fetor. The rash had practically disappeared.

A stab culture made from the spleen proved sterile, and no microorganisms were found in the sections of the tissue cut.

In considerating this case the questions which first

arise are:- Was it really scarlet fever infection plus puerperal septicemia, or was it simply the latter condition accompanied by a brilliant septic rash, which was typically scarlatinal in character? It is well known that rashes, which are quite indistinguishable from that of scarlatina, occur in certain septic conditions, but these, as a rule, rapidly disappear, and are not followed by desquamation. Though the patient did not live sufficiently long to allow of desquamation, yet there were other symptoms present to decide the diagnosis. The congestion of the fauces, the peeled tongue with markedly prominent papillae, and the fact that her baby was admitted to Ward 23 a week or two later with typical scarlatinal desquamation of the palms of the hands, altogether settled the diagnosis.

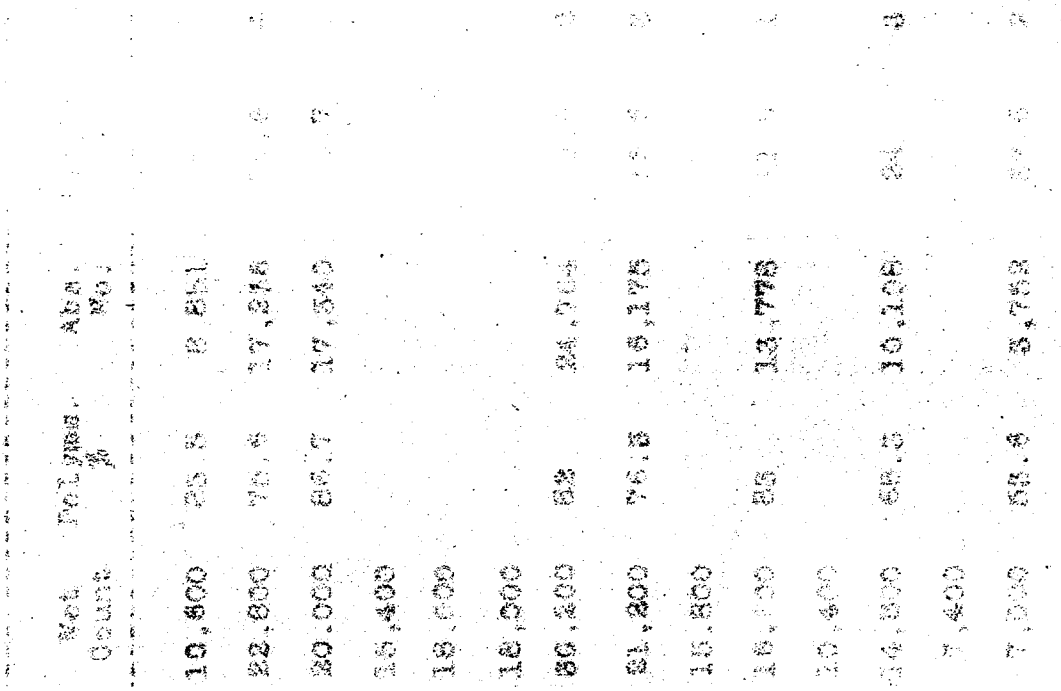
Another point in favour of this diagnosis was added by an examination of the blood, when the comparatively high percentage of eosinophiles were found present, viz., 35. Cabot, Da Costa, Zappert, Kotschetkoff all agree upon this point, though the last observer states that eosinophiles may be temporarily absent at the very beginning of the scarlatina in favourable cases.

The number of leucocytes varied greatly from day to day, and it is difficult to account for these sudden changes. The first estimate of the fresh blood was made on the day of admission, when a leucopenia was found to exist, and this unexpected result was verified, as also on 24th and 25th January, by more than one estimation. Such a result made up further by 91% of the polynuclear variety had an unfavourable significance, and suggested inability on the part of the hemogenic tissues to react to the circulating toxines.

On the following day, however, a moderate leucocytosis (16,400) was found. On the 24th and 25th, however, the wet blood estimate was practically normal, though there was no improvement in the patient's general condition. (The high percentage (ranging from 91 to 97.8) of polynuclear cells was constantly present throughout the illness.) No relation is apparent between the leucocytic curve and the occurrence of rigors, for after the first the leucocytes numbered 10,200, and rose to 31,000 on the following day (31st January), while on 1st February, though several rigors had occurred, the leucocyte count had fallen to 23,800.

No marked change in the number of leucocytes resulted from the intravenous injection of serum, unless it were the temporary fall from 15,600 to 10,200 on the following day. The differential estimate shewed little change. The fall in number might be accounted for by the accumulation of the leucocytes in the pulmonary capillaries.

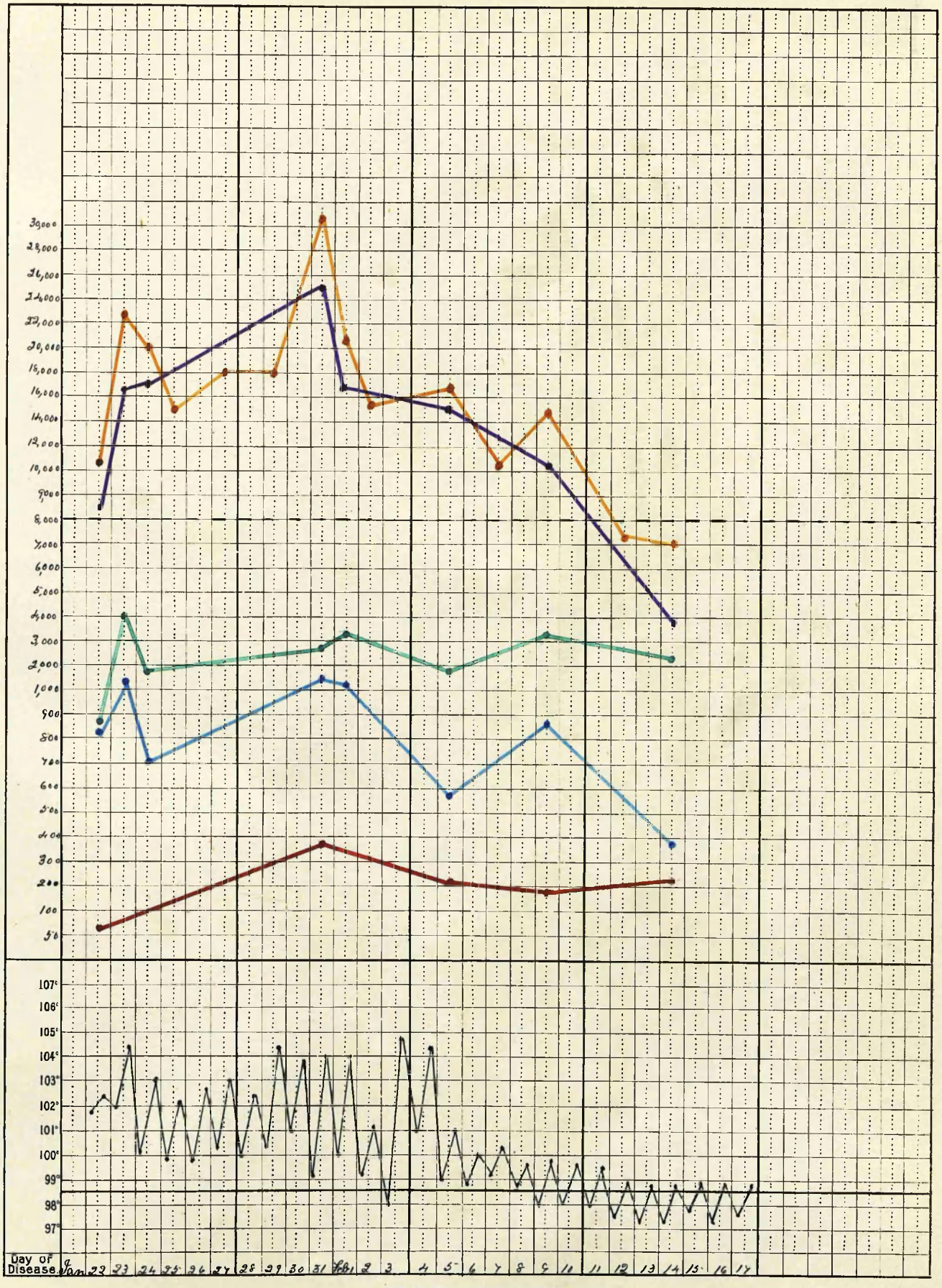
It will be noticed how the eosinophile cell disappeared as the patient's condition became grave, and how red nucleated corpuscles and myelocytes made their appearance.



CASE XIII. Mrs. M., Aet. 20 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	Myels.	
Jan. 22	10,600	83.5	8,851	8.2	869	8	848	.5	53		
23	22,800	75.6	17,236	17.6	4,012	6.6	1,504				
24	20,000	86.7	17,340	9.7	1,940	3.5	700				
25	15,400										Red count 2,544,000
27	18,000										
29	18,000										Chol. 3 administered
31	30,200	82	24,764	9.6	2,899	5.6	1,691	1.3	392	1.3	
Feb. 1	21,200	76.3	16,175	15.6	3,307	5.3	1,123			2.6	
2	15,800										
5	16,600	83	13,778	11.6	1,925	3.6	597	1.3	213	.3	
7	10,400										
9	14,800	68.3	10,108	24	3,552	6	888	1.3	192	.3	
12	7,400										
14	7,000	53.6	3,752	37.6	2,611	5.6	392	3	210	.3	

CASE XIII


30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
50
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
Jan 22 23 24 25 26 27 28 29 30 31 Feb 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Total number in wet counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of Mononuclears
Absol. number of Eosinophiles

CASE XIII, Mrs. M., Aet. 20 years.

Admitted 22nd January, 1903; dismissed well, 7th March, 1903.

History. On 17th January the patient was delivered of a live child in her own house, a maternity nurse attending. The temperature rose two days later, and she was removed to the maternity hospital, where the uterus was curetted, and some very septic endometrium removed. The temperature oscillated between 102° and 104°, and she was therefore transferred to Belvidere on the 22nd.

On admission she appeared well nourished, though pale.

Her breasts were distended, and the right was painful, where a saline infusion had been given before admission. She had little or no complaint except weakness.

Examination of the chest was negative, except for slight prolongation of heart's first sound at the base.

Spleen and liver were apparently normal.

Abdomen not unduly distended, but some tenderness over lower part.

Fundus uteri palpable about level of umbilicus.

Per vaginam the uterus moveable, os slightly patulous. Surrounding parts swollen and painful. There was nothing definitely abnormal in the region of the broad ligaments.

Disease ran a somewhat protracted course. On 29th January pus was withdrawn by exploratory needle from right breast, which had therefore to be incised, and about oz. V pus evacuated. On the 31st leucocytes numbered 30,200, of which 82% were polymorphonuclear, while 1.3% were myelocytes.

On 5th February the polynuclear neutrophile variety were 83% of a wet preparation of 16,600, and she was not making satisfactory progress.

