THE SIGNIFICANCE OF TOTAL LEUCOCYTE COUNTS AND THEIR VARIATIONS IN CASES OF PNEUMONIA AMONG CHILDREN, WITH SPECIAL REFERENCE TO THOSE COMPLICATED BY EMPYEMA.

by

HENRY T.H. ARNOTT, M.B., Ch.B. (Edin.)

Thomson Memorial Medal, 1934.
THE SIGNIFICANCE OF TOTAL LEUCOCYTE COUNTS AND THEIR
VARIATIONS IN CASES OF PNEUMONIA AMONG CHILDREN, WITH
SPECIAL REFERENCE TO THOSE COMPLICATED BY EMPYEMA.

Of late years the Schilling blood picture has
been regarded as of far greater clinical importance
than has the common total leucocyte count. ROGATZ (1)
particularly stresses the use of the Schilling count
in prognosticating the changes in the temperature.
The Schilling count admittedly has its uses where one
or two isolated cases of pneumonia occur, but if one
has to deal with about six cases simultaneously in
the course of ordinary Hospital routine, the work
involved would become too great for the average
Hospital Resident or Clinical Assistant. Further,
this would become still more so if its undertaking
were attempted by a busy General Practitioner.

The object of this series of observations on the
behaviour of the total leucocyte counts, was to
ascertain whether any clinical use could be made of
these counts in the course of a Pneumonia, and whether
the results obtained repay the time expended upon
them.

METHOD:

A good deal of derogatory criticism has been
advanced in the Leading Article in the British Medical
Journal/
Journal (2), attacking the validity of total leucocyte counts on the grounds of their fallibility as regards technique and variation due to various causes. In so far as has been possible, the method, time, and manner of making these counts has been the same throughout the series of observations. The time selected for withdrawing blood from the patient was between 10 a.m. and 12.30 p.m. This, it was considered, would eliminate variations which might be due to a post-prandial leucocytosis following the patient's breakfast. The method used of pricking the finger was that described by HARVEY and HAMILTON (3). The haemocytometer pipettes were used, marked to 11 above the bulb, and the technique of withdrawing the leucocyte counting was that described by NICHOLSON (4), with the exception that the stain used was that of TURK, formula:

- Glacial Acetic Acid 3 cc.
- Aqueous Gentian Violet 1% 3 cc.
- Distilled water 60 300 cc.

This diluting fluid recommended by HARVEY & HAMILTON (3), as it shows up the lines on the counting stage better than any other fluid and stains the leucocytes more deeply than do the others. The counting stage used was a double-sided Zeiss-Jena, Neubauer, and the blood was spread by capillarity. A special automatic recorder was used to ensure speed and further accuracy. 36 cases were obtained, 17 of which were primarily of uncomplicated pneumonia. The remainder started as/
as pneumonias but were complicated by empyema or other complications at a later date. This series of blood counts has been carried through from the date of the patient's admission into Hospital to the date of his discharge or till his leucocyte count has reached a steady low level.
Chart A.

Graph showing the average leucocyte and temperature curves for the first eighteen days of an uncomplicated case of Pneumonia.
OBSERVATIONS:

1. Daily leucocyte counts are of practical value in Hospital work.

2. Isolated leucocyte counts are of no use from a prognostic point of view, and are apt to be misleading as to the severity of the disease at the time at which they are taken.

3. The leucocyte count curve closely follows the temperature curve. In very few cases has it been found to precede the temperature curve. Reference is here made to the accompanying chart A, giving the average leucocyte-temperature curve for the first 17 days of a case of uncomplicated acute alveolar pneumonia. This chart was obtained from the 17 cases of uncomplicated pneumonia in this series.

4. If the leucocytes remain high, circa 15,000, 3 days after a crisis, empyema can be expected.

5. Any inflammation super-imposed upon the initial complaint will cause a sudden rise in leucocytosis, but, as soon as this secondary infection has subsided the leucocytes return to approximately the same level as they were at before the second infection.

6. In many cases after a crisis in uncomplicated cases of pneumonia one can often observe a slight temporary rise in both leucocytes and temperature.

7. During the course of an empyema the Leucocyte chart shows a great irregularity, and does not closely follow the Temperature chart, but when the inflammatory process subsides, it then does so.
CHART B.

CHART SHOWING LEUCOCYTE AND TEMPERATURE CURVES, TAKEN.
FROM CASES OF EMPIRISMA FOLLOWING PNEUMONIA.
FROM FIRST DAY OF CRISIS.

The average temperature and leucocyte count has been used for each day shown.
DISCUSSION:

1. Daily leucocyte counts are of practical value in Hospital work. However soul-destroying the labour may be (2), I maintain that it is well worth the trouble. This is proved by the fact that empyema can, by this means, with a degree of certainty be foretold. This statement is proved by a study of the charts in Class B., and in particular Chart B. on previous page, where it is seen that, although the average temperature comes down to the 99° F. mark the leucocyte curve steadily rises to 18500, the two curves behaving in a directly opposed manner.

   This does not happen in the case of uncomplicated pneumonia where it is seen that the leucocyte curve follows the temperature curve to a low level.

2. Isolated counts are of no use. Very often the House-Physician is ordered to count the leucocytes of a certain patient. This result is probably not repeated for about a week, if at all. Suppose this has been done in the case of Rose Allan, Chart No.A.1. of my series. On 24th December, 1933, her leucocyte count was 22,000, while her temperature was only 99.2. The next day her leucocytes had fallen to 11,400, while her temperature was 99. This rapid fall constituted part of a leucocyte crisis. If her leucocyte count had been done a week later, it would have been found/
found to have been 10,000, while her temperature was 97.8. Again, 9 days later her temperature was 98.6, yet during this time she had had an attack of otitis media, which was subsequently found to be due to an infection by the B. Diphtheria. So, if these isolated counts had been performed, the somewhat swinging nature of the leucocyte chart during this attack of otitis media would not have been observed, the peaks of which reached the 15,500, 15,000, and 14,000 marks respectively, while the temperature was at no time above 98.8. This is one instance of where a solitary leucocyte count is of little use to the clinician. Further instances of this can be obtained by a study of the charts of those pneumonias in my series which have been complicated by some intercurrent disease.

3. The leucocyte curve closely follows the temperature curve. From a rapid and superficial glance through the charts in my series of cases, one of the most striking things is the closeness with which the leucocyte curve follows that of the temperature. This is not so apparent before the fastidium as after it. The leucocyte curve is generally about a day or two at the most behind the variations of the temperature curve. I give as one instance the chart No. A.17, where this is most strikingly borne out. RETZNIKOFF (5) states that - The blood count will change as long as 48 hours before the patient shows signs and symptoms of an acute infection; All I can say/
say to this is that in most of my cases this is not so, and that if the leucocyte curve does not rise with the temperature curve it usually does so about one to two days after it.

I disagree with ROGATZ (1) when he states that in only a very small percentage of cases of pneumonia in infancy and childhood does the leucocyte count lag behind the temperature curve. I say that an even greater majority lag behind, than the 80% figure that he gives.

4. If the leucocytes remain high 3 days after a crisis, empyema can be expected.

By going through my series of cases where empyema has followed a pneumonia, I have found in every case that the leucocytes remain high, and that where a case is not going to be complicated by empyema, the leucocytes show a rapid drop, as I have already explained, one or two days after that of the temperature. See cases B.1-9.

5. Any inflammation superimposed upon the initial complaint will cause a sudden rise in leucocytosis, etc.

This point is proved by further study of the charts of my series. I would again refer to that of Rose Allen, A.1. whose complication was aural diphtheria. To Jessie Boyd, A.4. who on 2.12.33 was proved clinically to be suffering from Pericarditis, but whose leucocytes after their crisis on 19.11.33, had been
of a swinging character, their peaks being 15,200, 16,500 and 16,800 respectively. The temperature in this case was also of a swinging character, though never above 99 during this period; and James Ritchie, case No.B.8, whose pneumonia had been complicated by nasal diphtheria, and who, at a later stage, i.e., 24.4.34, contracted Measles. In these three cases sudden rises in the leucocytes are noticed, which when the infection subsides come down to the level at which they were before.

NICHOLSON (6), states that a small amount of pus under pressure such as a Mastoiditis or Appendicitis will produce a much higher leucocyte count than a case of suppuration that is draining freely. I have found this to be the case frequently and quote two outstanding instances of this, namely, Class B.3 and Class A.1., where, in the former case, a superficial abscess on the temple sent the leucocytes soaring, and in the latter a marked rise in leucocytes occurred at the onset of the otitis media.

