PNEUMONIA IN CHILDREN.

(with especial reference to the fibrosis following broncho-pneumonia)

An analysis of 169 cases of pneumonia in children, and a histological examination of 78 lungs.

A thesis submitted to the University of Edinburgh for the degree of Doctor of Medicine by A. Eisdell Moore. M.B. Ch.B.
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Pneumonia in Children.

1. Introduction.

Considering that 30% of all deaths in England and Wales are in infants under the age of two years, and that in infancy the lungs are perhaps more frequently the seat of organic disease than are any other organs in the body, the importance of the subject of this thesis can hardly be over-estimated.

It is a subject upon which an immense amount of work has been done, yet the type of the disease known as primary broncho-pneumonia has no recognised classification, some authors regarding it as a lobar pneumonia, most placing it with secondary broncho-pneumonia, while only a few consider it as an individual disease.

Again, though most writers refer to the possibility of fibrosis being a sequel of broncho-pneumonia, there has been but little histological work done upon the subject.

In this paper my object is

Firstly, to emphasise the differences between the various forms of pneumonia, and bring forward the reasons why primary broncho-pneumonia should be
considered as an individual disease, and

Secondly, to show that fibrosis is a very frequent occurrence in broncho-pneumonia, and that by thickening the alveolar and bronchiole walls even to a slight extent, the lung tissue is so devitalised that a relapse or an exacerbation of the disease proves rapidly fatal.

In order to gain information regarding the frequency of the various types of pneumonia in childhood, the clinical course of each, and the varying mortality, I have taken a series of 169 consecutive cases of pneumonia admitted to the East London Hospital for Children during a period of six months.

Hospital statistics vary very much from the different classes of patients attending at different hospitals, from the inclusion or exclusion of infectious diseases, the prevalence of an epidemic, etc. Thus it is necessary to mention that these cases were taken from a hospital where children from birth to the age of fourteen years are admitted, so that the age distribution is fair; where the patient is taken from the poorest slum class, so that the vitality is low and the mortality high, and where a limited number of cases of diphtheria, pertussis,
and measles are treated in an infectious block.

The cases of pneumonia were divided into three groups, lobar pneumonia, primary broncho-pneumonia, and secondary broncho-pneumonia. This classification was made after viewing each case as a whole; history, physical signs, symptoms and course—all being taken into account, and in the fatal cases, the pathological appearances as well. The main points in the differential diagnosis will be brought out in the clinical comparison of the diseases, but it may be wise to say that the diagnosis of primary broncho-pneumonia was made when a previously healthy child was attacked by a sudden severe pneumonic fever, with the physical signs of patchy consolidation.
II. A Clinical Comparison of the Three Types of Pneumonia in Childhood.

Relative Frequency.

In the 189 cases studied the diagnosis of

LOBAR PNEUMONIA was made in 85 cases = 38%
PRIMARY BRONCHO-PNEUMONIA " 28 " = 17%
SECONDARY " 76 " = 45%

These figures are important because they show that lobar pneumonia is a common disease in childhood, a fact that is frequently overlooked. It is very essential that its frequency should be recognised in practice because its prognosis, as will be shown later, is so widely different from that of either form of broncho-pneumonia.

By referring to the statistics of all cases of pneumonia treated at the East London Hospital for Children during the years 1909 - 1912 I find that out of 988 cases of pneumonia treated, 508 or 51% were diagnosed as lobar pneumonia.

Thus one can state definitely that lobar pneumonia is a common disease in childhood.
Though each form of pneumonia is frequent in children, there is a difference in the ages at which the various types are most common.

The following table shows the relative age incidence of the different types:

<table>
<thead>
<tr>
<th></th>
<th>Lobar</th>
<th>Primary Broncho</th>
<th>Secondary Broncho</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 6 months</td>
<td>1</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>6 months-1 year</td>
<td>7</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>1 year-2 years</td>
<td>14</td>
<td>12</td>
<td>39</td>
</tr>
<tr>
<td>2 years-3 years</td>
<td>15</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>3 years-4 years</td>
<td>10</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4 years-5 years</td>
<td>5</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Over 5 years</td>
<td>13</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Thus the greatest number of cases of lobar pneumonia occurred between the first and third years, while the greatest number of both primary and secondary broncho-pneumonia occurred between the sixth month and the second year.

Also it is important to note that although in the earlier years of infancy there was a fairly uniform proportion of two to three times as many cases of secondary broncho-pneumonia as of primary broncho-pneumonia, yet there was a distinct infrequency of
of primary broncho-pneumonia after the age of three.

Previous History.

A comparison of the previous history in the various cases studied showed a marked difference in the different types of the disease.

Lobar pneumonia usually attacks people in good health. In children, I think it frequently occurs after measles, yet so long after the attack as not of necessity to be called a secondary pneumonia.