On vaginal examination there was some perimetritic thickening in region of posterior fornix, causing some fixation of the uterus. By 14th February the blood count had fallen to 7,000, and the temperature remained normal until dismissal. The polymorphonuclear cells had fallen to 53.6%, but myelocytes were still found to the number of .3%. Though the temperature remained normal a small

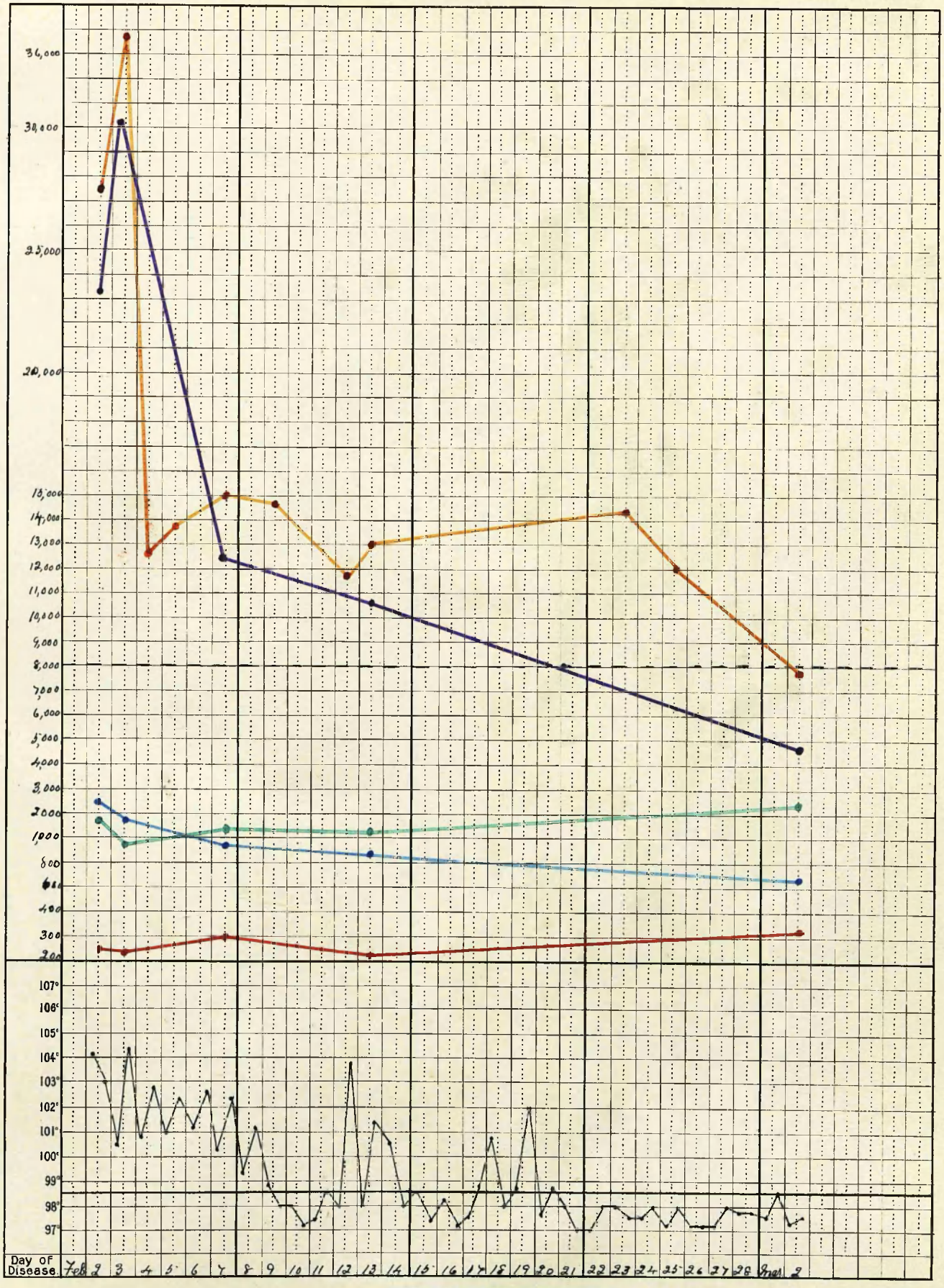
secondary abscess formed in the right breast, and had to be incised.

From that date gradual recovery took place, and she was dismissed on 7th March.

CASE XIV. Mrs. D., Aet. 21 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Eosin. %	Abs. No.	
Feb. 2	27,800	84.3	23,435	6.6	1,834	8	2,224	1	278	Curetted, Quin. sulph. grs. V 4 hourly, douched
3	36,800	91.7	33,745	2.7	993	4.7	1,729	.7	256	
4	12,600									
5	13,600									
7	15,000	83.6	12,540	8	12,000	6.3	945	2	300	
9	14,600									Quin. stopped on 8th, temp. normal
12	11,800									Temp. 103°8
13	13,000	82.6	10,738	9	1,170	6.6	858	1.6	208	
23	14,400									Temp. normal
25	12,000									"
Mar. 2	7,800	57	4,446	30.6	2,386	8.3	647	4	312	Allowed up yesterday

CASE XIV


36,000
30,000
25,000
20,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2000
1,000
800
600
400
300
200
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease
Feb 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 Mar 2
Total number in wet-counts
Absol. number of Polymorpho.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears.
Absol. number of Eosinophiles

CASE XIV, Mrs. D., Aet. 21 years.

Admitted 2nd February; dismissed 18th March.

Her first confinement took place 12 days before admission, when labour lasted for 54 hours. A female child delivered alive with instruments. The placenta was removed immediately after in a broken condition. Several days later the lochial discharge became fetid, and she experienced headaches, sickness, and nausea. No rigors occurred. She had also experienced pain in the lower part of the abdomen, especially on the right side. Her bowels had been regular, and there had been no difficulty in micturition.

On admission to the ward she looked acutely ill, and at least 10 years older than her age. Her eyes appeared sunken, and the tongue furred, and the skin slightly moist.

Her temperature registered 103°.2. The pulse numbered 138 in the minute, and was regular, but easily compressible, and respirations numbered 30.

Examination of the chest was negative except for

some sibilant rales being audible over the back. She had a slight cough, but little or no expectoration.

The abdomen was neither distended nor painful.

The lower margin of splenic dulness corresponded to left costal margin.

The fundus uteri could be felt almost on level of umbilicus. There was partial rupture of the perineum, and the stitches had apparently sloughed, and the wound looked unhealthy.

The body of uterus was freely moveable on pelvic examination, the os was patulous. There was nothing abnormal to be made out in the region of the broad ligaments.

The cavity was curetted and douched out daily.

The maximum leucocytosis occurred on the second day after admission, 36,800, but dropped suddenly to 12,600 on the following day, and did not again exceed 15,000 up to time of dismissal. The number of leucocytes, however, remained above normal, independently of the temperature, which became normal on 9th February, though a leucocytosis was present for several weeks later.

The sudden and unexplained rise of temperature on

12th February to 103.8 was not accompanied by any marked change in the blood estimate. The eosinophiles were constantly present in the fibres examined, rising in number to 312 in cb.mm. by the time she was allowed up, and this fact was to be regarded as a distinctly favourable sign.

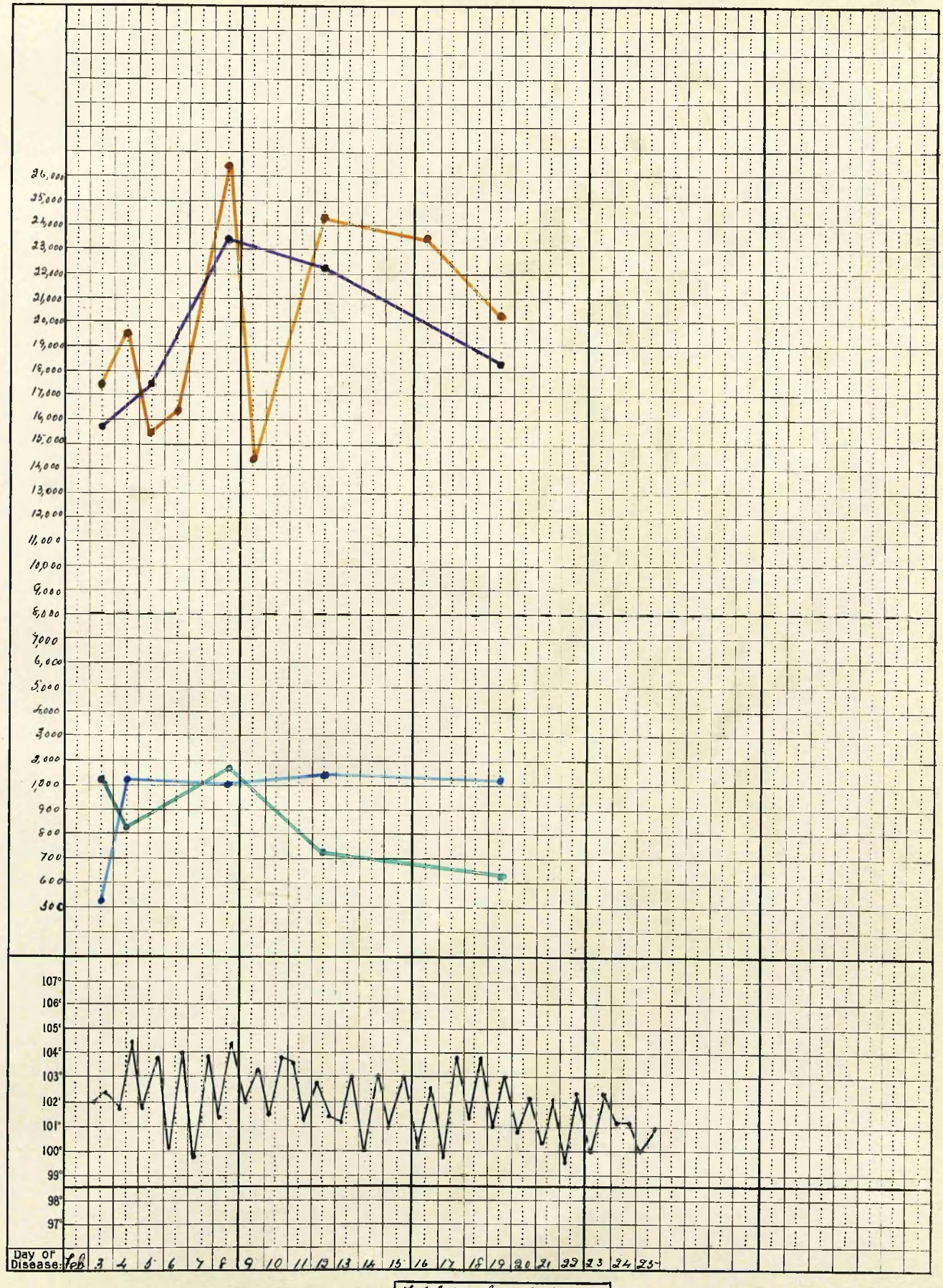
She was dismissed well on 18th March.

CASE XV. Mrs. H., Aet. 25 years.

Date	Total Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.
Feb. 3	17,400	91	15,834	6	1,044	3	522
4	19,600	89.3	17,502	4.3	842	6.3	1,234
5	15,600						
6	16,400						
*8	26,800	88.3	23,664	7	1,876	4	1,072
9	14,600						
12	24,400	91.3	22,277	3	732	5.6	1,366
16	23,600						
19	20,200	91.6	18,503	3	606	5.3	1,070

N.B. On March 8th film shewed two cells resembling myelocytes. These have been classed with the mononuclears.

CASE XV


26,000
25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease: Feb 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
Total number in wet counts
Absol. number of Polymorphs
Absol. number of Lymphocytes
Absol. number of L. mononuclears

CASE XV, Mrs. H., Aet. 25 years.

Admitted 3rd February, 1903; died 27th February.

Her second confinement occurred 10 days before admission. A midwife attended. The labour lasted three hours, and a seven months' child (still-born) delivered. The placenta expelled immediately. Discharge at first copious and inoffensive, but seven days later she was seized with a rigor, which lasted about two hours, followed by pain in the lower part of abdomen. From that time lochia scanty and fetid, with accompanying headache, sickness and vomiting. For several months she has had a troublesome cough with expectoration.

On admission temperature 102°. Pulse 112 in minute, regular, but easily compressible. Respirations 30. She looked acutely ill, pale and haggard, and appears much older than her years. She had a troublesome cough with mucopurulent expectoration. Heart's sounds toneless in quality.

Lungs, percussion note impaired over right apex, especially behind about level of third dorsal spine,

where breathing tubular in character. On auscultation, moist, crackling and cooing rales audible all over the chest.

No pain or rigidity of abdominal wall on palpation, but fundus uteri still palpable above pubes.

Per vaginam, cervix high up, but the body of uterus freely moveable. Nothing abnormal detected in broad ligaments. The os patulous admitting a finger, the endometrium roughened, and thrown into folds. Cavity curetted and douched.

6th February. Physical signs of consolidation of both lungs more marked. Whispered pectoriloquy was present. Expectoration abundant and numerous tubercle bacilli present in sputum.

27th February. Her condition became gradually worse though uterus practically involuted, and all discharge ceased. Subjective symptoms referred to respiratory system. Sitting up in bed brought little relief. Pulse became feeble and soft. Breathing became more and more laboured, and about 4.30 a.m. the patient died rather suddenly.

AUTOPSY. Body much emaciated. Pericardial sac continued about oz. I clear fluid. With much difficulty the lungs were removed from thorax, owing to strong adhesions. These were most marked upon left side. Both lungs were markedly involved by the tubercular process and cavities in apex of left. On section a creamy pus exuded from many orifices. Liver was fatty. Numerous tubercular ulcers found in ileum. Uterus involuted.

It will be seen that a well marked leucocytosis was present from admission until time of death. Such a condition is unusual in early tuberculosis, but in the present case the disease was advanced, and was probably much exaggerated by secondary infection occurring.

Under these circumstances a leucocytosis is to be expected, as was present in this case, with a decided rise in the number of the polymorphonuclear cells - here the percentage varied between 88.3 and 91.6. The proportion of small lymphocytes remained decidedly low, while the large mononuclear cells were distinctly increased in number, and this is made evident on looking at the chart where the blue line rises abruptly above the green. The significance of this fact is uncertain. The eosinophile cells remained persistently absent.