6. In cases after a crisis one can observe a slight temporary rise in both leucocytes and temperature. This can be well seen from the cases of Emma McQueen, No.A.20, Kenneth Houston, No.A.15., Sheila Morrison, No.A.21, Charles Birrell, No.A.2., Ellen Macdonald, No.A.19, etc. A possible explanation for this phenomenon is, that while the crisis has occurred the infection/
infection may regain a slight temporary supremacy and thus cause the temperature and the leucocyte curves to exhibit a slight rise, but, that the body resistance overcomes this infection and the leucocyte and temperature once more fall.

NICHOLSON (6) mentions that among the toxic conditions that may produce a leucocytosis is acidosis. Now in examining the urines of several of these cases of pneumonia acetone has been present. This may possibly be the explanation of the rise in leucocytosis following the crisis.

7. The irregularity of the leucocyte curve during a case of empyema is striking: and probably it is a mirror which reflects the internal picture, during the acute stage of the disease; the rise and fall being regulated by the greater or less hold which the infecting organisms have upon the body at the time. In most of the cases where pus has been found by aspiration, as soon as the pus has been evacuated, the curve becomes more settled, and generally when no more pus can be obtained the curve begins to slowly drop towards a normal level.

Difficulties encountered in the making of this series.

1. The patient's normal leucocyte count is not known unless the patient has been in Hospital at some previous date with some afebrile complaint.

2./
2. It is very rare to get a case of pneumonia in Hospital before the second or third day of the illness, unless the patient is already in Hospital with some other complaint, and the pneumonia is superimposed on that complaint.

3. In several cases the patient's clinical condition allows of the patient's discharge before the leucocytes are anywhere near a possible normal mark.
CONCLUSIONS:

The most outstanding conclusion which arises out of this investigation, is that a steady rise in leucocytosis after the crisis of a pneumonia is the invariable rule, in cases where Empyema will subsequently become manifest. This fact alone, makes it worthwhile to perform daily total leucocyte counts on Hospital cases of Pneumonia in childhood. At the crisis if the count is seen to rise, precautions can be taken during the few days which elapse before the onset of empyema, to ensure rest and nutriment to the already devitalised body, which may be invaluable in the treatment of the Empyema, always a long and wasting disease to the body resources.

The fact that the leucocytes do rise after the crisis of a pneumonia when empyema can be expected, is of great use in general practice, for while the average practitioner may be too busy to undertake daily total leucocyte counts throughout the whole course of a pneumonia, he could surely perform six counts, one a day before the crisis is expected, and, the other five, on the day of crisis and the four subsequent days, thus observing the critical period, when empyemas commonly occur.

It would put the practitioner even more than ever on guard against the occurrence of empyema, if he was expecting/
expecting it to occur, from observing the rise of the leucocytes, at shortly after the crisis, and in this way, valuable time would not be lost in uncertainty of diagnosis in instituting early treatment of the affected pleura.

Further, I conclude that haphazard isolated total leucocyte counts are of little value either to the physician in Hospital or in General Practice, except to show that some inflammation or toxic state is present.

MYER (5), I conclude is right in his statement that Hyperleucocytosis is to be found at the height of the infection, a glance at Chart A will confirm this. I am inclined to agree with him in concluding that the mortality in pneumonias of children is inversely proportional to the total count, though it is not possible for me to be dogmatic on this point, from lack of material. Certainly the chart of case A 6, would point to this being the case.

According to HOLT (7), the mortality in all cases of infantile pneumonia is 4%, while in my series, we find it to be 2%. The fact that all the patients in the series had Hyperleucocytosis at the height of the infection may possibly account for the lower death rate.
REFERENCES:

1. ROGATZ, J.O., In American Journal of Diseases of Children (45 May, 1933 1022-1035), showed, that only in a very small percentage of cases on Pneumonia in infancy and childhood does the leucocyte count lag behind the temperature curve. The majority of leucocyte curves, 80%, precede that of the temperature curves.

2. LEADING ARTICLE IN BRITISH MEDICAL JOURNAL, March 31, 1934, page 586, states:— Meanwhile clinical Medicine as a whole has received a warning against too close an interpretation of the findings of a blood count. A false assumption based on unreliable data is much worse than having no data at all. This may perhaps mean that some blood counts were better not performed at all, and a good deal of soul-destroying labour would be saved if they were not. Some would go so far as to say, that an accurate haemoglobin estimation will ordinarily yield all the information that is needed in states other than actual blood diseases. This, of course, implies that the function of the clinical pathologist is to confirm and define conditions of which there is clinical evidence, and not to conduct innumerable fruitless investigations for the sake of an occasional unlikely or unexpected discovery.

4. NICHOLSON, DANIEL, M.D. Laboratory Medicine, Published Henry Knapton, 1934. pp. 64-73.
   (1) The following toxic conditions may produce leucocytosis.......acidosis.
   (2) A small amount of pus under pressure such as a mastoiditis or appendicitis will produce a much higher leucocyte count, than a large suppuration that is draining freely.

5. REZNIKOFF, P. in the American Journal of Medical Science (167-184, August 1932 "Leucocytes in Convalescence from Infectious Diseases"): The blood count will change as long as 48 hours before the patient shows signs and symptoms of an acute infection. (Illustration - Case 16).

6. MYER, H.F. in the Prognostic Significance of a Leucocyte count in the Pneumonias of Childhood, in the American Journal of Medical Science, page 181-2. 45 February, 1931, showed that hyperleucocytosis is to be found at the height of the infection, and further, that mortality is inversely proportional to the total count in Pneumonias of Children.

7. HOLT, in Diseases of Infancy & Childhood. Published/
Published, Appleton & Co., p. 575. Lobar Pneumonia, Table 15, Mortality rate, 4% of all cases.

ACKNOWLEDGMENT.

I wish to express my thanks to PROFESSOR CHARLES MCNEIL for permission to study patients under his care in the Royal Hospital for Sick Children, Edinburgh.
APPENDIX.

For convenience, I have divided the cases up into 2 classes.

Class A.

1. Those of uncomplicated pneumonia, and also these in which some complication such as Aural Diphtheria took place.

   and -

Class B.

2. Those of pneumonia followed by Empyema, or, Empyema.

   The cases are in alphabetical order, the number referring to the series, i.e., Isaac Whiteford Case B. No. 9.

   Each case has been treated in the following order and is accompanied by the appropriate Leucocyte Temperature Chart.

   Name.
   Admission.
   Discharge.
   Disease.
   Result.
   History.
   Examination.
   Progress Notes.
   Discussion.
INDEX TO APPENDIX.

CLASS A. UNCOMPLICATED PNEUMONIAS AND PNEUMONIAS WITH INTERCURRENT COMPLICATIONS.

| Case 1. | Rose Allen       |
| Case 2. | Charles Birrell |
| Case 3. | John Blackwood  |
| Case 4. | Jessie Boyd     |
| Case 5. | Agnes Brown     |
| Case 6. | Helen Brown     |
| Case 7. | Stewart Chisholm|
| Case 8. | James Coventry  |
| Case 9. | John Corrigan   |
| Case 10.| Margaret Craig  |
| Case 11.| Henry Duncan    |
| Case 12.| John Galloway   |
| Case 13.| James Greig     |
| Case 14.| Margaret Haig   |
| Case 15.| Kenneth Houston |
| Case 16.| Roma Jessieman  |
| Case 17.| Mary Kelly      |
| Case 18.| John McCraw     |
| Case 19.| Ellen McDonald  |
| Case 20.| Emma McQueen    |
| Case 21.| Sheila Morrison |
| Case 22.| Andrew Purves   |
| Case 23.| Robert Ronaldson|
| Case 24.| Joseph Sibbald  |
| Case 25.| James Watt      |
| Case 26.| Agnes Yorkston  |
| Case 27.| Robert Yorkston |
CASE 1.

ROSE ALLAN, aged \( \frac{14}{12} \). Admitted 11.12.33.
Discharged 30.1.34.

Disease: - Alveolar Pneumonia Right and Left Lung.

History: - Well until day before admission, when she was lifted out of bed and had a fit of shivering. Cough developed which caused her pain. The breathing became very heavy. She refused all food. She vomited three or four times. On admission the cough became much worse. The child was very pale and the breathing far more distressed.

Progress Notes: -

14.12.33 Still very cyanosed. Temperature 102.0. Taking fluids well, and getting plenty of rest.
16.12.33 Pulse no worse, Colour still poor. Cough only troublesome when child is disturbed.
19.12.33. The right lung shows extensive pneumonia. The left lung shows a small patch.
26.12.33 Left ear discharging. \( \text{H}_2\text{O}_2 \) drops started.
30.12.33 Temperature settled at 99.0 for the last three days. Crepitations still heard at the right base. Ears discharging freely.
3.1.34/
3.1.34 The colour is now good. Patient is hungry. Discharge of ears continues.
7.1.34 Slight rise of temperature. Fretful. General condition is stronger.
11.1.34 General condition is good. Still a few crepitations, however, less discharge from ears.
16.1.34 Improvement maintained. More vigor, Still some discharge from ear.
22.1.34 Hungry and eating well.
29.1.34 Discharge continues. Swab taken from discharge.
30.1.34 B. Diphtheria found in aural discharge. Child transferred to City Hospital.