In the series of 65 cases, 9 had had measles from one month to three months previous to the attack of pneumonia, and in all these the pneumonia was typically lobar both in symptoms and physical signs. All pneumonias occurring within a month of measles I have classed as secondary irrespective of their course.

Of the other patients who had lobar pneumonia, five were in poor health at the time of onset of the disease. All others were strong children in good health; i.e., 51 out of 65 or 78.5% were healthy.

In primary broncho-pneumonia the previous history obtained was very similar. In the 28 cases included in this group three had had measles six to
ten weeks previously to the onset of the pneumonia, and two were said to be "weakly children". All others were strong and in good health i.e., 22 out of 28 or 80% were healthy.

In secondary-broncho-pneumonia the previous history was of course very different from that in the other varieties of pneumonia. In the secondary type a preceding disease is invariable, but it may be either acute or chronic. The commoner of the acute diseases are measles, pertussis, diphtheria, and infective enteritis. Two of the cases under study had a history of more than one of these diseases, whilst one was secondary to malignant endocarditis, and one to erysipelas. Of the chronic diseases predisposing to broncho-pneumonia rickets is by far the most important, and a typical history is that of the rickety child with chronic bronchitis and chronic diarrhoea.

In all cases the preceding disease has been of sufficient severity to lower substantially the vitality of the patient, and this contributes largely to the great severity and high mortality of the disease.
Premonitory Symptoms.

The wide differences found in the previous histories of the various types of pneumonia lead one to expect similar differences in the mode of invasion of the diseases.

Thus - in lobar pneumonia

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting</td>
<td>38%</td>
</tr>
<tr>
<td>Severe diarrhoea</td>
<td>10%</td>
</tr>
<tr>
<td>Marked constipation</td>
<td>9%</td>
</tr>
<tr>
<td>Apathy</td>
<td>8%</td>
</tr>
<tr>
<td>Convulsions</td>
<td>6%</td>
</tr>
<tr>
<td>Delirium</td>
<td>4%</td>
</tr>
<tr>
<td>Rigidity</td>
<td>2%</td>
</tr>
</tbody>
</table>

The varying ages made a great difference. Headache, and pain in the side, and shivering were present in most of the older children, but the inability to ascertain their presence in babies makes a percentage impossible.

In children the occurrence of nervous symptoms is no guide to the site of the pneumonia. Apathy, rigors, or rigidity are more likely to be found in a widespread involvement of the lung, with high temperature and great toxaemia than with an apical pneumonia.
In primary broncho-pneumonia

Vomiting was present in 22%
Severe diarrhoea 18%
Marked constipation 10%
Convulsions 13%

Convulsions were thus more than twice as common at the onset of a primary broncho-pneumonia than at the onset of a lobar pneumonia, and at this early stage when a diagnosis between the two is frequently very difficult, the occurrence of convulsions is one point in favour of the case being a primary broncho-pneumonia, when a guarded prognosis will naturally follow.

In secondary broncho-pneumonia the presence of the preexisting disease greatly masks any premonitory symptoms that occur. One can say only this, that the first indication of the complication of pneumonia in these diseases is a rise of temperature, some cyanosis, and a rapidity of the respiration, and these are really the symptoms of the disease itself. Convulsions, present in but 4% at the onset, were less common than in either of the other forms.
Site most frequently affected.

The following table shows the proportions in which the lobes were affected in the different forms of pneumonia.

<table>
<thead>
<tr>
<th></th>
<th>Lobar</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Both lower lobes</td>
<td>8%</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>Right lower lobe</td>
<td>59%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>Left lower lobe</td>
<td>31%</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>Upper lobes</td>
<td>22%</td>
<td>14%</td>
</tr>
</tbody>
</table>

In adults it is generally recognised that lobar pneumonia affects the right lower lobe more frequently than the left lower lobe. In children this is not nearly so definite, though the series studied shows a greater frequency in the right lower lobe. Certainly whilst lobar pneumonia tends to be limited to one base, both forms of broncho-pneumonia are more widespread.

Physical Signs of Consolidation

Owing to the great differences in the amount and rapidity of consolidation in lobar pneumonia and in either form of broncho-pneumonia, the physical signs naturally are very different, but there is
also a difference in the time at which the signs appear and disappear.

The following table shows the average in cases under study.

<table>
<thead>
<tr>
<th></th>
<th>Lobar</th>
<th>Primary</th>
<th>Secondary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Broncho</td>
<td>Broncho</td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>4th day</td>
<td>4th day</td>
<td>4th day</td>
</tr>
<tr>
<td>Disappearance</td>
<td>11th day</td>
<td>15th day</td>
<td>22nd day</td>
</tr>
</tbody>
</table>

This average may be slightly misleading because many children seen for the first time have well marked physical signs and it is impossible to say how long they have been present.