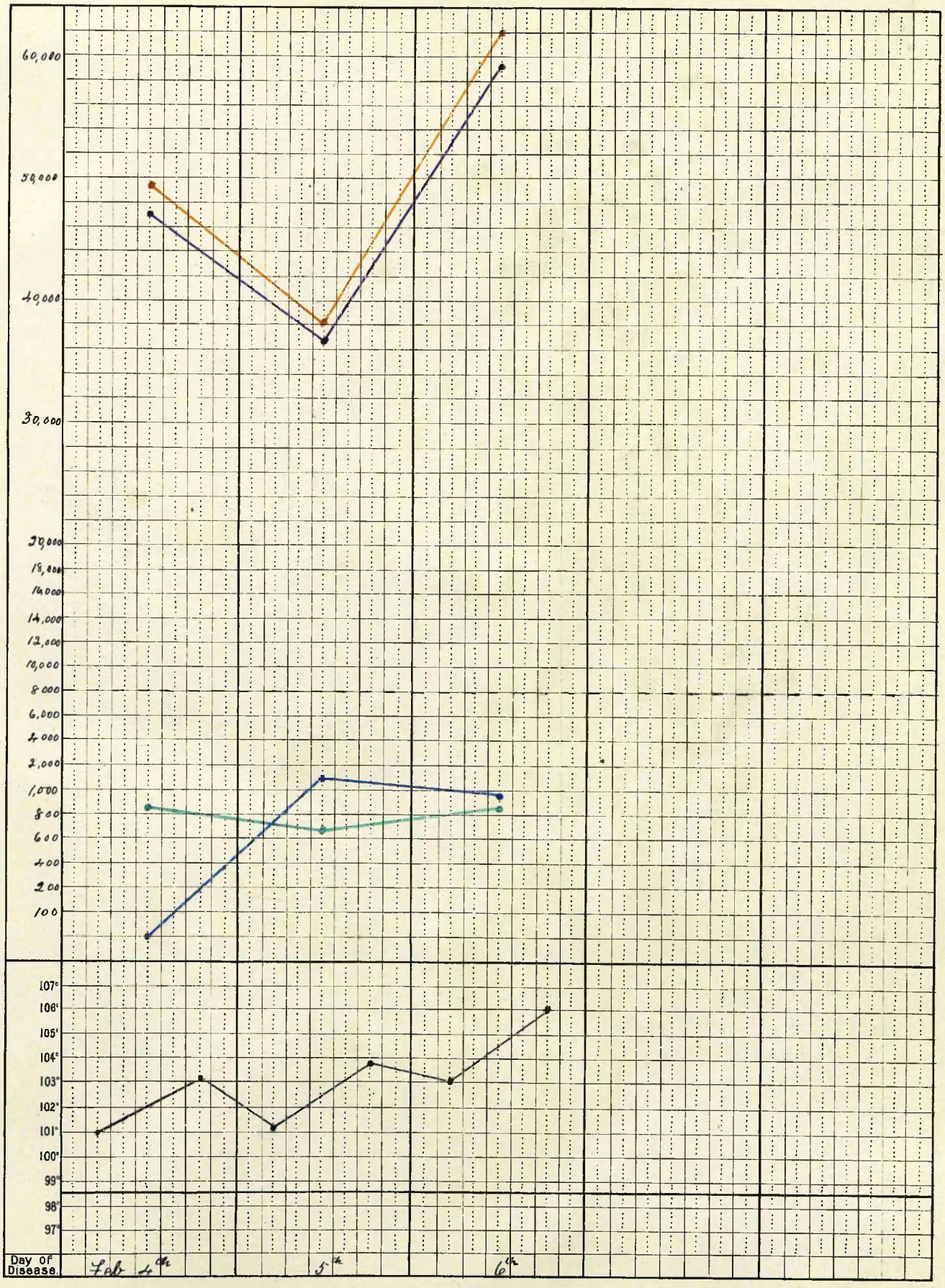
CASE XVI. Mrs. D. Aet. 22 years.

CASE XVI. Mrs. D., Aet. 22 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Red Nuc. Corp. %	Myels. %
Feb. 4	49,600	95	47,120	1.7	843	.2	99		.5
5	38,600	93.6	36,129	1.8	694	3.4	1,312	.1	.1
6	61,000	96.3	58,743	1.5	915	1.6	976	.1	.3

Final observation, count of 800, made at 7.30 a.m. Died at 8.30 a.m.

CASE XVI



Total number in Wet-count.
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears

CASE XVI, Mrs. D., Aet. 22 years.

Admitted 4th February, 1903; died 6th February.

The patient was admitted on 4th February. Her first confinement took place 10 days previous to admission. A midwife was in attendance. The labour lasted 19 hours, when the child was delivered at full time alive. The placenta was expelled immediately. On the third day a severe rigor occurred with sickness, vomiting, and severe abdominal pain. The lochia became fetid, and she suffered from diarrhoea and flatulence. For the previous six weeks she had been subject to a troublesome cough with a slight expectoration and shortness of breath.

On examination she was pale and emaciated. The tongue was fairly clean, moist, but flabby. Temperature 101°6. Pulse numbered 152, was feeble but regular. Respirations 44 in minute. Hearts sounds were scarcely audible owing to their toneless quality, and her noisy breathing.

There was dulness to percussion over the right chest in front, where the respiratory murmur was harsh

and expiration prolonged. Behind the percussion note was resonant.

The abdomen was rather prominent and tender. Percussion note over left flank was tympanitic, but dull over right.

Spleen appeared somewhat enlarged.

The rigidity of the abdominal muscles hindered palpation.

On pelvic examination the os readily admitted tip of finger. Uterus freely moveable, but some thickening posteriorly. The discharge was fetid, and the interior surface was roughened. The cavity was curetted, and, owing to bleeding, it was packed with iodoform gauze.

6th February. The patient remained acutely ill. The pulmonary and general septic symptoms became more pronounced. The pulse feeble and numbered 150 in the minute. The face was pale and pinched. She died at 8.30 a.m.

AUTOPSY. Both lungs were covered with thick plastic purulent exudation, and the septic process involved almost the whole lung substance. The abdominal contents were glued together with thick purulent, almost gelatinous,

substance which could be picked off in considerable quantity from between the coils of intestine.

Uterine cavity contained a considerable quantity of placental debris, which was firmly adherent. The broad ligaments were congested, while in the right was an abscess the size of a small marble, containing creamy pus.

The spleen was semi diffluent, and the liver was soft, and flabby in character.

In this case the rapidity of the pulse, the rising temperature, the high degree of leucocytosis, with the appearance of abnormal elements in the blood stream, all pointed to an intense poisoning. Grawitz is of the opinion that the leucocytosis is likely to be greater when a purulent exudate occurs, and the condition present in this case strongly supports this view, as the final leucocytosis noted here was the highest blood estimate made in the whole series of cases.

CASE XVII. Mrs. M., Aet. 29 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Red Nuc. Corp.	Myels. %
Feb. 18	8,400	73.2	6,148	21.6	1,814	3.8	319	1.4	
19	5,800	82.6	4,790	13.6	788	.3	17	3.3	
20	10,000								
21	12,000								
22 3.30 p.m.	7,000								
Midnight	20,600	75.5	15,553	14.2	2,925	5.2	1,071	3.5	1.2

Feb. 18 Erythrocytes 1,620,000

Hemoglobin 15%

22 Erythrocytes 1,456,000

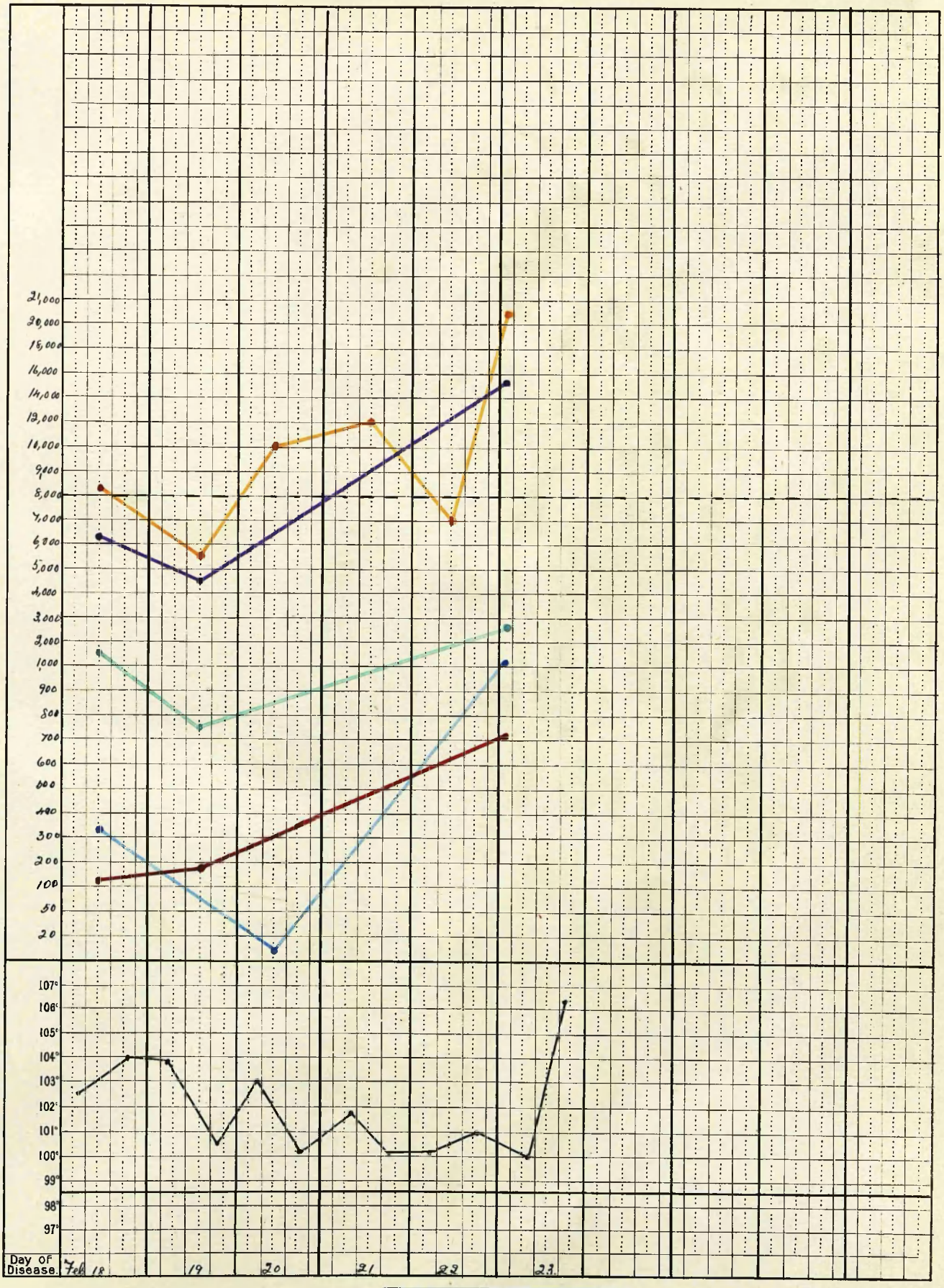
Hemoglobin 16%

18 Red cells markedly irregular in shape

In count of 500, 7 nucleated red corpuscles

22 In count of 400, 13 red nucleated cells

CASE XVII


21,000
20,000
18,000
16,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
50
20
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Feb 18
19
20
21
22
23
Total number in Incl-counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of L. Mononuclears
Absol. number of Red nucleated corpuscles

CASE XVII, Mrs. M., Aet. 29 years.

Admitted 17th February, 1903; died 23rd February, 1903.

History. Her fifth confinement took place 18 days previous to admission; midwife in attendance. Labour lasted 14½ hours. Child delivered alive. Placenta expelled ½ hour later in broken condition. Bleeding profuse for first 48 hours. On morning of second day rigor for 20 minutes occurred, and soon after, severe pain in lower part of abdomen. On fifth day discharge became scant and offensive. Vomiting and sickness since onset of illness. On tenth day severe pain and swelling of both legs. Except for slight cough at times previous health had been good.

On examination she was indifferently nourished, and intensely pallid. Tongue blanched and baked in appearance. Skin dry and hot. Pulse 132 regular, easily compressible. Respirations 40 in minute. Pupils moderately dilated. Temperature 102°6.