Discussion:— This is a case in which the leucocytosis at the time of admission was hardly increased at all, it being 6,400, and remaining there for 3 days, a steady rise then taking place until the leucocytes reached a peak of 22,000, followed thereafter by a rapid leucocyte crisis which, as seen on the chart is only a day behind the finish of the temperature crisis. I have noticed in two or three cases this delay or lag in leucocytosis. The effect of the aural diphtheria I have discussed earlier on in this paper.
20.

CASE 2.

CHARLES BIRRELL, aged $\frac{13}{12}$. Admitted: 6.4.34.
Discharged: 12.4.34.

Disease: - Left-sided alveolar pneumonia.

History: - Well, until 14 days before admission, then coughing started with occasional vomiting. The chest was poulticed last week, but not great improvement resulted. There has been a loss of weight, and for two days breathlessness and green stools.

Physical examination revealed left-sided pneumonia.

Progress Notes: -
7.4.34 Very ill. Rapid pulse, breathing very rapid about 60 respirations to minute. Aspiration = nil.
9.4.34 Slightly better. No great cyanosis. Cough dry. Occasionally mucous brought up, which causes distress. Strength poor. Placed in steam-tent.
12.4.34 Stronger. Cough less and looser. Temperature swinging. Throat swab revealed Bacillus Diphtheria, and was therefore transferred to City Hospital.

Discussion: - In this case the Leucocytosis was 27,400, on the day after admission. The only notable thing about the temperature-leucocyte curves is that the temperature/
21.

temperature and leucocyte crises end on the same day. This is one of the cases in which you get the slight rise of temperature and leucocyte after the crisis.
CASE 3.

JOHN BLACKWOOD, Aet 4 Yrs. Admitted 27.3.34.

Discharged 1.4.34.

Result: Cured.

Disease: - Alveolar Pneumonia (Left Lung).


Examination: - Dullness on percussion over left base. A few crepitations. No accompaniments elsewhere. Vesicular breathing throughout.

Progress notes: -

29.3.34. Child much better. Condition very satisfactory. No definite sign of pneumonia except at the left base.

1.4.34 Condition satisfactory. Child discharged.

Discussion: - Only three leucocyte counts were performed on this child. These showed a rapid crisis, which corresponded with that of the temperature curve. The peak point of the leucocyte curve was the 24600 mark, the lowest level being 14000. The child made an uneventful recovery.
CASE 4.

JESSIE BOYD, aged 11 1/2. Admitted: 9.11.33.
Discharged: 10.1.34.

Disease: - Pleurisy non-tubercular with query empyema, and non-rheumatic pericarditis.

History: - Five days before admission pain in right side, which became worse when deep breaths were taken. Vomiting occurred next day, and cough developed. On day of admission the colour very cyanosed. Breathing difficult, expiration prolonged. Child was constipated. The right side was immobile. Posterior and lateral dullness over the right lower lobe. Pleuritic friction heard there.

Progress Notes: -
10.11.33 Fresh-air treatment with antiphlogistine. Colour better in the morning with breathing easier.
11.11.33 Slept better, colour better.
15.11.33 Slight rise of temperature at night. Condition much improved. Physical signs over right lung still vague.
18.11.33 Aspirated at right base. No fluid found. Colour rather poor.
26.11.33/
29.11.33 Colour varies. Cough still bad.
2.12.33 Dull note on percussion shows fluid at right base. Higher up friction is heard. In the heart a rough systolic murmur and reduplicated second sounds are marked at the pulmonary area. Is this the cause of the poor colour? There is displacement of the heart to the left side.
4.12.33 Suggestion of friction at pulmonary area. Query pericarditis. The child is not so well.
6.12.33 A coarse rubbing murmur is heard all over the precordia. Pericarditis confirmed. Antiphlogistin is applied. The child in no pain. There is enlargement of cardiac dullness.
10.12.33 Friction disappeared to-day. Great enlargement of cardiac dullness on percussion. The colour is better. Cough is troublesome.
13.12.33 Heart is 1" to right of sternum. The sounds are muffled. The colour is poor. The child is well-behaved and lies on her back all day.
27.12.33 Temperature is settled. The child now looks very well. The cardiac dullness is now only slightly beyond the mid-clavicular line.
1.1.34 The child looks very well. Sitting up all day. Eats well. No effusion nor fibrosis can be manifested clinically.

6.1.34 Continues well. Temperature normal.

10.1.34 Continues satisfactorily. Heart condition good. Discharged for slow convalescence at home.

Discussion: Clinical evidence does not indicate that this is a case in which empyema has followed the pneumonia. However, the leucocytes do not come down to a normal level after the crisis, and this to my mind is a fact in favour that empyema did develop, although no positive clinical proof was obtained. The super-added pericarditis prevented the leucocyte curve and also the temperature curve from following a normal course, and had the effect of prolonging the height of both curves. However, a study of the chart clearly reveals the gradual drop of both the curves and further reveals the close association of the leucocyte curve to that of the temperature.
Case 5

Agnes Brown

1933 December

11 12 13 14 15 16 17 18

WAC Temp.
25000
102 101 100 99 98

...
CASE 5.

AGNES BROWN, aged 1 year 9 months. Admitted 11.12.33.
Discharged: 18.12.33.

Disease: Left-sided alveolar pneumonia. (Left upper lobe).

A History of Pyrexia, cough and panting, for two days previous to admission. On day of admission, awoke screaming, and very feverish, with a short cough. Appetite lost; vomited once.

Progress notes:
14.12.33 Temperature normal, colour good. The child was irritable but active.

Discussion: The leucocyte crisis was a day behind that of the temperature. Again, we note, the small rise in temperature and leucocytosis after the crisis. In this case there was never a very high leucocytosis, the peak being 11,500.
CASE 6.

HELEN BROWN, aged 2 years. Admitted 18.1.34.

Discharged 2.4.34.

Disease:- Left-sided Pneumonia leading to empyema.

History:- The child was well until 3 weeks before admission. She then caught a chill and shivering and vomiting commenced. She did not recover from this chill, her appetite has gone and she has become very pale. For the last 14 days she has had a pain in the back with an irritating cough, and she has been feverish. There has been no vomiting. Physical examination revealed stony dullness on percussion over the left base with very faint breath sounds.

25.1.34 The chest was aspirated, and 8 cc. of pneumococcal pus withdrawn.

29.1.34. General condition good. Not so dull at the left base.

1.2.34 Aural discharge. Bacillus Diphtheria found.

Discharged to City Hospital, 2.2.34


21.2.34 Running mild temperature. Still pale.

Stony dullness at left base.

22.2.34 Aspiration 30 cc. pus evacuated.

23.2.34 Aspiration, No pus withdrawn.

4.3.34 Temperature steady and normal. More active.

Eating well. No cough.
8.3.34 Eating well, happy, no cough.
11.3.34 Small septic swelling at angle of eye.
Query dachrocystitis.
14.3.34 Dachrocystitis definite. Oedema of both lids.
The swab taken from the eye proved negative for bacillus diphtheria. Eye-washes and fomentations applied.
15.3.34 General condition good.
19.3.34 Eye practically healed. Intermittent ear discharge.
26.3.34 Child continues to improve. No respiratory symptoms. Ear discharge ceased.
30.3.34 Child now up for part of day. Gaining weight.
2.4.34 Discharged home, Well.

Discussion:-- This case of empyema illustrates two points. 1. That the leucocyte curve follows the temperature curve and gradually comes down to a normal level although three months is taken to accomplish this. and - 2. That a super-added infection as in this case, a dachrocystitis, causes a rapid rise in the leucocyte curve which after the infection has subsided falls to the level on which it was before the commencement of the super-added infection.
CASE 7.


Disease:— Alveolar Pneumonia, Right lung.
Result:— Cured.

History:— Well, till 4 days before admission. Then dry cough started in throat. To-day cough worse and is felled. Anorexia, great thirst, feverish.

Examination:— Impairment of percussion note at the right base. Vocal resonance increased. There are a few crepitations.

Progress notes:—
20.12.33 Pulse, respiration and temperature, have all fallen. Child very weak, cough not bad.
23.12.33 Temperature normal. Resting and taking fluids well, general condition improved.
26.12.33 Condition good. No physical signs in right lung now.

Discussion:— Another case of uncomplicated pneumonia. The leucocytes have never been above 14,000. The unaccounted rise in temperature on 21st is possibly due up to a little flare up in the pneumonic condition. It is followed two days later by a similar rise in the leucocyte curve.
CASE 8.