In lobar pneumonia the physical signs are very distinct. They include deficient expansion over the area of solid lung, with increased vocal fremitus and sometimes palpable pleural friction, dulness to percussion, and tubular breathing. At the earliest stage the percussion note is often tympanitic and the breathing harsh, though sometimes the breath sounds are fainter than on the normal side. When resolution is occurring crepitations and later mucous râles accompany the breath sounds.

In the cases examined I note that in those cases where the appearance of the physical signs was
delayed, the first suggestion of alteration in breath sounds or in resonnance was usually found high in the axilla. As this is a region likely to be overlooked I consider it possible that some cases which clinically are lobar pneumonia but have no physical signs, might show evidences of some consolidation if more attention was paid to this region. Some writers say that there can be consolidation so deep in the lung that it is obscured by normal lung superficial to it. In all the autopsies carried out consolidation deeply in was looked for, and in all cases it was found that consolidation started rather from the surface and worked inwards, and in none was a localised patch found deep in the substance of the lung.

In children the rapid resolution of lobar pneumonia is very striking. In many cases the child appears perfectly well immediately after the crisis, and often all signs of consolidation will disappear within forty-eight hours.

The physical signs are identical in both forms of broncho-pneumonia, though they naturally vary greatly according to the extent of consolidation.
The earliest and most reliable sign is the presence of moist crepitations of extremely high pitch, usually audible at both bases, but certainly audible in more than one part of the lung. Later there is impaired resonance, and if confluent consolidation occurs the physical signs closely resemble those of lobar pneumonia, though the breath sounds are harsher and have more accompaniments.

A very important point is the marked difference in the general appearance of the patient. In lobar pneumonia, the child though irritable and restless, is a good colour; but in either form of broncho-pneumonia the child is obviously in great distress and cyanosis is practically invariable.

The course as indicated by temperature chart.

In order to compare the typical course of each variety of pneumonia, the maximum temperature, pulse rate, and respiration rate was noted and an average worked out for each series.

The following table shows the results obtained:
LOBAR PNEUMONIA

PRIMARY BRONCHO-PNEUMONIA

SECONDARY BRONCHO-PNEUMONIA
<table>
<thead>
<tr>
<th></th>
<th>Lobar.</th>
<th>Pri: Bron:</th>
<th>Sec: Bron:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pyrexia</strong></td>
<td>101-103.4</td>
<td>100.5-103.8</td>
<td>99-103.5</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crisis on 7th day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irreg:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(steady lysis) (about 18th)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(on 12th day.) (day.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pulse</strong></td>
<td>130-158</td>
<td>135-162</td>
<td>140-165</td>
</tr>
<tr>
<td><strong>Convalescent pulse</strong></td>
<td>94</td>
<td>100</td>
<td>102</td>
</tr>
<tr>
<td><strong>Respiration</strong></td>
<td>40-56</td>
<td>45-60</td>
<td>50-67</td>
</tr>
<tr>
<td>Pulse respiration ratio</td>
<td>2.9:1</td>
<td>2.7:1</td>
<td>2.6:1</td>
</tr>
</tbody>
</table>

**Pyrexia:** Though the pyrexia in lobar-pneumonia is more constant than in the broncho-pneumonia, it is not nearly so constant as in adults, a fact probably explained by the less stable character of the beat regulating centre in children. Primary broncho-pneumonia is characterised by a high temperature with morning remissions, and a constant pyrexia is by no means frequent in this type, though it is often given as a point of diagnostic value. In secondary broncho-pneumonia the pyrexia is definitely hectic, and there is an irregular swing of three or four degrees, which is very characteristic. It is usually slow to reach its highest point, and does not shoot to a great height at the outset as lobar and primary broncho-pneumonia so frequently do.
A point of special interest is its tendency to mount higher and higher just before death, a marked terminal rise being seen in 51% of these cases.

Duration. In lobar pneumonia the average of non-fatal cases was 7.1 days. In children shorter types of five days and longer types of nine days are more common than in adults. A definite crisis is common; 80% of the charts showing it well.

In primary broncho-pneumonia a definite crisis was present in 56%, a steady lysis in 49%, while in 15% the defervescence was irregular.

In secondary broncho-pneumonia only 8% of the cases showed a critical defervescence, and the duration of the disease as judged by the pyrexia worked out to 18 days in the non-fatal cases, and death on the 12th day in fatal cases.

Pulse. Though there is a marked increase in pulse rate in each form of pneumonia, the greatest rapidity is seen in secondary broncho-pneumonia. This is compatible with the greater cyanosis and the greater tendency to dilated heart found in this variety.

Dunlop has noted that in lobar pneumonia the pulse is frequently very slow during convalescence. The slowest in the series studied was 68 and the average slowest 94. I think a notably slow pulse is more
common in convalescence after fevers such as measles where there has been no complicating pneumonia.