Heart's sounds toneless, and first sound accompanied

by faint systolic whiff. Lungs clear to percussion, but on auscultation widespread sibilant and coarse moist rales audible. Some distension and considerable tenderness over lower part of abdomen.

Per vaginam os patulous. Cervix dilated with Hegar's dilators, and cavity curetted. Some old placental tissue removed. Owing to vomiting, whisky and saline fluid per rectum.

22nd February. Dark red patch appeared on tip of nose, which increased in size until greater part of nose appeared deeply cyanosed. Colour is fixed. Complaint of pain in legs with considerable oedema. Heart's sounds irregular in rhythm with dyspnoea.

23rd February. Died 4.30 a.m.

AUTOPSY. Lungs - old adhesions, oedema with partial consolidation at base of left lung. Heart muscle pale with some fatty infiltration.

Spleen enlarged; and rather firm.

Uterus - walls thin, involution fairly satisfactory. Cavity contains little or no debris.

Veins of the broad ligaments on section markedly thrombosed, and process extended along the broad ligament. No peritonitis. Dark red colouration of nose persisted after death.

This case, therefore, may be looked upon as one of very acute septicemia with little resistance on the part of the tissues generally. The blood count remained practically normal throughout the disease, from time of admission to the ward. Red nucleated corpuscles, however, were present from the first, and that, along with the marked anemia, indicated the virulence of the infective organism. There was little or no relative increase in the polynuclear variety, and this was the case even a few hours before death, when the leucocytosis (probably preagonal) of 20,600 was found to exist. Here the polymorphonuclear cells were present only to the extent of 75.5%, and is, in this respect, to be compared to Case XVIII, where the final blood count was 21,800, of which 78.2% were the polynuclear neutrophile variety. These two results would appear to differ considerably from those found in the other cases as, e.g., Case XVI, where the final leucocytosis was 61,000, of which 96.3% were the

polymorphonuclear variety.

The discolouration of the nose is probably to be explained by its being due to a septic thrombus, and may be compared to a case quoted by Grawitz (Internat. Clinics 1894, p. 48). This case he terms as one of Foudrayante sepsis, in which, on the night of abortion at second to third month, deep cyanotic patches appeared upon the nose and cheek, and the red corpuscles numbered 300,000. Death occurred, in this case, upon the second day.

Cultures made from odourless blood clots from the uterus were saturated with minute cocci.

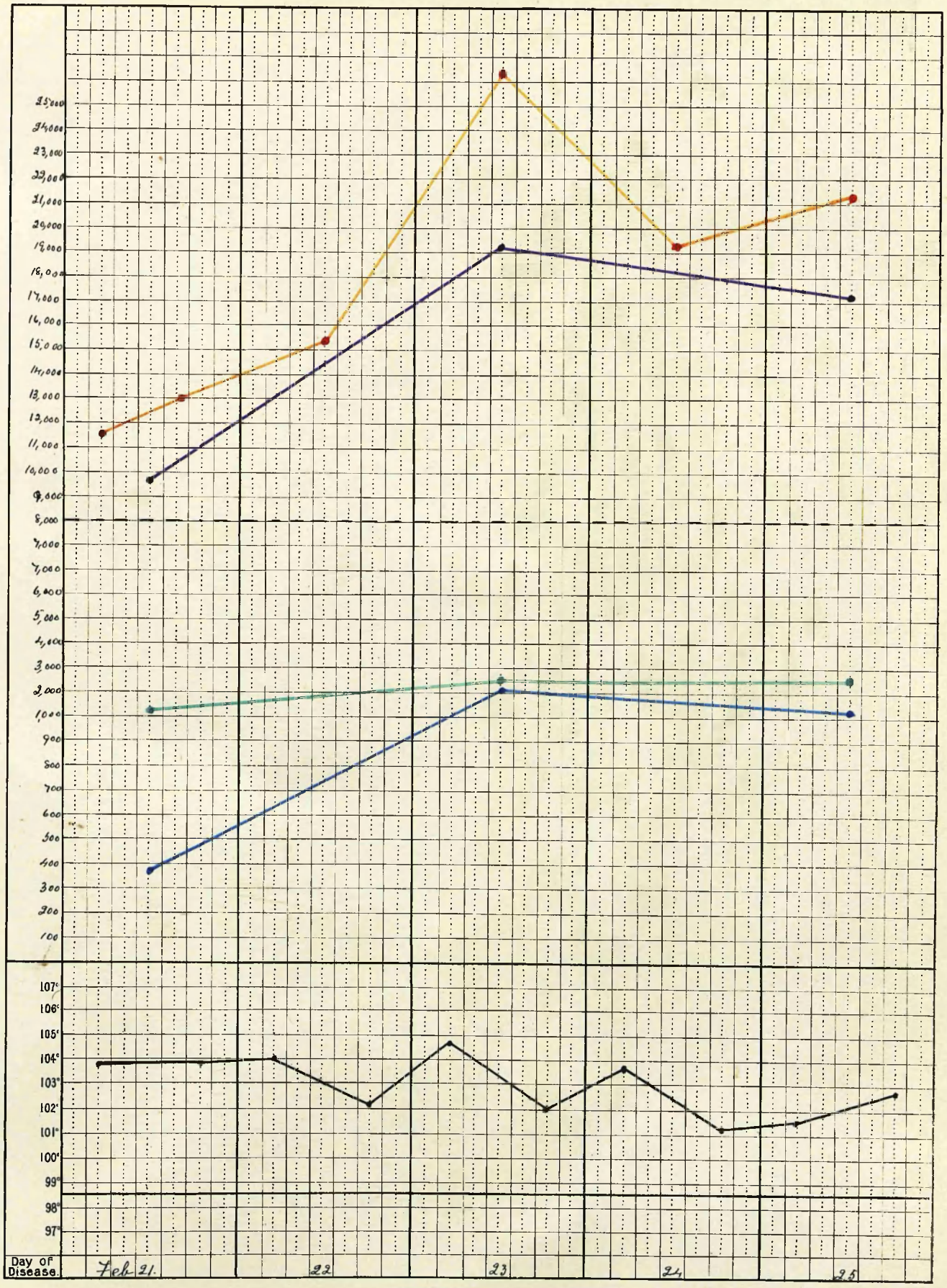
Sections cut from the spleen in the present case also shewed numerous organisms - bacilli and cocci.

CASE XVIII. Mrs. McC., Aet. 30 years.

Date	Wet Count	Polyms. %	Abs. No.	Lymphs. %	Abs. No.	Large Mons. %	Abs. No.	Red Nuc. Corp. %	Myels.
Feb. 21 4 p.m.	11,800	84.3	9,947	12.3	1,451	3.3	389		
11.30 p.m.	13,000								
22 3.30 p.m.	15,800								
23 3.45 p.m.	25,600	76.3	19,532	11	2,816	6.6	1,689		
24 4 p.m.	19,600								
25 4 p.m.	21,800	78.2	17,047	12.8	2,790	5	1,090	2.6	1.4

N.B. On Feb. 25th in count of 500, 13 red nucleated cells were present and 7 myelocytes

CASE XVIII


25,000
24,000
23,000
22,000
21,000
20,000
19,000
18,000
17,000
16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Feb 21.
22
23
24
25
Total number in Red-counts
Absol. number of Polymorphs.
Absol. number of Lymphocytes
Absol. number of Mononuclears.

CASE XVIII, Mrs. McC., Aet. 30 years.

Admitted 21st February, 1903; died 27th February, 1903.

She was admitted with the following history. Her third confinement took place five days previously. Labour lasted 11 hours. Male child, breech presentation, and instruments were found necessary. The child was stillborn. Placenta expelled immediately after, and is said to have been in "good condition". Three days later discharge became scanty and fetid. There was frequent retching, and a more or less constant complaint of pain in left side of abdomen. There had been no vomiting or rigors.

She had had two abortions previously at the third and sixth months. This patient was exceedingly stout, looked ill, and the tongue rather dry and furred. Pulse numbered 132 in minute, regular, but easily compressible, and respirations 24 per minute. Temperature 103°.8.

Examination of chest negative.

Abdomen. The fundus uteri was palpable about level

of umbilicus, and there was tenderness, especially in left iliac region.

Liver and spleen apparently normal.

The perineum was completely ruptured, involving the sphincter ani with consequent incontinence of feces, and the surfaces of the wound appeared extremely septic. On vaginal examination, relation of the parts obscured by amount of laceration. The cervix was torn, and part hung down in the form of a loop.

The uterus was douched and perineal wounds swabbed with pure carbolic.

21st February. Delirious. Pulse numbered 174 in minute. Lochial discharge was extremely fetid.

26th February. Has remained gravely ill. Sudden rigidity of right side, and ptosis of right eye. The former disappeared quickly, but death occurred at 2.30 p.m.

No autopsy was obtained.

This was an acutely septic case. The temperature reached its maximum of 104°.8 on the third day, when it fell gradually for the following three days to 101°.4, when death occurred. The pulse was characteristic of

septicemia remaining about three days at rate of 160 in the minute. A feature of the blood was its tendency to coagulate immediately on touching the coverslip. The varying size of the polymorphonuclear elements was also noticeable, while they were found present on the day before death occurred in the comparatively low percentage of 78.2. The average leucocytosis was approximately 17,900, but the relation of the various forms was not markedly affected. The last count is worthy of note for red nucleated corpuscles and myelocytes appeared in considerable number.

------oOo------

In drawing up the foregoing charts, shewing the results of the estimates in the fresh blood, and the absolute numbers in which each of the different elements occur, it will be seen that an orange yellow line has been chosen to represent the former, while a violet line graphically denotes the rise and fall in the number of the polymorphonuclear leucocytes. One is immediately struck by the fact that the orange and violet curves run practically parallel to one another throughout the whole series of charts. In other words, when a leucocytosis exists it is due almost entirely to an increase in the number of the neutrophile cells, both absolute and relative, while the mononuclear cells shew a proportionate diminution in their number.

We may now consider in greater detail the behaviour of these orange and violet curves. The interrupted black line upon the charts has been drawn to represent approximately the normal number of leucocytes present in the peripheral circulation.

It will at once be seen that at one time or another the orange line in every case rises considerably above

this base, shewing that a leucocytosis was always found at some time during the course of the disease.

The degree of leucocytosis, as has already been indicated, varied very considerably in the eighteen cases of undoubted puerperal fever here tabulated. The average maximum leucocytosis of the series of eighteen cases is found to be twenty-seven thousand five hundred, but the maximum estimate in the fresh blood made in the different cases will be seen to vary between fifteen thousand and sixty-one thousand. The former blood count was made from a patient who rapidly recovered, while the latter observation was made in another case three quarters of an hour before death. The following is a list shewing the maximum leucocytosis of the eighteen cases:-

			Number of Cases	Number of Deaths
Between	15000 & 20000	leucocytes per chmm. =	4	0
"	20000 & 25000	" =	5	1
"	25000 & 30000	" =	3	2
"	30000 & 35000	" =	2	1
"	35000 & 40000	" =	2	1
"	40000 & 45000	" =	1	0
Above	60000	" =	1	1

It will be seen that in 50% of the total number of cases the maximum leucocytosis ranged between fifteen thousand and twenty-five thousand, while the remaining cases arrange themselves in groups gradually diminishing in size as the leucocytoses approach the maximum of sixty-one thousand.

It has already been indicated that the degree of leucocytosis, per se, does not necessarily indicate the severity of the disease, and that a prognosis could rarely be based upon the blood examination alone.

A list of the fatal cases is given in the above table with the maximum leucocytosis which occurred at some time during the course of the disease. The leucocytic curve, however, may not be at its highest point shortly before death, as in Case VIII where the maximum blood count of thirty-nine thousand was made on the first day in hospital, but where the white cells had fallen to eight thousand four hundred a few days before death, and three months after admission to the ward. On studying the curves, however, of those other cases (XII, XVI, XV, XVIII, XVII) which ended fatally, such a fall would ap-

pear to be exceptional, and as a rule a preagonal leucocytosis is more likely to occur. To facilitate the study of the relation of the febrile disturbance to the leucocytosis, the temperatures were taken four hourly, and the highest and lowest reading for the day have been registered on these charts.

Kanthack held that the temperature and the leucocyte curves often run independently of one another, as experimentally a leucocytosis may occur without any rise in the temperature. He found that the more marked the febrile reaction was the greater was the leucocytosis, but so far as his observations on rabbits went the leucocyte and temperature curves did not go together. Da Costa states that there is no relationship between the degree of increase and the degree of fever during the active stages of pneumonia.