JAMES COVENTRY, aged 10 8/12. Admitted: 30.11.33.


Disease:— Alveolar pneumonia, right lung.

History:— A week before admission after visit to the baths, vomiting started, and this continued at intervals for 2 days, accompanied by fever. Four days before admission cough started which rapidly became worse, and caused pain in the side. The vomiting has stopped. For the last three nights the child has been delirious, and during the day-time has been confused. He has had a severe headache.

Examination:— Impaired note at left-base. Breath sounds faint and tubular there. Friction heard over that area.

Progress Notes:—

30.11.33 Very felled and prostrate. Fresh air treatment and antiphlogistine.

1.12.33 Gravely ill. Delirium and poor colour. Thready pulse.

2.12.33 Colour poor, and delirious. Definitely duller over the lower lobe of right lung but no typical tubular breathing heard. Breath sounds faint.

3.12.33 Colour still poor, but the pulse is less thready. Still delirious.

4.12.33/


Discussion:-- This was a very severe case of pneumonia from the outset. Although the leucocytes started at 13,000, they rapidly fell to 6,000 in four days, and when the temperature curve showed a crisis the leucocytes showed a remarkably quick ascent up to 24,000, on the day before the child's death. Whether this rapid rise can be due to the commencement of an empyema which is a possible conclusion in view of the fact that on the 4th December, aspiration yielded 8 cc. of yellow turbid fluid, or not, cannot, I am afraid be proved or disproved in view of the fact that no post-mortem was obtained. If some new infective process had not been at work it seems to me to be scarcely likely that the leucocytes would rise to such a high level, especially after the temperature had come down to normal.
JOHN CORRIGAN, aged 1 $\frac{7}{12}$. Admitted: 12.4.34. Discharged: 18.4.34.

Disease: - Alveolar pneumonia left-base.
Result: - Cured.

History: - 1 month before admission the child developed bronchitis. This lasted for 2 weeks, the child has not been well since. 5 days before admission coughing started, with slight anorexia and fever. 3 days before admission the breathing became rapid, the alae nasae dilated with breathing and the cough became worse. The day before admission vomiting started after every meal. The stools became loose and yellow.

Examination: - showed dull percussion at the left base, also tubular breathing there, with moist crepitations and Ronchi in both lungs.

Progress notes: -
13.4.34 Temperature 102°. Pulse very rapid - 172. Antiphlogistine applied.
15.4.34 Temperature coming down, not quite settled. Pulse rate slower.
18.4.34 Temperature settled. Child looks well, colour good. Taking food well. Discharged, for careful convalescence at home.

Discussion/
Discussion:-- A case of uncomplicated pneumonia where the leucocyte curve closely follows that of the temperature curve. Both crises occurring on the same date.
Case 10.

Margaret Craig 9/2 yrs.

April - May 1934
CASE 10.

MARGARET CRAIG, aged 10½. Admitted: 16.4.34.
Discharged: 7.5.34.

Disease: Double alveolar pneumonia.
Result: Cured.

History: Well till 12 days before admission, then developed cold in head. 8 days before admission child had lost weight. Doctor said left-sided pneumonia was present. Since then there has been pyrexia, and vomiting after coughing. Yesterday the condition became worse, with laboured breathing.

Examination: Dullness on percussion at both bases. More marked on the right. Ronchi at both apices. Fine crepitations heard at the right base. Harsh vesicular breathing at left base.

Progress Notes:
18.4.34 Pulse slower. Still cyanosis, but taking fluids well.
20.4.34 Pulse better. Colour better. Still a loose cough which appears to cause pain. Dullness on percussion at right base. Note more resonant on the left side. Crepitations heard on both sides.
22.4.34 Much better. Breathing slower and more easy. Colour better. Smiled.
23.4.34/
23.4.34 Temperature down to 98.6° & Pulse strong and down to 136.
25.4.34 General condition good. Cough still painful. Colour good.
27.4.34 Still dullness at right base. Left base resonant. Crepitations at both bases. Tubular breathing still heard at right base.
3.5.34 Temperature normal. Looks very well, eats and sleeps well.
6.5.34 General condition very satisfactory.
7.5.34 Discharged home well.

Discussion:— This is a case where pneumonia was seen simultaneously in both lungs, and as seen by the chart, has the effect of prolonging the resolution so that no true crisis either in the temperature or leucocyte curves is seen. Once again, the leucocyte curve follows that of the temperature in its downward path.
CASE 11.

HENRY DUNCAN, aged 4 $\frac{6}{12}$. Admitted: 7.5.34.
Discharged: 18.5.34.

Disease: - Alveolar pneumonia, right lung.

Result: - Cured.

History: - Two days before admission anorexia. Day before admission vomited. Anorexia; and at night became flushed and screamed. Great restlessness during the night. Neck became stiff and delirium commenced.

Examination: - No cough, slight cyanosis. No impairment of percussion, and only a few bronchi scattered throughout lung, more on left side than right.

Progress notes: -

8.5.34 Case thought to be one of Meningitis. Very delirious, continually moving about and crying.
Lumbar puncture. Fluid was clear, but under slight pressure. Temperature 102.2°.

9.5.34 Temperature suddenly dropped to 98.8.
Not so flushed, no delirium. Slight dry cough.
There is now some impairment of percussion note over the posterior part of the middle of the right side of the chest. There is a slight increase in vocal resonance, but no tubular breathing or accompaniments heard. X-Ray shows consolidation across the upper part of the right lung.

10.5.34/
10.5.34. Child is much better, only a little impairment of percussion note now.

13.5.34  Temperature down to normal. Looks very well and happy. Still slight impairment of percussion note. No accompaniments.

18.5.34  General condition very good. Slight cough, no impairment over right apex. No accompaniments. Discharged.

Discussion:-- This is a case of cerebral pneumonia, and was at first mistaken for meningitis. X-Ray examination, however, proved the true state of affairs. The leucocyte chart is clearly seen to follow the variations of the temperature.
CASE 12.

JOHN. GALLOWAY
3 YRS.

MARCH - APRIL 1934

[Graph with data points and lines indicating fluctuations over time]
JOHN GALLOWAY. Aet \( \frac{3}{12} \) yrs. Admitted 1.3.34.

Discharged 18.4.34.

Disease: - Indigestion of infants. ?Alveolar Pneumonia.

Result: - Cured.

History: - The child was admitted suffering from indigestion of infants and was getting on well till the 19.3.34 when symptoms akin to those of Pneumonia developed. The breathing was laboured. X-Ray examination revealed a dull patch at the apex of the Right Lung.

Progress notes: -
24.3.34 Condition much improved now. Breathing is quite normal.
26.3.34 General condition improved. Still cyanosed.
5.4.34 Improved. Child taking feeds well.

Now no Cough.

Discussion: - From the symptoms it is fairly sure that the child had a Pneumonia, but it was not a severe infection, and the child made an uneventful recovery. There is nothing peculiar to note about the Temperature Leucocyte Chart.
CASE 13.

JAMES GREIG, aged $\frac{17}{12}$. Admitted 30.3.34.

Transferred 26.4.34 to City Hospital.

Disease: - Alveolar Pneumonia, right and left lung, successive. Empyema.

History: - Adenoids were removed in City Hospital, due to continued diphtheritic discharge, which cleared up subsequent to their removal. The patient was sent there after pneumonia in R.H.S.C.E. On re-admission dullness on percussion was found at the left base. The left base had been aspirated in the City Hospital on 20.3.34: pus had been removed. The child was thin and cyanosed.

2.4.34 Child was breathless and cyanosed.
7.4.34 Still dullness in left axilla. Looks better and has a better colour.
10.4.34 Is now sitting up and is happier. The breathing is still rapid. Gain in weight.
15.4.34 General condition improved, feeding well.
18.4.34 Still a little nasal discharge.
20.4.34 B. Diphtheria, isolated from the discharge. General condition improving.
25.4.34 Rise in temperature. Eyes bleary. Query Measles.
26.4.34 Measles rash appeared. Child transferred to City Hospital.

Discussion/
Discussion:— This is a most interesting case. The first part of the chart shows the effect of the empyema on the leucocytes. By 15th April when the general condition was much improved, the empyema had subsided. On 17th April the leucocytes had reached their lowest level 6,500. Two complications followed one and other within one week, namely, nasal diphtheria, which recurred on 18th April, and Measles which occurred on the 25th April. Both these conditions causing a rise in the leucocytes.
CASE 14

MARGARET HAIG 16 years

January - March 1934
CASE 14.

MARGARET HAIG, aged $\frac{18}{12}$. Admitted 9.1.34.

Discharged 28.3.34.

Disease: Coeliac disease, with super-added alveolar pneumonia, left base, and right base.