Respiration. In some cases of secondary broncho-pneumonia the respiration may be exceedingly frequent. The highest I have seen is 110, but a rapidity of 120 has been recorded.

In secondary broncho-pneumonia the course is greatly influenced by the disease to which the pneumonia is secondary.

Thus the broncho-pneumonia secondary to measles is of an acute type coming on violently either with the invasion of the disease, or with the eruption of the rash. It runs an acute type with high temperature and has a high mortality.

The broncho-pneumonia secondary to pertussis is less acute. It most frequently occurs in the third or fourth week of the primary disease, lasts a longer time and the temperature tends to be lower.

The broncho-pneumonia secondary to infective enteritis is sub-acute. It occurs late in the disease and is frequently only suggested by the dyspnoea, as the temperature remains low. Occasionally it is found in the post-mortem room in
children, where because of a normal temperature, and an absence of distress, it has been over-looked in life.

The broncho-pneumonia secondary to diphtheria is mostly peculiar from its short duration and exceptionally high mortality.

The broncho-pneumonia secondary to antecedent bronchitis and rickets is usually sub-acute and prolonged, and relapses are more frequent than in other types.

Complications:

The commonest and most important complications of pneumonia in children are -

(1) Intestinal; usually severe diarrhoea.
(2) Nervous; delirium, or convulsions:
(3) Septic; empyema, abscess, and stomatitis.

The following table shows the frequency of these complications.

<table>
<thead>
<tr>
<th></th>
<th>Lobar</th>
<th>Prim: bronc</th>
<th>Sec: bronc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe diarrhoea:</td>
<td>10%</td>
<td>4%</td>
<td>17% non-fatal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>31% fatal</td>
</tr>
<tr>
<td>Delirium:</td>
<td>6%</td>
<td>3%</td>
<td>75%</td>
</tr>
<tr>
<td>Convulsions:</td>
<td>5%</td>
<td>21%</td>
<td>5%</td>
</tr>
<tr>
<td>Empyema:</td>
<td>2%</td>
<td>4%</td>
<td>3%</td>
</tr>
</tbody>
</table>
An interesting fact about this table is that it shows how more frequent convulsions are in primary than in secondary broncho-pneumonia. Convulsions occurring in the secondary type are very serious, and death usually occurs in the convulsions. For some reasons they seem more common and more severe in those broncho-pneumonias secondary to pertussis.

Severe stomatitis is undoubtedly a serious complication as it may convert a pneumonia of pneumococcal origin into a septic pneumonia. All types from a simple ulcer on the lip to a cancrum oris were present in the series under study and of them only a very few survived.

Soltau Fenwick has drawn attention to the paralysis of the gastro-intestinal tract which sometimes occurs in broncho-pneumonia. There is great distension of the abdomen, and obstruction to respiration.

He says it is always followed by death in twenty-four hours. This complication was noted in two of the fatal cases, one in a primary and one in a
secondary broncho-pneumonia, but the former survived for three days after the onset of the distension. In this case the abdominal symptoms were so severe as to mask the underlying broncho-pneumonia, and the abdomen was opened by an experienced surgeon as an "acute peritonitis". It was not till nearly four hours after the operation that any signs of broncho-pneumonia could be detected.

The occurrence of purpuric spots is a sign of the gravest importance in prolonged broncho-pneumonias. It is, of course, most frequently associated with tuberculosis, but it occurred in four fatal cases in which no evidence of tuberculosis could be found post mortem.

Mortality: - The great difference in the mortality of the various types is very striking.

The following table is worked from the cases under study -

<table>
<thead>
<tr>
<th></th>
<th>Lobar.</th>
<th>Prim. bronc.</th>
<th>Sec. bronc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality:</td>
<td>6.1%</td>
<td>50%</td>
<td>68.4%</td>
</tr>
</tbody>
</table>

In lobar pneumonia the death rate is exceedingly small. The four fatal cases in my series of sixty-one cases were all under two years of age, and of these four, one had had several previous attacks of
pneumonia, and one developed diphtheria whilst running a typical course of lobar pneumonia. I think that it is only very occasionally that lobar pneumonia is a fatal disease in the later years of childhood.

In secondary broncho-pneumonia the only satisfactory way to get an idea of the mortality is to estimate it under the heading of the preceding disease. It will then be seen what a great variation there is in the severity of the pneumonia.

The result, in order of increasing severity is thus found to be: -

Measles (45 cases) = 58%
Antecedent Bronchitis (12 cases) = 76%
Pertussis (9 cases) = 78%
Infective Enteritis (5 cases) = 100%
Diphtheria (5 cases) = 100%
Erysipelas (1 case) = 100%

**Bacteriology of Pneumonia:**

In some twenty fatal cases I took cultures of the lungs post-mortem. In all cases the pneumococcus was found, but in many of them other organisms were present also.