On considering the whole series of the foregoing charts this fact appears to be borne out with regard to these two curves in puerperal fever also. It may be noted, however, in the charts of those cases which had a favourable termination the two curves as a whole tend to ap-

proach the normal line together, but it will frequently be seen that a sudden rise in temperature need not necessarily be accompanied by a rise in the number of leucocytes. Instances of this will be found in charts Nos. VII and VIII. That there may be a well marked leucocytosis a day when the patient's temperature is normal is a fact which is illustrated in the charts II, IX and IV.

RELATION OF RIGORS TO LEUCOCYTOSIS

The diagnostic value of rigors in puerperal sepsis is discussed in a report from Chrobak's Klinik in Vienna (Monats. f. Gebartsh u. Gyn., XVI, 1902), but no reference is made in any literature on the subject (as far as I have been able to find) to the relationship, if any, between the behaviour of the leucocytes and the occurrence of such a phenomenon. Rigors occurred in eleven of the cases in the present series, but in seven of these only on one occasion, and that for the most part before admission to hospital. In Bucara's report on two thousand five hundred and forty-one cases of puerperal fever (i.e. temperature once over 100° F.) he had seventy-eight cases

with rigor, excluding those immediately due to douching, injection of serum, etc. More than five rigors occurred only in pyemia, and out of twenty-four cases with this condition with rigor seventeen died.

In one of the foregoing cases (No. VII) it will be seen that nineteen rigors occurred during her stay in hospital, when frequent opportunities were afforded for making blood counts both before and after this phenomenon. It may here be stated that the cause of these rigors was afterwards found to be a deeply seated abscess in the upper part of the thigh, which was eventually evacuated under chloroform, and no further rigors occurred. On 27th January her temperature rose to 104°.6 at 4.50 a.m., when she was seized with a rigor. The leucocyte count on the afternoon of the same day was six thousand six hundred. On 2nd February a rigor occurred at 3 p.m., and the leucocytes, two hours later, numbered seven thousand, while she was again seized with a shivering at 11.15 the same night. On 5th February a rigor occurred at 6.10 a.m., and that afternoon a distinct leucopenia was found to be present, the white cells numbering only three thousand per cb.mm., and on the following day a similar count was

made, and another rigor occurred. The differential count shewed the varieties of leucocytes to be present in the following proportions. Polymorphs 78.6%, small lymphs. 14.6%, large mononuclears 6.6%, eosinophiles none, myelocytes .6%. Up to this time, therefore, examinations of the blood, both before and after rigors occurred, resulted in normal or subnormal leucocyte counts, but further observations proved that the behaviour of the white cells was quite unreliable with regard to basing any opinion as to the likelihood of such a phenomenon as rigor occurring. On 12th February another rigor occurred at 11.30 a.m., and the blood count was fourteen thousand two hundred. The differential count shewed polymorphs 87%, small lymphs 7.3%, large mononuclears 5.3%, eosinophiles .3%, myelocytes 3%. On 4th March there was a leucocytosis numbering twenty thousand two hundred at 5 p.m., and on 5th March at 3 p.m. the leucocyte count was nineteen thousand eight hundred, made up as follows:- polymorphs 88.3%, small lymphocytes 7%, large mononuclears 4.6%, eosinophiles none. On the same day the patient was seized with three rigors, each lasting about half an hour, at 3 a.m., 7 p.m., and 10.35 p.m. respectively. By 8th March the

leucocytes at 3.30 p.m. had dropped in number to seven thousand eight hundred, and a rigor, the last during the course of her disease, occurred at 10.30 p.m., and persisted for thirty minutes. The differential count on this occasion was polymorphs 88.3%, small lymphocytes 7%, large mononuclears 4.6%

In Case XII six rigors occurred during the course of her illness while in hospital. It is therefore of interest to compare the behaviour of the leucocytes here with that in the previous case. In doing so, however, we must bear in mind the facts that the first rigor occurred on admission after curetting, when the patient's temperature rose to 108°, and also that the intravenous injection of antistreptococcic serum adds further difficulties to the consideration of the leucocytosis, quite apart from the occurrence of rigors. On the evening of 21st January the leucocyte count was five thousand four hundred per cb.mm. A second count was made to corroborate this result. The differential count was polymorphs 91%, small lymphocytes 3%, large mononuclears 2.5%, eosinophiles 3.5%. A rigor occurred a few minutes after the operation of curetting. On the following day a considerable leucocytosis was

found to be present, the white cells numbering sixteen thousand four hundred per cb.mm., made up as follows:- polymorphs 95%, small lymphocytes 2%, large mononuclears 2.5%, eosinophiles .5%. No further rigors occurred until 30th January. On that day the leucocyte count was ten thousand two hundred, polymorphs 94%, small lymphocytes 2%, large mononuclears 4%, eosinophiles none. Serum had been injected on the previous day. On 31st January three rigors occurred at 1.30 a.m., 3.30 a.m., and 7 p.m. respectively, while at 3 p.m. the leucocytes numbered thirty-one thousand per cb.mm., and a count of four hundred shewed polymorphs 95.7%, small lymphocytes 1.2%, large mononuclears 3%, eosinophiles none, three myelocytes, and one red nucleated corpuscle, and at 8 p.m. sixteen thousand six hundred, and a count of five hundred shewed polymorphs 97.8%, small lymphocytes 1.4%, large mononuclears .6%, and one red nucleated corpuscle observed.

From these observations it will be seen that there is a decided lack of uniformity in the results obtained with regard to the number of leucocytes, or to a change in the different varieties either before or after the

occurrence of rigors. At one time a leucocytosis existed, at another a leucopenia was present. The percentage of polymorphs was either high or low. No prodromal symptoms therefore pointing to such a phenomenon being imminent are to be expected from an examination of a patient's blood.

RELATION OF ANTITOXIN SERUM TO LEUCOCYTOSES

Much work has been done chiefly by continental observers in experimentally induced leucocytoses. The experiments have consisted in the administration to animals of a large variety of drugs and various other substances by the mouth or subcutaneously. In this way Löwit ("Studien z. Physiol. und Pathol. d. Blutes" Jena 1882) studied the effects of such substances as pepsin, nuclein, filtered yeast cultures, etc., on the blood, and found that a more or less decided leucocytosis occurred preceded however by a temporary leucopenia. Wilkinson (B. M. J., 1896, Vol. II) published his results obtained with the injection of pot. iodid., salicine, quinine, antipyrine,

etc., which were similar to those of Löwit, but he found that by repeated injection of pilocarpine the granules of the polynuclear neutrophiles disappeared. Allusion has already been made to Kanthack's work on injection of bacterial cultures into animals. No investigations, however, have hitherto been made (as far as the writer is aware) upon the effect of antitoxin sera on the leucocytes present in the blood. The following observations therefore, though few in number, are worthy of consideration. Serum therapy was adopted in four cases of puerperal fever belonging to the present series, and also in a case of sepsis, which was not of puerperal origin, but owing to its peculiar interest has been included here.

Both antistreptococcic and antistaphylococcic sera were used. The former, obtained from Parke, Davis & Company, was injected subcutaneously, and also directly into a vein. The latter, supplied by Burroughs, Wellcome & Company, owing to its recent production and to the consequent lack of previous results published, was only administered subcutaneously. The technique adopted for the intravenous injection was as follows. The site chosen

for its administration was a superficial vein at the flexure of the elbow joint. The part was rendered thoroughly aseptic by the application of turpentine, methylated spirit, and carbolic lotion. The upper arm was then firmly bandaged, making the superficial veins stand out tense and firm. By this means the sterilised needle was readily introduced into the lumen of the vessel, thereby rendering a dissection of the part (which has generally to be done when dealing with infants in diphtheria) quite unnecessary. The bandage was then removed, and from 10 to 20 c.cs. of the antistreptococcic serum slowly injected. Any error in introducing the needle would quickly become apparent on injecting the serum by a superficial tumour forming near the site of the puncture.

The first case in which this treatment was carried out was in Case VI. On 2nd January her leucocytes numbered twenty thousand three hundred per cb.mm. A differential count shewed polymorphs 90.6%, small lymphocytes 8.6%, large mononuclears .6%, eosinophiles none. On the following day the leucocyte count at 3.45 p.m. was twenty-six thousand two hundred. Blood films made at the same time shewed polymorphs 91.5%, small lymphocytes 4.7%,

large mononuclears 3.7%, 10 c.cs. antistreptococcic serum were injected intravenously at 4 p.m., and a blood count again made at 9.45 p.m. The leucocytes then numbered twenty-one thousand four hundred, made up of polymorphs 92.6%, small lymphocytes 5%, large mononuclears 2.3%. On 4th January the white cells numbered twenty-eight thousand six hundred, and on 5th January thirty-one thousand, eight hundred. In this case, therefore, there was a temporary fall in the number of the leucocytes immediately after inoculation, while the number again rose on the following day, and the differential count shewed little variation throughout. The temporary fall in the leucocytosis is probably to be explained by a change brought about in the distribution of the blood cells - a larger number collecting in the deeper vessels - rather than by a dilution of the blood, for the quantity of fluid injected was small. The patient eventually made a good recovery.

The next case in which a similar treatment was adopted was Case VIII. This patient was admitted on 9th January. On the following day the leucocyte count was twenty-seven thousand two hundred, and she appeared

critically ill. Both lungs were involved by the septic infection. On 11th January the leucocytes numbered twenty-eight thousand six hundred, the differential count being polymorphs 90.6%, lymphocytes 6.3%, large mononuclears 3%. On the same day 9 c.cs. antistreptococcic serum were injected into a vein of the left arm. On 12th January the leucocytes numbered twelve thousand four hundred per cb.mm., while the different varieties were found present in the following proportions, polymorphs 90%, small lymphocytes 7.5%, large mononuclears 2%, eosinophiles .5%. On 13th January the white cells were sixteen thousand eight hundred, polymorphs 90%, small lymphocytes 5.6%, large mononuclears 3.6%, eosinophiles .6%. Owing to the apparent improvement in the patient's condition a further 20 c.cs. of serum were injected intravenously, and on 14th January the number of leucocytes was found to have fallen to eight thousand four hundred, polymorphs 86.6%, small lymphocytes 11.3%, large mononuclears 1.6%, eosinophiles .30, while on the following day a slight rise occurred, the count being ten thousand six thousand. It will therefore be noted that the injection of serum on both occasions resulted in a drop in the num-

ber of leucocytes on the following day, but an increase again occurred on the third day. Whether this temporary fall in the leucocytosis is analogous to the hypoleucocytosis following the injection of bacterial cultures into animals it is difficult to say. Such an analogy would appear probable though it must be remembered that in the cases under consideration we are dealing with morbid processes where leucocytoses were present before inoculation. In both the cases cited there was pulmonary involvement consequent upon the septic condition, giving rise to symptoms of a typical pneumonia. It is not, however, to be expected that the leucocyte curves of these cases would follow those which occur in acute pneumonia, for here the lung conditions were complications of puerperal fever, and not the primary disease due to a specific organism, and running a definite course. In pneumonia Hayem and Klein found that the maximum leucocytosis was usually reached just before the crisis.

In Case VI the maximum leucocytosis was forty thousand eight hundred on 6th January, the eighth day of the puerperium. On the previous day, on examination of the

chest, abundant crepitation was audible at the right base with dulness to percussion, while on 8th January no crepitation was audible. The patient was feeling well, and was found reading in bed. The temperature touched normal, and there was a distinct fall in the number of the leucocytes to twenty-three thousand six hundred, and a week later to eight thousand four hundred.

It would therefore appear that though no definite crisis occurred in the course of her disease, the pneumonic condition had an influence upon the leucocyte curve, which, at the onset of illness, was augmented by this complication, but which tended to fall as improvement, gauged by the pulmonary physical signs, went on. The leucocytosis in both pneumonia and puerperal fever is almost always due to an increase in the polymorphonuclear type of white cell, and this variety was present in a proportion on the first day of 97.5% in the case under consideration. According to Turk and Zappert (i. Zeit. f. Klin., Med. Bd. 23, Ewing - ii. Klin. Blutuntersuch, Wien, 1898) the eosinophile cells at the height of the leucocytosis in pneumonia are always very scanty, or cannot be found.

In Case VI they were found present on the eighth day

of the disease as the curve was approaching its maximum height, and were present in all subsequent observations. With reference to such a pulmonary condition occurring during the puerperium a somewhat similar case came under my notice in the Maternity Ward of the Dundee Royal Infirmary. A few days after the patient was confined, pulmonary symptoms supervened. There was well marked dulness to percussion at base of one lung, and fine crepitation was audible on auscultation. She had not the symptoms of a typical acute pneumonia, however, and the condition was looked upon as a grave one, and due to some septic process. She however made a rapid and complete recovery. It would therefore appear that pulmonary complications which, at the onset, are likely to be looked upon as of very evil omen may not infrequently have a surprisingly speedy and favourable termination.