History: Child was getting on well and had gained weight until 6.2.34, when coughing started on 7.2.34; the Temperature was down but the child looked very felled. Examination of the lungs showed crepitations at the Right base, and alteration of breath sound.

9.2.34 The Pulse was poor, and Respirations thready. A definite pneumonic patch was found at the Right base. Very dull on percussion. Crepitations and bronchial breathing heard there.

12.2.34 Child was gravely ill. Temperature swinging, pulse good. Left base now shows patch as well as right.


18.2.34 Worse in the evening. Pulse uncountable. Aspirated, but no pus found. Right base very dull. Sleeping better.

22.2.34 Temperature still high, still very thready pulse, child holding her own.

25.2.34 Definite improvement. Pulse stronger.

Sitting-up.

3.3.34 Aspiration of right base did not illicit any pulse. General condition satisfactory.

10.3.34/

26.3.34  No respiratory sounds found. Child keeping well.

28.3.34  Discharged. Chest condition clear.

Discussion:— This case is interesting from the point that the Pneumonia started while the child was in Hospital. Unfortunately the leucocyte count was not taken until the crisis had started on 18th. The recovery was uneventful. The leucocyte curve is again seen to follow that of the temperature.
Case 15

Kenneth Houston. 5 yrs. 10.

December 1933 January 1934

31 1 2 3 4 5 6 7 8 9 10

Disease: - Alveolar pneumonia and incidental convulsions.

Result: - Cured.

History: - 3 days before admission the boy became tired and feverish, very thirsty but with loss of appetite. Next day developed a sore head, and a short time after had a convulsion. Some time after that he had another. He has had a thread-worm infection for some time. He has become pale.

29.12.33 Still delirious. Pulse is good and regular, but not sleeping well, breathing rapid and distressed.

31.12.33 Temperature still high, pulse improved, also colour. Leucocytes down to 11,000. Still restless and delirious.

1.1.34 Temperature normal, drop in pulse and respiration rate.

4.1.34 Pulse good, rather slow; breathing easier.

7.1.34 Child much better, lung clearing up well, eating and sleeping well.

10.1.34 Discharged, lung now clear, condition generally improved.

Discussion: - This is an uncomplicated case of pneumonia. The slight rise in temperature after the crisis may possibly have been due to irritation due to thread-worm infection. The leucocytes were never very high, the peak being 16,000.
CASE 16.

ROMA JESSIEMAN, aged 3 12. Admitted 29.3.34.
Discharged 1.4.34.

Disease: - Alveolar Pneumonia, Right base.

History: - Well, until 3 days before admission. Then right earache started, which has now disappeared. One day before admission pain in right side, short cough, pain increased by movement. Feverish; lost appetite; no vomiting. On day of admission still feverish and the pain in right side continues. The breathing is more rapid. The bowels are normal, but there is some frequency in micturition.

Progress Notes: -
30.3.34 Crisis occurred. General condition good.
1.4.34 Temperature still at 98. Child well.
Discharged.

Discussion: - Only two leucocyte counts were performed on this child. By luck, I happened to hit on the two days, one where the fever was still manifest, and the other on which the crisis had occurred. The leucocyte crisis is seen to follow that of the temperature very closely indeed.
MARY KELLY, aged 6 12. Admitted 6.5.34.

Disease: - Alveolar pneumonia, left lung.

History: - 3 days before admission, pain started in epigastrium. Child became sleepy and listless. Soon after, vomiting occurred, at frequent intervals. Diarrhoea began, at same time as vomiting. Appetite is poor, very thirsty. Delirium on day before admission.

Examination: - Percussion note dull at left base. Vesicular breathing, but more tendency to become bronchial at left base.

Progress Notes: -
7.5.34 Definite impairment of percussion note over posterior part of left lung. Breath sounds are bronchial, and fine crepitations are scattered about the base. Open-air treatment started.
8.5.34 Temperature down, slightly, but leucocytes risen from 7,000 to 10,000. X-Ray clinches diagnosis of left lung pneumonia.
10.5.34 Temperature risen again, leucocytes up to 23,000. Impairment of whole of left lung.
12.5.34 Crisis yesterday. Leucocyte count also falling to 22,000. Child looks much better.
16.5.34/
16.5.34 Temperature has remained below normal. General condition very much improved. Still some dullness over left middle lobe, with faint tubular breathing.

20.5.34 Child is very well. Eating and sleeping well. Loose cough. Still slight dullness over left middle lobe. Breathing vesicular. No accompaniments.

Discussion:– This is a case where the pneumonia at first seemed like some abdominal condition. The leucocytes were very low in the early stages, but reached a peak of 27,400, on the day in which the crisis occurred; the leucocyte crisis not occurring for three days after that of the temperature. The Leucocyte curve is very similar to that of the temperature after the crisis.
CASE 18.

JOHN McCRAW, aged 1 \( \frac{8}{12} \). Admitted 14.5.34. Discharged.

Disease: - Alveolar Pneumonia right lung.

Result: - Cured.

History: - Comparatively well until 5 days before admission, then anorexia commenced. Severe cough and heavy breathing. Child very flushed. Very constipated.

Examination: - Impairment of percussion note over the right base. Tubular breathing and fine crepitations heard there.

Progress Notes: -

15.4.34 Cough very troublesome.
16.4.34 Temperature 103° in morning, dropped to 98.2 in evening. Child seems much more comfortable.
18.4.34 Still faint tubular breathing and slight dullness at right base. General condition very good.
20.4.34 General condition very good. Slight increase in dullness towards apex of right lung. Crepitations heard there.
23.4.34 Child much better. No impairment of percussion note. Breath sounds are vesicular in all areas.
27.4.34 No impairment of percussion note. Breath sounds vesicular in all areas.
CASE 19.

ELLEN MACDONALD, aged 2 $\frac{8}{12}$. Admitted 11.12.33.
Discharged 12.12.33.

Disease:— Alveolar Pneumonia left lung (upper lobe).

History:— Three weeks before admission the child had slight mastoiditis. A week before admission she became felled. Breathing heavy, appetite poor. Two days before admission the cough started which caused pain. Since then she has been drowsy. The bowels have moved normally, and there has been no vomiting.

Progress Notes:—
12.12.33 Under open-air treatment, she has had a good night's sleep. The colour has improved, fluids well taken, the breathing is easier.
14.12.33 The temperature fallen at night, general condition better. Signs of pneumonia still at left base.
18.12.33 Discharged. Local condition good. General condition improved.

Discussion:— This is a very typical case of pneumonia, both from the temperature and the leucocyte points of view. The temperature crisis is seen to precede that of the leucocyte crisis by one day. Once more the rise in temperature and leucocytes is seen after the crisis.
EMMA MCQUEEN, aged 9. Aged Admitted 6.1.34.
Discharged 15.1.34.
Disease: - Alveolar pneumonia, left lung.
Result: - Cured.

History: - Three days before admission cough started which caused vomiting. White phlegm was also brought up. The child was fretful. Next day the breathing became fast and difficult. Anorexia and pyrexia. On day of admission the cough seemed to cause the child pain.


Progress Notes: -
12.1.34 Temperature settled. Slightly above normal. General condition good. Takes food well and sleeps well.
15.1.34 Discharged. General and local conditions good.

Discussion: - This is an uncomplicated case of pneumonia where the leucocyte count was never above 13,500. Again the rise in temperature and leucocyte curves can be seen after the crisis.
CASE 21.

SHEILA MORRISON, aged 1½. Admitted 7.1.34.

Discharged 17.1.34.

Result: Cured.

History: Well, until a week before admission. Then became choked up, wheezy, feverish. Four days before admission a hard cough developed. She was taken to the Medical Out-Patient Department, R.H.S.C.E., where medicine was given which loosened the cough, since then she has become very feverish, with anorexia and difficulty in breathing. There was no vomiting but the bowels have been constipated.

Progress Notes: - When examined the child was very ill and prostrate. Temperature 104.6. The pulse was rapid and thready, respiration was increased but not distressed.

9.1.34 Temperature still over 101.0. Pulse improved in tone and rate. The child insists on sitting up. Still ill looking, still no signs of pneumonia found.


17.1.34 Discharged, pale but well.

Discussion/
Discussion:—The diagnosis was uncertain on the physical side. X-Ray photographs did not reveal the condition. Diagnosis was made certain on general clinical features. In this case the leucocyte count on 8.1.34 was 16,700, and remained above 10,000 throughout the child's stay in Hospital. Although the curve showed a very gradual decline in the leucocytosis this was most likely due to the length of time taken by the inflammatory process to subside.
CASE 22.

ANDREW PURVES, aged 9 years. Admitted 25.12.33.
Discharged 9.1.34.

Disease: - Alveolar Pneumonia, Right upper lobe.