The subject of the bacteriology has been thoroughly worked out by other writers, (see summary of literature), and it has been definitely proved that
in lobar pneumonia and in primary broncho-pneumonia the pneumococcus is commonly present alone, whilst in secondary broncho-pneumonia it is present in conjunction with other organisms, as streptococcus, staphylococcus, bacillus diphtheriae, or bacillus influenzae.

The importance of this work in proving primary broncho-pneumonia to be distinct from secondary broncho-pneumonia is very great.
Thus to summarise the differences found in the types of pneumonia from the 189 cases studied:

<table>
<thead>
<tr>
<th></th>
<th>Lobar</th>
<th>Primary Bron</th>
<th>Secondary Bron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative frequency</td>
<td>38%</td>
<td>17%</td>
<td>45%</td>
</tr>
<tr>
<td>Age incidence</td>
<td>1 yr. - 3 yrs</td>
<td>6 months - 2 yrs</td>
<td>6 months - 2 yrs</td>
</tr>
<tr>
<td></td>
<td>uncommon after 3 yrs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous history</td>
<td>78.5% healthy</td>
<td>80% healthy</td>
<td>All had preceding disease</td>
</tr>
<tr>
<td>Site affected</td>
<td>Usually one of the lower lobes</td>
<td>53% affect both lower lobes</td>
<td>70% affect both lower lobes</td>
</tr>
<tr>
<td>Physical signs</td>
<td>massive consolidation</td>
<td>patchy consolidation</td>
<td>patchy consolidation</td>
</tr>
<tr>
<td>Disappearance</td>
<td>7th day</td>
<td>15th day</td>
<td>22nd day</td>
</tr>
<tr>
<td>Pyrexia</td>
<td>101 - 103.4</td>
<td>100.5 - 103.8</td>
<td>99 - 103.5</td>
</tr>
<tr>
<td>Duration</td>
<td>Crisis on 7th day</td>
<td>Crisis or steady lysis on 12th day</td>
<td>Irregular lysis about 13th day</td>
</tr>
<tr>
<td>Pulse</td>
<td>130 - 156</td>
<td>135 - 162</td>
<td>140 - 165</td>
</tr>
<tr>
<td>Minimum calm</td>
<td>94</td>
<td>100</td>
<td>102</td>
</tr>
<tr>
<td>Pulse respiration</td>
<td>40 - 56</td>
<td>40 - 60</td>
<td>50 - 67</td>
</tr>
<tr>
<td>Pulse respiration ratio</td>
<td>2.9 : 1</td>
<td>2.7 : 1</td>
<td>2.6 : 1</td>
</tr>
<tr>
<td>Complications</td>
<td>Rare</td>
<td>Infrequent</td>
<td>Common</td>
</tr>
<tr>
<td>Mortality</td>
<td>6.1%</td>
<td>50%</td>
<td>68.4%</td>
</tr>
</tbody>
</table>
This table clearly shows that primary broncho-pneumonia runs a course distinct from both the other forms of pneumonia, and bearing in mind that a bacteriological difference has been proved, I maintain that primary broncho-pneumonia should be regarded as a distinct disease.

It is a disease of which the clinical history and the bacteriology resemble lobar-pneumonia, of which the age incidence and physical signs resemble secondary broncho-pneumonia, but of which the course (as shown by the temperature chart), the site affected, and the mortality are intermediate.

If this work has proved these differences to exist, the only logical classification for primary broncho-pneumonia is to place it in a class by itself, and thus to divide pneumonia in children into three groups.

(1) Lobar pneumonia.

(2) Primary broncho-pneumonia.

(3) Secondary broncho-pneumonia.
111. A Histological Examination of the Lungs from 78 Autopsies.

These specimens were obtained from the Post Mortem Room of the East London Hospital for Children, the first fifty from consecutive autopsies. The rest were taken from consecutive cases of broncho-pneumonia.

Notes on the clinical history, the naked eye appearances at the autopsy, and the histology of the lung in each case are given in the appendix.

The following basis of classification was adopted:

1. Normal.

11. Oedema, congestion, and collapse.

111. Secondary Broncho-pneumonia (divided into three stages)

IV. Primary broncho-pneumonia.

V. Lobar pneumonia.

VI. Tubercle.

Many of the lungs which at the autopsy appeared to be only congested and oedematous were proved by the microscope to be early examples of broncho-
pneumonia. These and all the cases of pneumonia have been arranged according to the day of the disease on which death occurred, and an attempt has been made to trace the various stages in the histology of broncho-pneumonia. In each section special note has been taken of the amount of fibrous tissue present, and I hope to show that mild fibrosis is a very common accompaniment of broncho-pneumonia.

The summary of the various cases described at length in the appendix is as follows:

Normal Lungs: (Cases 1 - 3)

Naked Eye: - The Normal lungs examined were of a uniform pinkish grey colour, in some cases a little darker at the bases posteriorly from was hypostasis. The surface smooth and glistening; the tissue crepitant, and excised portions floated in matter.