The third case of intravenous inoculation of serum was that of Case XII. On 29th January the leucocyte count was fifteen thousand six hundred. The differential count was polymorphs 95.2%, small lymphocytes 1.5%, large mononuclears 3%, eosinophiles .2%. 20 c.cs. of anti-streptococcic serum were injected into vein of the arm.

On the following day, 30th January, the leucocytes had fallen in number to ten thousand two hundred, though there was little change in the proportion of the different varieties of leucocytes present except that no eosinophiles were observed. Polymorphs 94%, small lymphocytes 2%, large mononuclears 4%. Here again, therefore a hypoleucocytosis occurred on the day following the injection, while on the succeeding day a well marked leucocytosis existed, the white cells at 3 p.m. being thirty-one thousand. There were, however, new features present in the corresponding differential count. In a count of four hundred there was one red nucleated corpuscle and several myelocytes present. The fall in the number of white cells on the evening of the same day to sixteen thousand six hundred has already been alluded to in reference to the occurrence of a rigor. On 1st February, the day on which the patient died, the leucocytosis was twenty-three thousand eight hundred, and in a count of five hundred only two small lymphocytes were found, the polynuclear neutrophile cells being present in the proportion of 97.4%. The condition of the patient, therefore, judged

by the observations on the blood was not benefitted by the inoculation of serum. This fact was further borne out by the apparent aggravation of symptoms of sepsis. The temperature became more erratic, rigors occurred, and signs of cardiac failure became more urgent. This was an unlooked-for result, and one at first exceedingly difficult of explanation. Every precaution with regard to asepsis during the operation of injection of the serum was taken, though no animals had previously been inoculated with the serum.

A possible solution of the problem has been brought to light by the appearance of some recent literature on the subject. In May of the present year Wright (B. M. J., May, 1903) published a paper laying stress upon the fact that, in every immunization,process, a law of fundamental practical importance must be borne in mind. This he calls the "law of the negative and positive phase, and of the attainment of the higher base line". This conclusion is based on the observation that after inoculating animals with bacterial vaccines, the curve of the immunization reaction shews at first a negative phase, which is followed by a positive phase, and the attainment of a higher base

line which represents the more or less permanent achievement of the immunization process. It is further pointed out that, if serum is drawn off from an animal during this negative phase of resistance (which would be represented by the persistence of fever and local disturbance caused by the injection), it possesses distinctly toxic instead of anti-toxic properties. Marmorek has demonstrated this fact by the use of certain antistreptococcic sera on guinea pigs. It is therefore possible that the unsatisfactory result obtained in the case under consideration was due to serum being used from an animal incompletely immunized, but this explanation is improbable, judging from the complete absence of unfavourable symptoms following its use in the other cases mentioned here. In the study of immunity and of the reactions of sera it has recently been demonstrated in vitro that before hemolysis or bacteriolysis, i.e., destruction of the blood cell or bacterium takes place, the presence of both immune body and complement is essential. It has been stated that serum therapy has frequently been followed by disappointing results, owing to the insufficient quantity of complement the antitoxin serum contains, while Ehrlich is of the

opinion that the administration of immune body in excess has a harmful rather than a beneficial effect. Ehrlich's theory appears a possible explanation of the case in point.

It is still a matter of doubt as to how exactly the phenomenon of bacteriolysis occurs with regard to the action of the complement, and the immune body, and their method of attachment or combination. It is known, however, that a considerably greater quantity of immune body may attach itself to a bacterium than is necessary to bring about its destruction. Walker (Journal for Hygiene, Jan., 1903) considers that "great excess of immune serum might perhaps directly bring about a fatal issue by absorbing all the complement, and thus arresting normal protective processes". In other words, supposing ten times the necessary amount of immune body became attached to a bacterium, thus a proportionate excess of complement might be absorbed. The whole supply of complement might in this way be used up, and, as a result, vast numbers of the remaining bacteria would be unaffected. A fatal termination would thus be hastened, rather than averted by the natural protective process being inhibited. These theoretical considerations may throw some light on the

result in the case under discussion. It must also be borne in mind that the case was one of double infection. This fact would appear to increase the patient's danger two fold, for supposing the case to have been one of streptococcal with scarlatinal infection, the whole available complement, as has been indicated, might have been used up as the result of the inoculation of excess of antistreptococcic serum. And it appears probable that the complement which had been produced (possibly from the disintegration of leucocytes - Walker) by the organism in its effort to attain a higher base line of immunity to the scarlatinal infection, had also been absorbed in this reaction. The result of such a reaction was the complete collapse of the line of defence against the scarlatinal infection, and that disease which had already given evidence of considerable virulence, no longer encountering any resistance, suddenly assumed all the characteristics of the malignant type.

The last case on which trial of the intravenous treatment of antistreptococcic serum was made was that of Case VII. It may here be stated that the intravenous

method of administrating the serum, being still sub judice, and the number of cases reported to have been treated in this manner being extremely small, it was deemed advisable only to adopt this procedure with patients who were dangerously ill, and where their chances of recovery if left to themselves appeared very slight.

As this was apparently the condition in Case VII, 10 c.cs. antistreptococcic serum were injected into the vein in the front of the right elbow on 5th February. The leucocyte count then was three thousand at 3 p.m. On the following day a count of three thousand was again made, while on 7th February a slight rise occurred, the white cells numbering ten thousand six hundred. This leucocytosis occurring on the third day after injection of the serum is similar, though in smaller degree, to what occurred in the other three cases. The hypoleucocytosis on the second day was not evident, but probably this was due to the leucopenia already existing on the day of the injection. Little or no amelioration of her condition resulted from this treatment, and well marked symptoms of sepsis persisted. As no specific organism, which might

be looked upon as the cause of these symptoms, had so far been isolated, the use of antistaphylococcic serum was considered worthy of trial. This serum has but recently been prepared by Messrs. Burroughs & Wellcome and, as far as I am aware, no results following its use have been published. On 19th February 20 c.cs. of this serum were injected subcutaneously into the abdominal wall, and examination of the blood gave the following results. At 3.30 p.m. the time approximately of the operation the leucocytes numbered fourteen thousand eight hundred per cb.mm.

Feb. 19th	(5 p.m.	22,000
	(6 p.m.	18,000
	(8.30 p.m.	16,800
Feb. 20th	2.30 p.m.	11,600
Feb. 25th	4 p.m.	21,800

In this case, therefore, no immediate hypoleucocytosis followed the injection of the serum, as frequently happens after the inoculation of proteid substances into animals. There was, on the contrary, a decided rise in the number of white cells. The count on the following day of eleven thousand six hundred was little less than

the original leucocytosis. The condition of the patient meanwhile remained practically unchanged. This was the only instance of puerperal fever where trial was made of antistaphylococcic serum. It was however used in another case of sepsis in hospital, further details of which will be found in the appendix.

RELATION OF THE ADMINISTRATION

of

SALINE SOLUTION TO LEUCOCYTOSES

Of the immediate effects of salt infusion upon the blood of the human subject Ewing states that there are a few reports at hand which indicate that it has considerable influence in lowering the number of red cells and increasing the leucocytes. The temporary effect upon the erythrocytes might be explained by it being due to a simple dilution of the liquor sanguinis. Cabot also is of the opinion that intravenous saline solution at first increases the leucocytosis, but as already stated the

counts quoted were made in a case where considerable hemorrhage had occurred. To four cases of the present series saline fluid was administered, to two subcutaneously under a breast, and to the other two it was given per rectum.

Case II was admitted to the ward in a semi-comatose condition, which was considered possibly of eclamptic origin. For this reason on 29th November 38 ozs. of saline fluid were injected under the breasts. The leucocyte count on that day was eleven thousand six hundred. On the following day it had fallen to seven thousand eight hundred, while on 1st December there was again a rise to seventeen thousand. The differential counts were:-

	Polyms.	S. Lymphs.	L. Mons.	Eosins.
Nov. 29	80.8	17.1	2	-
30	91.4	7.1	1.4	-
Dec. 1	92.2	4.8	1.9	.9

In Case VI also a pint of saline fluid was injected under the breast. The leucocyte count on that same day, 30th December, was thirty-seven thousand two hundred.

Labour had occurred on the previous day, and she had all the symptoms of having lost a considerable quantity of blood. In addition to this, owing to her excitable condition, chloroform was administered while the initial examination and treatment were being carried out. The leucocytosis following hemorrhage has already been alluded to, and it has also been found that an increase of white cells occurs after chloroform anesthesia, nevertheless the blood count in this case on 31st December was twenty-five thousand, while on the following day there was a further decrease to seventeen thousand two hundred per cb.mm. Although, owing to the complications present, no definite conclusions can be arrived at in considering these two cases with regard to the effect of the salt solution, it would at least appear that the saline infusion tended eventually rather to diminish the leucocytosis than to increase it. In the two cases where the saline fluid was administered per rectum the following leucocyte estimates were made:-

No. (i) - Case IX				No. (ii) - Case XVII		
Saline enema	Jan.	23	11,200	Feb. 18	8,400	Saline enema
"	"	24	15,800	" 19	5,800	
"	F"	25	11,000			

In No. i the saline solution was injected daily, while in No. ii only one enema was given. In the former a slight increase, followed by a proportionate decrease, in the number of white cells occurred, while in the latter the leucocytes fell on the second day from eight thousand four hundred to five thousand eight hundred. Probably therefore treatment had little influence upon the behaviour of the leucocyte curves in these two cases. The highest percentage of the polymorphonuclear cells obtained in the present series was 97.8 in Case XII, while the average maximum percentage of polymorphonuclear cells in the eighteen cases is 91.8. In two cases (XVII and XVIII) the maximum percentage of this form of cell was 82.6 and 84.3 respectively (the lowest of the series), and therefore considered from that result alone they might be regarded as mild cases of puerperal fever. The very re-

verse, however, was the case, for both these patients died from an extremely virulent form of septicemia. The percentage of the polymorphonuclear variety present is therefore not necessarily an indication of the degree of toxemia. The total number of leucocytes, as well as the presence of abnormal cells in the blood, must also be considered before a correct idea can be gained of the case, and this is borne out by the fact that in the two cases under consideration both red nucleated corpuscles and myelocytes were found present in the blood, shewing that grave changes had occurred in the hemogenic tissues

It is stated generally that the increase of the polynuclear neutrophile cells is associated with a proportionate diminution of the mononuclear elements, which are diminished proportionately in number. This fact is borne out on examining the various differential tables on the previous pages, but it is especially true of the small lymphocyte variety which may fall as low as .4% as in Case XII. Marked fluctuations in the relative proportions of the various cells may take place within a day or two. In Case III, e.g., on 12th December the relative percent-

ages of polymorphonuclear cells and lymphocytes were 92.5 and 6.2 respectively, while on the following day the proportion of the polymorphs had fallen to 76.6%, and the lymphocytes had risen to 22.3%. The average small lymphocyte estimate of the eighteen cases taken on the first day of admission is 9.4%, a result which is about 15% below the normal proportion. The lowest initial lymphocyte estimate was 1.5% in Case VI, when the total estimate in the fresh blood was thirty-seven thousand two hundred, while the highest percentage of lymphocytes found was 21.6 in Case XVII when the total estimate was eight thousand four hundred. The absolute number of lymphocytes, therefore, in these two cases was five hundred and fifty-eight and one thousand eight hundred and fourteen respectively, but again the prognosis appears to be independent of such a result, for in the first case the patient recovered, while in the latter death occurred five days after the observation had been made.

The origin of eosinophile cells is still a matter of opinion among observers. Some maintain that they are produced in the bone marrow, while others, as Shaffer (Cent.

f. d. Med., Wissen, 1891), and Gulland (Journal of Path. and Bact., 1894), have found these elements in the thymus and lymph nodes before the appearance of the bone marrows. Others again have observed active mitosis (Muller Dent., Archiv. f. Klin. Med., 1891) occurring in these cells, and this phenomenon would point to another method of production. The supposition also that eosinophile leucocytes may be a further development of the polymorphonuclear variety has not been entirely disproved, and if such were the case then, as Muir points out, it would appear as if the toxines of pyogenic organisms stimulated the output of the latter, but inhibited the transition from one form to another. The following observations seem to bear out the truth of this suggestion. Of the slides made from the blood of the eighteen cases on the first day of admission, only four shewed the presence of eosinophiles, and of these, three recovered, while the fourth, where death occurred, was a patient suffering from the double infection of puerperal septicemia and scarlet fever, in which latter disease an increase in the number of eosinophiles has frequently been found, and as it approached a fatal

termination these cells, as far as was observed, completely disappeared. This case has already been discussed in detail. Of the six patients who died the blood films of fair shewed none of these cells from admission up to the time of death, while of the remaining two cases, in which eosinophiles were found, one was the case above referred in which scarlet fever was present as a complication, and the other (Case VIII) who lived for three months in the ward, and at one time shewed signs of recovery, but who ultimately died from rupture of an abscess into the bowel with associated peritonitis. The laws, therefore, regulating the behaviour of eosinophile cells in the foregoing cases would seem to be (I) in all acute cases in a recent stage of the disease they are for the most part completely absent; (II) as the patient's condition improves these cells gradually make their appearance, and increase in number as convalescence progresses, though there are frequently decided fluctuations in the daily percentage; (III) in those cases where acute sepsis is present and death occurs within a few days, eosinophile leucocytes are absent throughout the attack. From these facts there would therefore appear to be a distinct prognostic signi-

ficance with regard to this variety of cell in the peripheral circulation. Their presence in normal numbers might be considered to be a favourable omen, while a persistent decrease or complete disappearance would indicate impending danger.