Result: - Cured.


Examination revealed dullness on percussion, over upper lobe of Right lung. Vocal resonance increased. Breath sounds bronchial there.

Progress Notes: -
1.1.34 Temperature normal, child looks much better. Breathing easy and normal.
2.1.34 Rise of temperature in evening, due to constipation.
5.1.34 Child looks well, colour good. Eating and sleeping well to-night. Right apex practically cured of consolidation.
8.1.34/
Discharged. Local lung condition healed. General condition good. Improving daily.

Discussion:— This is another case of uncomplicated pneumonia. A rise of leucocytes is noted on the 3rd and 4th January, keeping up till the 7th. The most probable explanation of this is that slow resolution of the inflammatory processes was taking place. The leucocyte crisis is again seen to follow that of the temperature.
CASE 23.

ROBERT RONALDSON, aged 8 years. Admitted 19.3.34.

Discharged 29.3.34.

Disease: - Alveolar pneumonia, right lung.

Result: - Cured.

History: - Well till five days before admission. Then vomiting started suddenly, with headache, and pain in the stomach. Anorexia but great thirst. On day of admission still abdominal pain, but no headache. Child is very feverish. Hard and painful cough developed, with rapid breathing.

Examination: - Impairment of percussion note at right base. Breath sounds faint there.

Progress Notes: -


24.3.34 Respiratory symptoms much less.

26.3.34 Crisis occurred. Pulse, temperature and respiration rate down. Great improvement in general condition.

28.3.34 Chest clearing well. Now practically no signs of pneumonia. General condition good.

29.3.34 Discharged. General and local conditions good.

Discussion/
Discussion: - This case started with a very high leucocytosis which began to fall before the onset of the temperature crisis, but did not show a true crisis until a day after that of the temperature. It was an uncomplicated case, and the child made a rapid recovery.
Case 24

Joseph Sibbald 4 10/12
January 1934

Graph showing WBC counts from 1 to 5 weeks with values 20,000, 15,000, 10,000, and 5,000.
CASE 24.

JOSEPH SIBBALD, aged 4 12. Admitted: 1.1.34
Discharged: 6.1.34

Result:- Cured.

History:- Four days before admission child became feverish, with a heavy cold. He vomited once or twice. Cough started on day before admission.
Temperature 98.6. Leucocyte count 7,000.

Progress Notes:-
6.1.34 Chest condition now clear. Child well. Discharged.

Disease:- Bronchitis.

Discussion:- The significance of this case which I have included in the series merely to show what is the behaviour of the leucocytes is an average case of Bronchitis. The leucocytes at no time numbered more than 9,500. Very rapid recovery in Hospital took place. I find that in the case of Bronchitis the leucocyte count does not help to distinguish between it and pneumonia, for, in a Bronchitis the leucocyte count during the febrile stage is comparatively low, e.g., circa 7,000 - 11,000, while in a Pneumonia the leucocyte count is high during the febrile stage, 15,000 - 20,000.
Case 25.

James, Watt. 2 yrs.

Feb., 1934.

Graphical data showing changes in weight over time.
1.3.34 Another patch of pneumonia found situated in the left axilla, in spite of this general condition shows slight improvement.


9.3.34 General condition still poor. All fluids given by nasal catheter. Ears discharging freely.

10.3.34 Ear swab shows B diphtheria. Transferred to City Hospital.

Discussion: This case shows the course of a pneumonia which affected first the left and then the right lungs. It is interesting to note how closely the leucocyte curve follows that of the temperature. The super-added aural infection causes a considerable rise in both curves.
CASE 26.

AGNES YORKSTON, aged 1 1/2. Admitted: 14.12.34.

Disease: Alveolar Pneumonia (?Left Lung)

Result: Cure

History: Four days before admission the child became cross and developed a cough, which left the child exhausted. The mother thought it to be due to teething. The child became worse. Last three days breathing has become heavy. Anorexia has developed. Has vomited after taking fluids. She has been drowsy, but has not been in bed. Bowels have moved normally.

Examination - Faint vesicular breathing heard at the left base. Harsh vesicular breathing heard elsewhere. Ronchi bilaterally. Physical signs do not warrant a diagnosis of Pneumonia, but the clinical condition does.

Progress Notes:


23.12.33 Temperature still high. Pulse very rapid.

Volume/
Volume not good. Cough not troublesome. Looks very ill.


30.12.33 Temperature normal. Child fretful, probably due to irritability of convalescence.

3.1.34 Improving Lung condition practically healed.

4.1.34 Discharged. General condition requires careful convalescence. Local condition satisfactory.

Discussion:— This is case in which there is no definite crisis. Resolution takes longer than in most cases. The drop in the leucocytosis however, takes place on the same day as the drop in the temperature. A rise in the leucocyte curve without a corresponding rise in the temperature curve is seen. Again probably due to slow resolution.
Case 27

Robert. Yorkston 14 yr.

January. 1934
CASE 27.

ROBERT YORKSTON, aged 1 year. Admitted:-- 1.1.34
Discharged: 24.1.34

Disease:-- Alveolar pneumonia, right and left lungs, successive double.

Result:-- Cured.

History:-- 5 days before admission became very flushed. 4 days before admission, vomited, a hard cough started, very feverish. Yesterday breathing became very quick.

Examination -- Percussion impaired at right base, tubular breathing and crepitations heard there.

Progress notes:--
2.1.34 Temperature fallen to 99.6°. Improvement in pulse and respiration rate. Great dyspnoea.
4.1.34 Rise of temperature to 102°. Breathing distressed, but colour and pulse good, not much cough.
6.1.34 Restless but taking fluids well. Colour good. Still dyspnoea.
10.1.34 Temperature high, but child quiet.
11.1.34 Marked consolidation at right base, extending upwards.
21.1.34 Temperature now settled. Dyspnoea gone.

General condition improving. Very irritable.
24.1.34 Discharged. Lungs clear. General condition good,
good, but irritable.

Discussion:— This case is interesting from the fact that there is no true crisis shown in the temperature chart, and from the leucocyte curve one would suspect that an empyema would ensure, instead of that, pneumonia commences in the other lung, which happily resolves. A true leucocyte crisis takes place on 17.1.34.
INDEX TO APPENDIX. Contd.

CLASS B. CASES OF PNEUMONIA FOLLOWED BY EMPYEMA, OR, EMPYEMAS.

Case 1. James Conner
2. William Giblain
3. Mary Keenan
4. Jean Lovey
5. George McDonald
6. Elizabeth McLaren
7. Ronald Mathieson
8. James Ritchie

__________________________
CASE I.

JAMES CONNER, aged 6 years. Admitted: 25.1.34.

Discharged: 2.4.34.

Disease: Right-sided alveolar pneumonia and ampyema.

History: Three days before admission, pain in the chest started, with generalised headache, and a short hard cough, which caused the patient pain. Appetite became poor, and the child vomited. Since then the condition has become worse. Examination reveals impaired percussion note at right base.

Progress Notes:

26.1.34 Pain less, but restless and distressed.
 Fluids taken well.

28.1.34 Temperature down to 100° now. Fresh air treatment shows improvement.

29.1.34 Marked dullness over the right middle lobe, with bronchial breathing. General condition improved.

1.2.34 General condition improving. Fretful, but breathing easier.

4.2.34 Still dull at right base. Child happy, no cough.

7.2.34 Still dull at right base. More settled temperature.

Continues to improve.

10.2.34 Aspiration, 80cc, thick green pus removed.

15.2.34 Temperature settled, and general condition good. Very little cough.

20.2.34/
20.2.34 Very drowsy for last day or two. Temperature up again and irregular. Not much cough, but right base still stony dull.
24.2.34 Child brighter. Sitting up. Still dull at right base.
28.2.34 Aspiration revealed no pus.
4.3.34 Child well again, very little cough.
8.3.34 Gained 1 lb. in weight, eating well.
15.3.34 Again 1 lb. weight gained. Very well; Eats and sleeps well. No cough.
22.3.34 Child up in afternoon.
29.3.34 Up in past week. Gaining weight.
2.4.34 Discharged, well.

Discussion:— This is another case where the leucocyte count started at rather a low level, but instead of remaining low after the crisis, the leucocyte curve shot up to a peak of 33,000, and then slowly came down to 17,000, by which time empyema was clearly manifest by the clinical findings. Again, if we had only observed the temperature curve, empyema would not have been suspected, but seeing both curves together immediately puts one on one's guard, thus proving the usefulness of a leucocyte curve in a case of pneumonia.
Case 2.

William, Giblain 15

December 1933 - 34.

January.

Temp. 4 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

30000

25000

20000

15000

10000

5000

0

5000

78

105

104

103

102

101

100

99

98

97

96

95

94

93

92

91

90
CASE 2.

WILLIAM GIHLAIN, aged 1½. Admitted: 9.12.33
Death: 2.3.34

Disease:— Right-sided pneumonia, empyema.