Microscopically: - Pleura: This consisted of a thin layer of fibrous tissue, showing no dilatation of blood vessels, and no infiltration with cells.
Normal Lung

Slide 2 Stain Van Geison
Watercolour drawing
X 103 diam.
Alveoli: - The alveoli showed as small air sacs of varying shape, mostly polygonal, of which a few communicated forming little patches of emphysema. The air spaces were surrounded by a network of capillaries, of which there may be one or more layers between contiguous alveoli. These capillaries were occasionally slightly congested as a terminal process in lungs that could only be termed perfectly normal. Scanty fibrous and elastic tissue was seen between the alveoli, and usually a few desquamated endothelial cells (a terminal change) were present in the air spaces.

Bronchioles: - The bronchioles were lined by a layer of mucosa, which was composed of columnar cells in the larger tubes, and cubical cells in the smaller. The walls were formed of fibrous and muscular tissue, and some showed a dilatation of blood vessels, again a terminal change. The lumina were always empty.

Blood vessels: - These consisted of an internal layer composed of endothelial cells, subendothelial connective tissue, and an elastic lamina; a middle layer of muscular tissue; and an outer layer of connective tissue.
Lungs showing oedema, congestion, and collapse. (Cases 4 – 10)

The specimens illustrating this group were obtained from children in which the causes of death were varying, and included acute diseases, chronic diseases, and death from accidents.

Naked Eye: - The posterior parts of the lungs, especially of the lower lobes were purplish red from congestion. Excised portions floated in matter, and the lung was crepitant. On section it was uniformly reddish in colour, and its cut surface exuded a watery, blood-stained, frothy, fluid (oedema). Around the margins of the lungs were seen bluish depressed patches of collapse. The upper lobes and the anterior margins were frequently paler than normal and spongy to the touch, these being areas of compensatory emphysema.

Microscopically: - Pleura: -

The pleura was usually quite normal, but in those cases where the congestion had lasted a long time (cases 8, 9 and 10) there was slight thickening and some dilatation of the blood vessels.
Lung showing congestion, oedema, and collapse.

Slide no. 6 Stain H. & E.

Microphotograph
X 90 diam.
Alveoli: - The alveoli showed definite patches of collapse, surrounded by compensatory emphysema. The collapse was most frequently present immediately also deep to the pleura, but was seen around the bronchioles. The cells of the alveolar walls were sometimes swollen, but the most characteristic point was the great distension of the alveolar capillaries. The air spaces contained a few desquamated endothelial cells, and red blood corpuscles, often lying in a granular material, probably serum. These cast off cells were only scanty, and never sufficient to be termed "an exudate". Where the congestion was of old standing there was some thickening of the alveolar walls. (See case 10 of mitral disease with prolonged congestion of lungs.)

Bronchioles: - In most instances the bronchioles were quite normal. In a few sections the mucosa was seen to be breaking up, and in one was shed in patches. There was no cellular infiltration or fibrous thickening of the wall.

Blood vessels: - These were normal except in prolonged cases where a definite fibrosis was seen. (Case 10)
III. Secondary Broncho-Pneumonia.

This was dealt with first, because the death rate being much higher than in the other forms of pneumonia, more examples were obtained, and a better idea of the ordinary course of the disease was gained.

The time of death varied from the 2nd day to about the 12th week, and I have made three subdivisions according to three distinct stages in the naked eye appearance of the lungs.

A. The first stage of acute congestion.

(Cases 11 - 15)

The specimens illustrating this stage were obtained from fatal cases of secondary broncho-pneumonia, in which death occurred before the 5th day.

Naked Eye; - The naked eye appearances of lungs at this stage of broncho-pneumonia closely resembled the appearances already described in the congested oedematous and collapsed lungs. Of the five cases in this group, all of which showed definite broncho-pneumonia on microscopical examination, only three appeared to be broncho-pneumonia when seen at the autopsy. The congested parts of the lungs were darker and more extensively affected than in those
previously described, and similar patches of collapse were seen. Where early broncho-pneumonia was seen, small angular, purplish patches projected from the surface of the lung, and were usually surrounded by lobules distended with air (compensatory emphysema). These projecting pneumonic patches formed a marked distinction from the depressed bluish areas of collapse.

On section congestion was found throughout, and the pneumonic patches were seen to coincide with the lobules. They were smooth, and only a little fluid could be squeezed from them, while much frothy blood-stained serum was obtained from the areas of simple congestion around.

Microscopically: - Pleura: -

The pleura was quite normal in three cases. One showed some looseness of structure, and one some increased vascularity and small round celled infiltration. Thus pleurisy though uncommon at this early stage, may sometimes occur.

Alveoli: - The alveoli showed patches of broncho-pneumonic consolidation, separated by areas of
Lung showing first stage of acute congestion in secondary broncho-pneumonia.