Other observers have described a similar diminution in the number of eosinophile leucocytes in septic diseases. Too much importance, however, must not be attached to the fact as Klein (Cent. f. in - Med., 1899) describes a case of hemorrhagic septicemia with 76% eosinophiles in the pleural exudate and 40% in the blood. It is of interest to note in this connection the apparent difference between the reaction of the hemogenic tissues to bacterial infection in man and in certain animals. In the blood of rabbits after the intravenous injection of a small quantity of sterilised cultures, Kanthack found at times enormous leucocytosis, chiefly due to increase in the number of eosinophiles (B. M. J., 1892), while, though Neusser (Wien Klin. Woch., 1892, No. 4) sometimes found in man an increase in eosinophiles as the effect of various toxines, other observers have repeatedly found the leucocytoses,

when present, to depend, in the great majority of diseases, upon an increase in the number of the polymorphonuclear variety.

Eosinophilia will therefore be seen to be a rare phenomenon in sepsis, though it has been observed in very various conditions, especially cutaneous affections and certain diseases of the sympathetic nervous system. Zappert (Zeit. f. Klin. Med., Bd. 23) regards two hundred to three hundred eosinohhiles in the cb.mm. as a high normal number, and over three hundred as pathological.

In six of the cases of this series the number of eosinophiles counted at one time or another was in excess of this number. All of these patients made a satisfactory recovery. It is impossible, however, to draw any definite conclusion from this fact, though it is of interest to note that in one case (Case I who was readmitted after having been at work) 5.4% eosinophiles were found present, and a condition of phlegmasia alba dolens existed. Although such a percentage is not excessively high yet it is above the usual average, and the number fell to 2% as the condition improved. There was no accompanying temperature and no polymorphonuclear leucocytosis, though the

whole left leg was markedly swollen. The writer has been unable to find any reference to phlegmasis dolens with regard to its relation to the leucocytes, or to such a condition ever being accompanied by eosinophilia. It may here be noted that few, if any, forms were observed in the blood films counted, which might suggest that the eosinophile cells were developed from the coarsely granular polymorphonuclear leucocytes. From this it would appear that if such a transition does occur the change probably takes place in the tissues, and not in the peripheral circulation.

MYELOCYTES

Muir (B. M. J., 1898) pointed out the fact that in grave inflammatory or infective conditions, when the leucocyte number falls, finely granular leucoblasts of the marrow - myelocytes - appeared in the peripheral circulation, and he considers this to be of bad omen. Turk (Blutuntersuch bei Infect. Krankeit, 1898) found that a considerable number of these cells may appear accompany-

ing polynuclear leucocytosis of infectious diseases, and Engel (Deutch. Med. Woch., 1899) found as many as 12% in unfavourable cases of diphtheria. Myelocytes have also been found in various other conditions besides pernicious anemia and leukemia. Cabot found them in three cases of septicemia, and also in various other diseases, confirming Holmes' observations on their presence on the blood in phthisis, which was present as a complication in the fatal Case XV in the present series, and where myelocytes were also noted.

It will therefore be seen that though these cells morphologically closely resemble the polymorphonuclear leucocytes on the one hand, and hyaline cells on the other, and have also their origin in the bone marrow, yet their appearance in the peripheral circulation always points to some grave change influencing the cell-producing function of the bone marrow.

Myelocytes were noted in nine of the present series of cases, and in six of these death resulted. Of those who recovered two passed through an attack of great severity, while Case IV, in which the illness was much less

severe, was complicated by thrombosis of the veins of both legs. In the majority of those cases in which myelocytes were present, they were associated with a more or less marked leucocytosis, yet this was but slight in Case VII, though the myelocytes reached as high as 6% in a blood count of nine thousand six hundred white cells per cb.mm.

Cabot points out the occurrence of myelocytes in the blood in malignant disease especially sarcomatosis. Chiene regards their presence in such a condition as distinctly advantageous, being of the opinion that they lessen the danger of secondary infection after operation by their phagocytic action. From a surgical aspect this is of extreme importance, for it is well known that the wounds left after the removal of sarcomatous growths may often, from the nature of the disease, present large surfaces which are therefore liable to septic infection. The supposition, however, that the absence of secondary infection of the wound is in great part due to the presence of these cells in the blood of the patient, is scarcely tenable for the numbers in which they occur in

the peripheral circulation appear far too small to render their action as phagocytes as in any way important. Again, were such the case, it might be reasonably expected that their presence in the blood in septicemia should be of favourable rather than of evil prognosis, but the results in the present series do not support such a theory, considering that two-thirds of the cases in which they appeared ended fatally. There were, also, no signs of active phagocytosis seen in any of the observations made.

According to Grawitz, hydremia is rapidly established in puerperal sepsis. This, according to that observer, is due to the loss of albumin from the blood corpuscles, but more especially from the serum, partly as a result of increased destruction of red cells, and partly as a result of a transudation of fluid from the tissues into the blood, brought about by the lymphogogue action of bacterial toxines. This watery condition of the blood was very noticeable in at least two cases (XVII and IX) of the following series, so much so that it was at times extremely difficult to make suitable coverslip specimens. An exactly opposite condition, however, may exist in sepsis.

This was found in Case XVIII, where the blood tended to coagulate almost immediately the drop was placed on a coverslip.

That a marked destruction of red corpuscles may take place in puerperal sepsis is a generally accepted fact. Hayem and Toenissen estimated an average loss in ordinary septic fever at two hundred thousand to one million per week, while there is the frequently quoted case of Grawitz in which he counted only three hundred thousand erythrocytes in a cb.mm. Hayem quotes a case of recent puerperal sepsis in which the erythrocytes numbered 1.45 millions in the cb.mm., while the hemoglobin estimate was 20%.

This result closely resembles that found in Case XVII in the present series, where the red corpuscles numbered 1.45 millions per cb.mm., and the hemoglobin estimate was only 15%. In this case death occurred on the twenty-third day of puerperium.

In Case IX a marked diminution of red corpuscles was found to have occurred, though not to such an extreme degree. Here the red blood count on the tenth day of puer-

perium had fallen to 1.7 millions per cb.mm. In this case the patient recovered, and the blood condition so improved that in little over seven weeks the erythrocytes were found to have increased to 4.27 millions per cb.mm.

But, in the present series, such marked anemia was exceptional, though several decidedly low estimations in the number of red cells were made. These were 2.68 million in Case III, 3.2 million in Case VIII, and 2.54 million in Case XIII. In the majority of the other patients, however, the colour of the mucous membranes suggested such a moderate anemia as to make further investigation unnecessary or of little interest.

With regard to the appearance of abnormal elements in the blood Grawitz found irregular forms, such as microcytes, macrocytes, and poikilocytes only in very severe cases, and red nucleated corpuscles were very scantily present. Ewing has usually found a few red nucleated corpuscles in tense puerperal sepsis, but they were never numerous. Timofjewsky experimentally found nucleated red cells in the blood of dogs soon after moderate injections of pyogenic bacteria, and in one instance he states they

were present in the enormous proportion of twenty-five thousand six hundred and ninety-eight per cb.mm. It is well known that these cells have their origin in the bone marrow, where they are found in great number after hemorrhage. They are not normally present in the peripheral circulation, and their appearance there suggests some pathological condition. The blood destruction or hemorrhage has been followed by a greater demand for increased cell production than the hemogenic tissues can supply, with the result that normoblasts - the immature red corpuscles - pass into the circulation before they have reached their full development. Accepting this explanation of the appearance of red nucleated cells to be the true one, they are likely to be found present only in the graver cases of Puerperal Fever. This is borne out in considering the present series, for here of the five cases in which they appeared, four had a fatal termination, while the one patient who recovered was extremely ill, and suffered from perimetritis, pyosalpinx, cystitis, and melancholia. The number in which these elements were present, varied from sixty-one to seven hundred and

twenty-one in the cb.mm. All five cases shewed marked symptoms of acute sepsis, and registered temperatures from 104°8 to 108°. In only one (Case VII), however, were they associated with an intense degree of anemia (1.45 million), and there appeared to be no relation between their presence, and a purulent exudate, for in two cases no pus was found present.

Another type of red nucleated cell is the megaloblast, which is found in fetal bone marrow and in very grave forms of anemia, but none of this variety were detected in the series of cases under consideration.

CONCLUSIONS

From the foregoing observations the following conclusions may be drawn:-

1 Leucocytosis occurs at some period in the course of puerperal septicemia

2 When there is no increase in the number of white cells this is possibly due to the extreme virulence of the infecting organism causing cell

destruction, or it may be possibly due to a negative chemiotactic influence produced by a mixed infection

3 The leucocytosis is polymorphonuclear in character

4 There is a certain prognostic value in the presence of the eosinophile corpuscles, which are likely to be absent during the acute illness, and appear as convalescence progresses

5 The small lymphocytes are relatively, and may be absolutely, diminished in number during a leucocytosis

6 The large mononuclear cells remain more constant, though they also tend to be diminished in number

7 Red nucleated cells, myelocytes, and malformed red corpuscles are likely to appear in extreme forms of septicemia, and their presence in the peripheral circulation is to be looked upon as of grave significance. Marked anemia may also occur

8 Temperature and leucocyte curves do not closely correspond with one another. If the temperature is high, however, the leucocytosis is likely to be increased. On the whole the two curves tend to approach their normal base lines together, though a leucocytosis may continue for some time after the temperature has definitely settled

9 There appears to be no relation between the leucocyte count and the occurrence of rigors

10 There is little or no increase in the number of leucocytes in puerperal melancholia provided symptoms of sepsis have disappeared

11 Saline infusions tend to produce a temporary fall in the number of leucocytes on the day following the operation, with a subsequent though moderate increase

12 Intravenous injection of antistreptococcic serum is followed by no marked blood change, though a slight leucopenia may occur. The varieties of the blood cells are not altered markedly in relation to one another.

------oOo------

APPENDIX I

In the hope that some of the tissues examined post mortem might prove to be of interest, sections were made of the spleen from four of the foregoing cases. The following technique was adopted. The tissue was placed directly into absolute alcohol where it remained for several days, during which time the fluid was changed as required. In order to clear it the tissue was transferred to toluol for twenty-four hours. It was then embedded in Grubler's paraffin, which had a melting point of 52°C. Sections were made in the usual way with a Cambridge rocker, and stained with polychrom-methylene blue and tannic acid fuchsine.

The preparations all shewed definite pathological changes, characteristic of acute sepsis. A micro painting was made of the specimen obtained from Case XII, and will be found as a frontispiece. It will be seen to shew a great overrunning of the spleen pulp with polymorphonuclear cells, a great many of which are broken down, while

others are enclosed in hyaline mononuclear cells. Many of the phagocytes appear of unusual size, and a considerable proportion have either lost their nuclei or exhibit vacuolation or other signs of cell death. It is to be remembered that cell destruction, to a certain extent, occurs normally in the spleen, but when the process becomes exaggerated to such a degree as in this specimen, it is to be regarded as distinctly pathological. One or two red nucleated cells are present, and also some scanty marrow cells, though these are not clearly differentiated. Polymorphonuclear cells are found almost to the centre of the malpighian bodies, which are not markedly prominent.

The blood condition of this case is also represented by a micropainting (five hundred diameters) of a preparation made from the blood three hours before death. Ehrlich's triacic stain was used. The intense leucocytosis is at once noticeable, caused entirely by a marked increase of the polymorphonuclear cells. These vary considerably in size. One myelocyte was noted in a count of five hundred, and one red nucleated cell is also shewn.