History:— Was well till 5 days before admission, then became listless, short of breath, severe coughing started which caused vomiting, since then has become worse. No solid food taken, only liquids. Sleeping badly, apparently no pain, very pale.

Examination:— Breathing 72 per minute. Impairment of percussion note at right base. Crepitations of both bases. No prolonging of expiration. Breath sounds harsh and vesicular.

Progress Notes:—
10.12.33 Open-air treatment started.
12.12.33 Colour slightly improved. Pulse better; very definite dullness of right base. Tubular breathing heard there.
16.12.33 Sudden rise of temperature to 102° in evening.
19.12.33 Still dullness at the right base. No faint breath sounds. Very restless, remains pale.
22.12.33 Temperature fallen again, still very poor colour.
28.12.33/

1.1.34 Child still very cross. Rise in temperature and pulse. Still very dull at right base.


7.1.34 Aspiration of chest. 17 cc. of green pus withdrawn. Percussion note impaired, after aspiration.

11.1.34 Temperature more settled. Child still very ill looking. Chest stony dull at right base.

15.1.34 Very pale and listless. Temperature not high. Aspiration of pus. To go to Surgical side for operation.

18.1.34 Transferred to Surgical side. Rib resection performed by Miss Herzfeld. Good drainage established.

After operation, unsatisfactory progress occurred with fever, etc. About 6th February, a small superficial abscess appeared on the left side of the forehead. This was opened, and cleared up under fomentation treatment. Death took place in spite of blood transfusion on 2.3.34. Post-mortem puncture of the right pleura revealed thick pus.

Discussion:- This case illustrated a very severe empyema. The little patient had put up a good fight against the infection, but nevertheless in the end his resistance was worn out. It is interesting to note/
§8.

note that although both the leucocyte and the temperature crises occurred on the same day, that the leucocyte curve preceded that of the temperature by one day, in its rise, due to the empyema; also again we see the rise and fall due to a super-added infection beautifully illustrated in the leucocyte curve from the 16th - 13th February, 1934. This being due to the superficial abscess on the forehead.
CASE 3.

MARY KEENAN. Aged 8 1/2. Admitted 6.1.34 Death 23.1.34

History:— One week's malaise anorexia, loose green stools, irritability, head rolling, small hard cough. When admitted, thought to be a case of gastro-enteritis.

Progress Notes:—
14.1.34. Neck rigidity, lumbar-puncture, cerebro-spinal fluid under pressure. Nil abnormal was found in cerebro-spinal fluid by Pathologist. Then thought neck rigidity was due to meningism of apical pneumonia. Child coughing a good deal.
16.1.34 Vomited. Cough worse, refusing to take fluids.
19.1.34 Abdomen distended, painful on palpitation. Sudden rise in temperature. Query peritonitis.
20.1.34 Seen by Surgeon who recommended conservative treatment. Abdomen less distended. Exploratory paracentesis revealed no fluid.
21.1.34 Collapse in the morning. Response to stimulation, though colour and pulse remain poor.
22.1.34 Again morning collapse with response to oxygen, etc.
23.1.34 Death, 3 p.m.

Post Mortem revealed Right-sided Pneumonia and empyema with lung abscess.

X-Ray Examination on day after admission revealed the Pneumonia which was not shown clinically until 7 days later.

Discussion/
Discussion:- The first leucocyte count was taken on 9.1.34 and was 23,600. On 14.1.34 it had fallen to 12,500, but the next day had risen again to 19,500, which may have been due to the formation of the lung abscess. Thereafter there was a rapid drop in the leucocytosis to 9,000. This drop being in advance of the temperature. The significance of the leucocyte curve in this case is the rapid and unwarranted drop in the leucocyte curve showing that the body resistance could no longer hold its own against the infection working against it.
CASE 4.

JEAN. LOVEY

1933

7/12
CASE 4.

JEAN LOVEY, aged 7 10/12. Admitted: 25.9.33.

Discharged: 1.12.33

Disease: - Chronic right-sides pneumonia, and query empyema.

History: - Pneumonia at right base, in the spring of 1933, which followed whooping-cough. Child has never picked up since. 5 days before admission, she complained of a pain in the right side of the chest. She became feverish, the breathing became heavy, and she coughed up brown-coloured sputum.

Examination - revealed flattening of the chest on the right side. Percussion note dull at right base, up to the 8th interspace. Aspiration on date of admission - 2cc., blood-stained purulent fluid.

Progress notes: -

27.9.33 Child very ill. Cough bad, pain in the right side.

28.9.33 Dullness at right base increased.

29.9.33 Aspiration proved negative. Very dull at right base.

30.9.33 Better generally, but still very felled.

Temperature normal.

2.10.33 Colour better.

13.10.33 Local condition in statu quo. X-Ray shows a central empyema. General condition improved, reads and smiles.

16.10.33/
16.10.33 White blood cells fallen to 9,000. Still very thin, but is happy.
18.10.33 W.B.C. 15,400
19.10.33 W.B.C. 16,000
20.10.33 Pain in right ear. Slight otitis media with a small bulla.
28.10.33 Comfortable. Leucocytes still raised. Ear is better.
2.11.33 Gain in weight. Considerable dullness over left side. Bronchial breathing heard anteriorly.
4.11.33 Aspirated. No pus found.
8.11.33 Ear is again normal. Child is bright.
9.11.33 Gain of 14 ozs. weight. Eyes brighter.
16.11.33 1½ lbs. gain. Much better, colour better.

Discussion: The diagnosis of empyema in this case is very doubtful. I would not say from the leucocyte count that an empyema had been present. The main rise of the leucocytes was due to the child's otitis media and bulla. Except for this rise due to the otitis the leucocyte curve closely follows that of the temperature.
CASE 5.

George Macdonald, 23

1934

Graph showing temperature and other data for January, February, and March 1934.
CASE 5.

GEORGE MCDONALD, aged 2 1/2. Admission: 22.1.34
Discharge: 4.4.34

Disease:- Empyema.
Result:- Recovery.

History:- Well, until 3 weeks before admission, then the child developed a chill which was accompanied by vomiting and high fever, and anorexia. He has never been well since, and has been in bed. The fever has continued. He complains of pain in the side, and cries out with the pain. There is a short suppressed cough. He has become thinner and pale during the last 14 days.

Examination - reveals stony dullness at the right base, with faint breath sounds, and decreased vocal resonance.

Progress notes:-
24.1.34 General condition good. Temperature normal, no cough, nor pain.
25.1.34 Aspiration, 2cc. pneumococcal pus obtained. Temperature normal. Eating well. No cough.
30.1.34 Rise of temperature to 100°, very dull at right base, no cough.
1.2.34 Temperature swinging. General condition good. Gained 8 ozs. weight. Very dull at right base. Probably an increase of pus.
6.2.34 Temperature still swinging. Still dull at right base.
General condition good.
8.2.34/
8.2.34 Slight gain in weight. Dull at right base.
10.2.34 Aspiration, 30cc., thick green pus withdrawn.
14.2.34 Loss of weight, but child moderately well.
15.2.34 Not so well. Aspirated; 2cc. pus obtained.
22.2.34 8 ozs. weight gained. Child brighter.
3.3.34 Not so well, listless, very little cough. No increase of physical signs in chest. Aspiration revealed no pus.
4.3.34 Temperature 102°.
6.3.34 More active and happy. Stools pale, slightly jaundiced.
7.3.34 Catarrhal jaundice diagnosed.
9.3.34 Jaundice clearing up. Child is very well now.
15.3.34 Gained ½ lb. weight. Very well, no cough, appetite good.
22.3.34 No gain in weight, but condition very good.
29.3.34 Very well, up for a few hours.
4.4.34 Discharged well.

Discussion:— This illustrated a case of mild empyema, complicated by catarrhal jaundice. It is interesting to note here that there is no leucocyte response to the catarrhal condition, although there was a very definite febrile stage. The leucocytes are seen in the chart to gradually follow the temperature down to a normal level.
CASE C.

BETTY MCLAREN.

1933

OCTOBER

Tub. 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

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

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

WBC

35,000

25,000

15,000

5,000

0

105

104

103

102

101

100

99

98

97

96

95

94

93

92

91

90
CASE 6.

ELIZABETH MCLAREN, aged 4½. Admitted: 12.10.33
Discharged: 4.1.34.

Disease:— Alveolar Pneumonia, (left lobe), and empyema.
Result:— Cured.

History:— Pain in the chest, loss of appetite, and cough, for four days. No sputum. Examination revealed bronchial breathing at left base and bilateral crepitations.