Slide no 14, Stain H. & E. Microphotograph - X 90 diam.
emphysema, and usually some collapse. The capillaries of the alveolar walls were invariably congested, and the cells swollen and desquamating. In the air spaces there was a definite exudate mainly composed of endothelial cells. Other cells present were occasionally, such as red blood corpuscles, and pigment cells (case 15), and leucocytes (case 15). In most instances the alveoli showing the several lesions were those around the bronchioles. In no case was there any increase in the fibrous tissue of the alveolar wall.

Bronchioles: - The bronchoiole mucosa showed some swelling of the cells and patchy desquamation. There was usually some dilatation of blood-vessels, and infiltration of a wall with small round cells. In case 14 where bronchitis had been present some time the mucosa was almost entirely shed, and there was a definite fibrosis. In the other sections there was no fibrosis.

Blood-vessels: - In three of the sections the blood vessels were quite normal. One showed some cellular infiltration and one (case 15) a little fibrous thickening.
Watercolour drawing showing the
EXUDATE of ENDOTHELIAL CELLS
seen in first stage of acute congestion
of secondary broncho-pneumonia.

Slide No. 15. Stain H. & E.
X 460 diams.
Thus the most characteristic points of the histological appearances at this stage were -

(1) Patchy consolidation; separated by normal or emphysematous lung.

(2) Congestion of alveolar capillaries.

(3) Exudate mainly composed of endothelial cells.

(4) Bronchiole mucosa shed in patches.

(5) No alteration in amount of fibrous tissue.

B. The second stage of mottled red and grey consolidation. Cases 16-37.

The specimens illustrating this stage were obtained from fatal cases of secondary broncho-pneumonia, in which the day of death was between the 5th day and the 14th day.

Naked Eye: - All specimens showed definite consolidation, which was in some instances confluent, the extent apparently depending on the length of time that the pneumonia had been present. The surface of the lung was "mottled", consolidated parts being reddish grey, prominent and airless; congested parts reddish and exuding fluid; collapsed parts depressed and bluish; and emphysematous parts dilated and crepitant.
Watercolour drawing showing the PLEURISY frequently present in the second stage of mottled red and grey pneumonia.
On section the same mottling was seen and the consolidated patches were found to surround the bronchioles, which were dilated and full of muco-pus.

Where confluent consolidation was present the appearances resembled those found in lobar pneumonia, but the outline of the consolidation was always irregular and the density of consolidation variable. This together with the scattered consolidation in other parts of the lung usually made evident the diagnosis of broncho-pneumonia. Over massive consolidation there was often naked eye pleurisy.

Some congestion and enlargement of the bronchial glands was a frequent accompaniment at this stage. Other organs in the body were usually normal.

Microscopically: - Pleura: -

The pleura was commonly affected at this stage though this is generally thought to occur only where there is confluent consolidation, and the absence of pleurisy is frequently considered a point of distinction between broncho-pneumonia and lobar pneumonia. In the twenty-two cases examined at this stage, nine showed a thickened
Lung showing microscopical appearance of SECOND STAGE of broncho-pneumonia - The stage of mottled red and grey consolidation.

Slide No. 17. Stain H+E. Microphotograph X 90 diams.
pleura, seven some fibrinous lymph, while in many others there was some dilatation of the blood vessels, and an infiltration by small round cells.

Alveoli: -

All sections exhibited definite broncho-pneumonic consolidation of varying extent, sometimes patchy and then usually most marked around the bronchioles, sometimes confluent, with breaking down of the intervening alveolar walls.

The exudate was mainly cellular, and composed of endothelial cells and leucocytes in varying proportions. Usually the leucocytes were more numerous in the exudate of the alveoli around the bronchioles. In nine sections fibrin was present in the alveoli, usually in plugs, and not in the stringy form so typical of lobar-pneumonia. The presence of fibrin in broncho-pneumonia is another fact that is sometimes questioned.

Where the consolidation was patchy there were intervening areas of congested lung tissue with the appearances already described, also some normal or emphysematous lung.
A definite thickening of the alveolar walls was frequently seen at this stage. It was especially common in association with pleurisy, and perhaps best seen in those broncho-pneumonias secondary to pertussis. Eight of the twenty-two sections showed this thickening, but in only a few could it be called a fibrous thickening; it was really the inflammatory thickening that might precede a fibrosis.

In two cases there were seen collections of small round cells suggesting early abscess formation.

Bronchioles: -

The bronchioles always showed definite lesions at this stage. The mucosa was shed either in patches or completely, a row of columnar cells often being seen in the pus with which the lamina were commonly blocked. The bronchial wall showed dilatation of blood vessels, and infiltration by small round cells and at this stage evidence of destruction was observed in two cases. In three cases there was a definite though slight increase in the fibrous tissue of the wall. (See section 36 of broncho-pneumonia in a child subject to frequent attacks of bronchitis.) The lumina of the bronchioles were
usually full of desquamated cells and pus cells.