Case XVI. Spleen. The walls of the vessels and the trabeculae of the pulp shewed signs of general hyaline

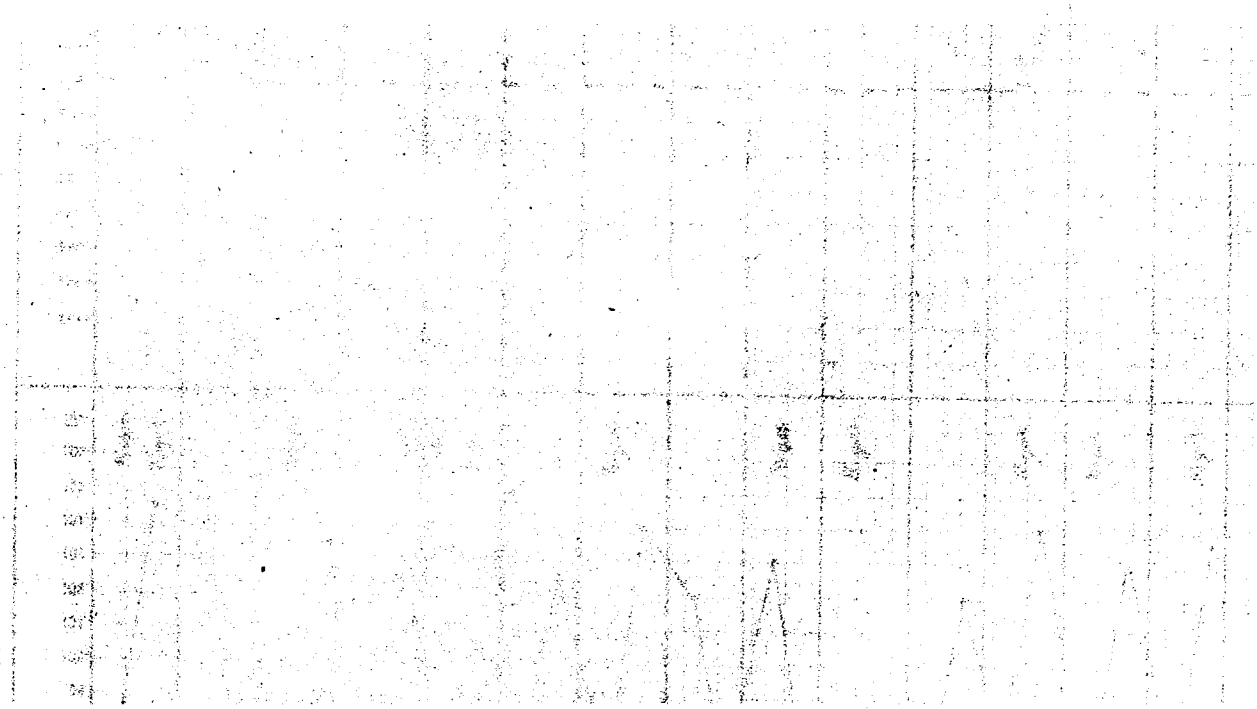
degeneration. There were also widely spread granular changes affecting the fibrillae of the pulp which was overrun with polymorphonuclear cells. There was little sign of increased phagocytosis, for the hyaline mononuclear cells did not appear to be increased in number.

Case XV. The spleen in this case, on microscopical examination also shewed hyaline degeneration of the walls of the smaller blood vessels and of the fibrillae. The larger venous sinuses were much dilated. The element of sepsis was not a marked feature, though a considerable number of polymorphonuclear cells were present throughout the pulp, and a few large multi-nucleated cells apparently acting as spleen phagocytes were also noted.

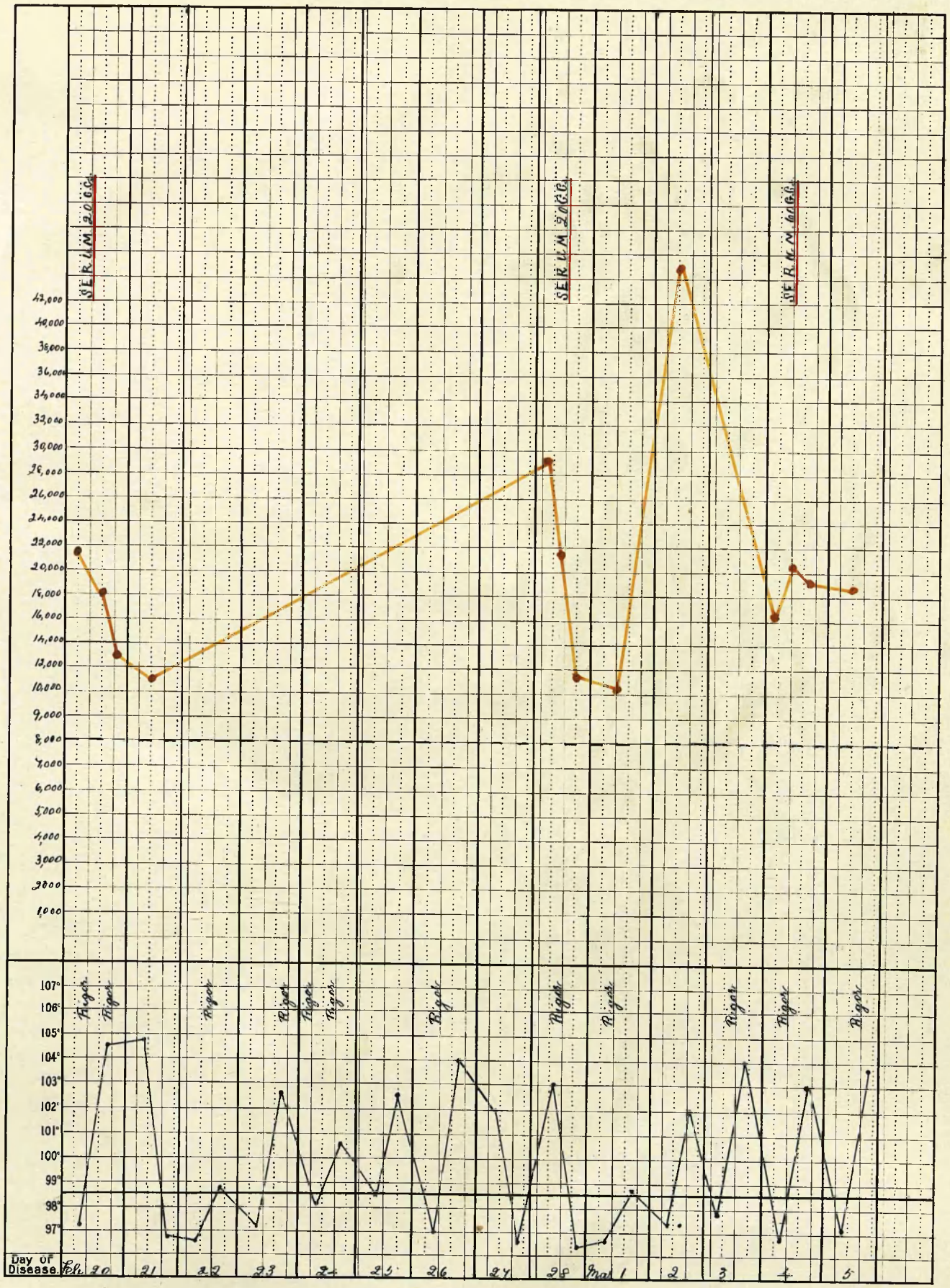
Case XVII. The spleen, on microscopical examination, shewed marked increase of fibrous tissue with thickening of the trabeculae and walls of the sinuses. There were marked septic changes throughout, and these had an irregular focal distribution. Numerous microorganisms, short bacilli, and cocci were also visible.

A micropainting of a blood preparation, made from this case on the second day after admission to hospital,

is shewn as a frontispiece. The white cells numbered eight thousand four hundred per cb.mm., which were made up as follows:- polymorphs 73.2%, lymphocytes 21.6%, large mononuclears 3.8%, red nucleated cells 1.4%. In addition, the coloured drawing shews a great diversity in the form of the red cells, some of which were balloon shaped, others curved, and others again very irregular in shape. Many of the red corpuscles stain with difficulty.



APPENDIX II


SERUM 20 C.C.
SERUM 20 C.C.
SERUM 40 C.C.
42,000
40,000
38,000
36,000
34,000
32,000
30,000
28,000
26,000
24,000
22,000
20,000
18,000
16,000
14,000
12,000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2000
1,000
Rigor
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Day of Disease.
Feb 20
21
22
23
24
25
26
27
28
Mar 1
2
3
4
5
Total number in red counts

APPENDIX II

The following case is here appended, though not of puerperal origin, owing to its being one of considerable interest on account of the obscure symptoms of sepsis, for which antistaphylococcic serum, injected subcutaneously, was tried as a remedy.

D. McP. was admitted to an enteric ward on 14th February, 1903, with the history that he had suffered from headache, sickness, and vomiting for the previous six days. Rigors had also occurred on several occasions.

The temperature on admission was 98. The pulse numbered 88 in the minute, was regular, but soft, and easily compressible.

The patient was very thin and pale. The eyes were clear, the tongue was dry and dirty, brownish in colour, but not fissured.

On further examination nothing suggestive of enteric fever was found, but during the following three or four weeks frequent rigors occurred day after day. The temperature was markedly remittent in character, and with an

accompanying pulse rate which varied between 68 and 160.

In spite of frequent examinations nothing could be found to explain the cause of these symptoms, and in the intervals between the rigors the patient appeared to have little or no complaint.

On 13th March, a month after admission to hospital, he complained of pain in the right side of his head, and two days later a slight fulness behind and below the right mastoid region was noticed.

On 17th March the swelling was incised, and a small quantity of pus evacuated. The septic process was found to burrow in the region of the petrous portion of the temporal bone, and the styloid process was laid bare. The cavity was drained, and no further rigors occurred. It eventually healed sufficiently to allow of his returning home on 3rd June, 1903, though there was still a sinus and bare bone could be felt with a probe.

Owing to the symptoms of acute sepsis and the complete absence, for the first three weeks after admission, of any physical signs pointing to the situation of the septic focus, the injection of antistaphylococcic serum

was considered worthy of trial. An estimate of the number of leucocytes per cb.mm. was first made, and this was found to be twenty-one thousand eight hundred at 3 p.m. on 20th February. 20 c.cs. of antistaphylococcic serum were then injected subcutaneously into the abdominal wall. At 4.30 p.m. the leucocytes numbered eighteen thousand per cb.mm., and at 8 p.m. the estimate was thirteen thousand four hundred, while on the following day at 8.30 p.m. the white cells numbered eleven thousand per cb.mm.

Two rigors occurred on 20th February, one at 6.30 a.m., the other at 10 p.m., when the temperature registered 104°6. It remained normal for the following two days, but on the 23rd it again rose to 103° On 28th February at 2.30 p.m. the leucocytes numbered twenty-nine thousand two hundred per cb.mm., and 20 c.cs. antistaphylococcic serum were again injected. At 3.40 p.m. the white cells numbered twenty-one thousand six hundred. At 8.20 p.m. the blood estimate had fallen to eleven thousand two hundred, and on 1st March at 9 p.m. the leucocytes numbered ten thousand six hundred. On 2nd March, however, they had again risen in number to forty-two thousand two hun-

dred, and rigors had occurred at varying intervals.

On 4th March at 2.15 p.m. the leucocytes numbered sixteen thousand two hundred per cb.mm., and 60 c.cs. were, on this occasion, injected subcutaneously. The following estimates were made, viz.,

	4.30 p.m.	20,200
	9.15 p.m.	19,000
5th Mardh,	2.20 p.m.	18,400

Rigors had again occurred at irregular intervals.

On considering these blood estimates it will be seen that the number of leucocytes fell steadily on two occasions, after the injection of serum for the first two days, with a subsequent rise upon the third day, as shewn by the second observation. After the third injection of serum, of which a triple dose was given, there was little change in the blood estimates, which therefore differed from those results obtained in the previous two observations, and in addition to this the patient suffered from nausea and vomiting.

It will be remembered in Case VII that, after the

use of antistaphylococcic serum, instead of a hypoleucocytosis occurring, a decided increase in the number of white cells was noted, and in the same case no typical staphylococci were found on bacteriological examination.

In the present case, therefore, where a different result was found on examination of the blood it was of interest to note later, when the septic focus was discovered, whether such an observation had any diagnostic value in relation to the infective organism.

The conclusion arrived at, however, was negative, for on bacteriological examination of the pus evacuated, the organism isolated was not a staphylococcus but closely resembled the bacillus coli in appearance.

-------o-------

Further references:- Text-books on Clinical Hematology of Da Costa, Ewing, and Cabot, Treatise of Midwifery (Jewett).