Progress Notes:—
13.10.33 Fresh air treatment started. Temperature falling to 102°. Less felled.
16.10.33 Looks toxic. Pulse irregular. Tuberculin re-action ++. Heady and restless
19.10.33 Looks better, colour improved. Asks for food.
20.10.33 Brighter, and eating better.
23.10.33 More restless. Leucocytes have risen. Not eating well.
25.10.33 Left base duller than before. Query empyema. Looks a little better.
26.10.33 Stony dull left lung.
27.10.33 Left lung aspirated. 35cc. semi-purulent fluid withdrawn. Eating well, and happy.
28.10.33 Pleural effusion shows pneumococcus.
31.10.33/
31.10.33 Aspiration again attempted, but child would not permit of it. Exhausted after attempt.
1.11.33 Aspiration again failed. Child languid.
2.11.33 Eating well, local improvement.
4.11.33 Colour poor. Fairly well. Still extensive local dullness and effusion.
10.11.33 Condition no worse, W.B.C., 15,000.
11.11.33 Local condition improved, W.B.C. 18,000.
14.11.33 What is apparently a superficial abscess of the chest-wall was aspirated. Leucocytes yesterday, 22,000. Fomentations applied.
16.11.33 Abscess opened in theatre, rubber drain inserted. Temperature fell from 102° to 99°. Loss of weight noted.
18.11.33 Temperature normal. Profuse blood-stained discharge from wound. Fairly bright and comfortable.
19.11.33 Rubber tube inserted through wound into cavity by me. Discharging freely. Temperature normal. Child well.
21.11.33 General condition improved. Profuse discharge.
21.1.33 No gain in weight. General condition still continues to improve. Hardly any discharge from wound, which is healing well. Has now been up for a few days. Child becoming stronger.
28.12.33/

3.1.33 Further gain in weight. Child very well.

4.1.33 Discharged to Gullane Convalescent Home.

Discussion: This case is interesting in that it shows, a delay in the crisis of the leucocyte curve. If the temperature had been relied on alone, one would have suspected that no further inflammatory processes were at work, but the fact that the leucocyte curve, instead of following that of the temperature down to normal, kept rising from 17th October, till the 31st, thus showing that the leucocyte curve is of use in foretelling the onset of the empyema. It is interesting also to note the extremely high leucocytosis caused by what was at first thought to be a superficial abscess of the chest wall, but which in reality was a pocket of pus which had tracked there and formed the apparent abscess. When free drainage had been established, the condition very soon cleared up, as shown by the rapid drop in the leucocytes.
CASE 7.

Death: 26.10.33.

Disease: - Alveolar Pneumonia, left lung. Empyema.

History: - Well, until 10 days before admission, then developed a cold. 7 days before admission became felled, since then has become worse, listless, anorexia, cough, but no sputum. No vomiting, earache but no discharge.

Examination - shows dullness on percussion at the left base. Bronchial breathing over that area. Vocal resonance increased.

Progress Notes: -
9.10.33 Condition worse. Fresh-air treatment started.
10.10.33 Colour very bad. Fresh-air treatment stopped, as it distressed the child. Temperature very high.
11.10.33 Colour better. Fresh-air treatment re-started.
12.10.33 Slight improvement. Still delirious.
13.10.33 Taking fluid well. General condition improved.
14.10.33 Fretful.
16.10.33 Not improved. Colour poor. Bronchial breathing over the right-middle lobe as well as that on the left side.
19.10.33 Leucocyte count lot. Aspiration 2½ ozs. pus withdrawn.
20.10.33 Further 8 oz. pneumococcal pus removed.

Cannula/
Cannula inserted. Pulse thready, colour poor.  
22.10.33 Weaker. 2 oz. pus aspirated. Colour bad.  
23.10.33 General condition worse. Pulse fluttering.  
Aspiration impossible, due to air leak in cannula.  
25.10.33 Much worse, pulse hardly perceptible.  
Rubber tubing inserted into pleura, draining better.  
26.10.33 Condition slightly better. At 8 p.m.  
breathing became very difficult and pulse very bad.  
Strychnin and oxygen administered. Child responded  
to stimulation. At 11.15 p.m. grey and cyanotic.  
Breathing stopped. 11.20 p.m. Death.  
Discussion:— This is a case where the toxic processes  
at work overcame the body resistance of the child.  
Although the temperature fell to normal the leucocytes  
ever fell below 14,500 before the onset of empyema.  
This case illustrates very well the importance of the  
leucocyte count at the crisis, and the two or three  
days following the crisis of a pneumonia.
JAMES RITCHIE, aged 1 year. Admitted: 15.3.34
Transferred: 13.4.34

Disease: - Right-sided empyema.
Result: - Discharged to City Hospital with nasal diphtheria.

History: - 2½ months before admission child had whooping cough which later developed into pneumonia. Since then the child has had a cough which has been severe and hard in character. He has been feverish at night, but losing weight. Food is taken well, but vomiting often occurs. The colour is pale.

Examination - The percussion note is impaired at the left base, probably due to adhesions. At the right base the breath sounds are vesicular and faint. Crepitations and bronchi are heard there and friction at one localised area. Elsewhere, throughout the lungs harsh vesicular breathing can be heard with crepitations and bronchi.

Progress Notes: -
18.3.34 Still abundant Ronchi and crepitations. The cough is troublesome and the child is still very ill.
20.3.34 Nasal discharge. B. Diphtheria found.

Transferred to City Hospital.

5.4.34 Patient in City Hospital for a week, then re-admitted with percussion note impaired down the right side.
8.4.34/
8.4.34 Temperature dropped to 97°. Colour fairly good. Food taken well. Looks better.

11.4.34 Blood-stained nasal discharge. B Diphtheria positive, but looks better. Eating well.

13.4.34 Getting on well, but as virulence test is positive for diphtheria, child again transferred to City Hospital.

Discussion:— The leucocyte curve in this case shows an irregularity which one associated with an empyema. On the 13th April, there is a sudden rise due most probably to the aural inflammation.
Case 9.

Isaac Whiteford 10y.

November - December 1938
CASE 9.

ISAAC WHITEFORD, aged 10 years. Admitted: 9.11.33
Discharged: 8.3.34

Disease: - Left-sided pneumonia and empyema.
Result: - Improved.

History: - Pneumonia started 14 days before admission. He had then a loose cough and no sputum.

Examination - revealed stony dullness on percussion over the left side. Breath sounds very faint.
Examination revealed stony dullness on percussion over the left side. Breath sounds very faint.
Examination revealed stony dullness on percussion over the left side. Breath sounds very faint.

Vocal resonance practically gone. Percussion poor over the right middle lobe, over a larger area than can be accounted for by Grocco's triangle. Breath sounds. On day of admission child lies quiet.

Fluids well taken, diarrhoea and breathing more difficult.

Progress Notes: -

9.11.33 270cc. of green purulent fluid aspirated from left ear.

11.11.33 Coin test +. X-Ray shows a straight line of fluid, pyo-pneumo thorax.

13.11.33 Temperature rose to 103° in evening. Colour poor, pulse good, pain in left side. T.R. +.


16.11.33 240cc. pus withdrawn, temperature lower, still swinging.

20.11.33/

23.11.33 General condition better, eating well, no pain.

2.12.33 Cannula slipping in the thoracic wall, and leaking. No pain.

3.12.33 Cannula removed, drainage tube inserted. General condition improved.

6.12.33 General condition satisfactory.

9.12.33 The temperature steady. General conditions improving. No pain in the right side. Pus discharging freely. Iodoform and paraffin injected into the thorax every second day.

18.12.33 Good progress, local condition satisfactory.

25.12.33 Temperature swinging again, very little discharge. Sinus forceps passed. Good drainage established.

30.12.33 Temperature again settled. Good discharge. The child is bright and the colour improving.

7.2.34 Child becoming visibly fatter, and eating very well.

13.2.34 Breathing exercises twice a day. General condition good.

18.2.34 Improving.

26.2.34 Still progresses favourably. Colour very good.

8.3.34/
8.3.34 Discharged to Gullane Convalescent Home. Temperature settled. Drainage well. Much less discharge.
5.4.34 Re-admitted from Gullane. Drainage tube still in.
14.4.34 Good drainage from wound. Child improving.
23.4.34 Good drainage. Child well.
30.4.34 Amount of pus less. Looks very fit.
6.5.34 Gained 2½ lbs. weight. Still a little discharge from wound.
10.5.34 Satisfactory.
13.5.34 General condition very good. Still a little pus discharging. Leucocyte count has been steady at 7,000.

Discussion:- The chief interest in this case of empyema is the affect which bad-drainage from the pleural cavity has on the leucocyte count, invariably making it rise sharply, and a corresponding fall, which you get when proper drainage is established. The long drawn out course of an empyema is well seen in this case.