Blood Vessels: -

In seven cases there was a definite though slight increase in the fibrous tissue of the walls of the blood vessels. In three there was some inflammatory swelling and some infiltration by small round cells.

Thus the most characteristic points of the histological appearances of this stage are: -

(1) Extensive consolidation with some patches of normal, congested or emphysematous lung.

(2) Exudate composed of a mixture of endothelial cells and leucocytes, with a preponderance of leucocytes around the bronchioles.

(3) Extensive destruction of bronchial mucosa, with dilatation of blood vessels and cellular infiltration of the wall.

(4) Frequent mild pleurisy, and thickening of the alveolar wall.
C. The third stage of massive grey consolidation

(Cases 38 - 49)

The specimens illustrating this stage were obtained from fatal cases of secondary broncho-pneumonia, in which the day of death varied from the 14th day to the 12th week.

Naked Eye: -

All specimens showed definite consolidation, some parts of them being in the condition described under stage B. In other parts, however, the appearance was different, there being large solid patches of a uniform grey colour. These patches could be traced to consist of many consolidated lobules, and the solid lung was frequently softer than when in the earlier mottled condition. On section, yellowish spots of muco purulent material appeared at the bronchioles, and on squeezing, this muco purulent material exuded freely. There was much less congestion of the surrounding lung tissue than was seen in stage B., and but little of the oedematous blood-stained fluid was obtained on squeezing.
The condition of the bronchiole wall could often be roughly decided on naked eye examination. If the grey patches surrounding the bronchioles were small, the wall was usually thicker than normal, suggesting a fibrotic process. This was commonly found in the more chronic types of broncho-pneumonia, especially in those following pertussis. If, on the other hand, the grey areas were larger and less distinct in outline, it was frequently hard to determine the position of the bronchiole wall. This was due to an infiltration of the wall with softening and destruction, so that the bronchioles had become the centre of what might be called a minute abscess.

The yellow plug of purulent matter surrounded by greyish consolidation may simulate miliary tuberculosis so closely that a diagnosis may not be definite without the microscope.

The pleura frequently showed old or recent adhesions.

The bronchial glands were usually congested, enlarged and soft.
Microscopically: -

**Pleura** usually affected. In three cases out of the twelve examined at this stage there was definite early pleurisy with a layer of fibrinous lymph on the surface, dilatation of blood vessels, and infiltration by small round cells. In four other sections the pleura was thickened, in two it was loose and oedematous.

Alveoli: -

Most showed a definite broncho-pneumonic consolidation of patchy or widespread distribution. When of patchy distribution it was mostly present around the bronchioles, when widespread, it varied in density. In six sections some collapse was seen in five some compensatory emphysema.

The exudate was composed of both leucocytes and endothelial cells, but in four sections in which it was scanty endothelial cells predominated. Definite thickening of the alveolar wall was seen in seven sections, and thick fibrous bands in three. Thus a large proportion showed some fibrous overgrowth. As the endothelial cell is the typical cell of an early exudate (see description of stage A.) it seems reasonable to conclude
Microphotograph showing appearances of

THIRD STAGE

of massive grey consolidation in secondary broncho-pneumonia

Slide No. 49.
Stain H+E.
X 900 diams.
that in those cases where the exudate was mainly endothelial, there had been an exacerbation of the inflammatory process a few days before death. As these sections showed a fibrous overgrowth it is possible that the early fibrosis accounted for the exacerbation being fatal.

As in stage B, some four sections showed plugs of fibrin, the occurrence of which cannot therefore be regarded as unusual in broncho-pneumonia.

Bronchioles:

Though always involved, the extent varied considerably. In most instances the mucosa was completely shed. There was always marked infiltration of the walls with small round cells, and the lumina was sometimes blocked with pus, as in stage B. In three sections there was a definite overgrowth in the fibrous tissue of the bronchial wall, while four showed some destruction of the wall.

Blood Vessels:

Nearly always showed a fibrous overgrowth. Four were slightly thickened, two extremely thickened, and only three were normal.
Thus the most characteristic points of the histological appearances of this stage were:

1. Patchy or extensive consolidation.
2. Exudate composed of a mixture of endothelial cells and leucocytes, with commonly a predominance of endothelial cells in sections showing fibrous overgrowth.
3. Frequent thickening of the alveolar wall.
4. Extensive destruction of bronchiole mucosa with either fibrosis or softening of the wall, and infiltration with numerous small round cells.
5. Usually a fibrosis of the blood vessels.
IV. Primary Broncho-Pneumonia.

(Cases 50 - 61)

Of the fourteen fatal cases of primary broncho-pneumonia discussed in the clinical section of the paper, eleven were examined post mortem. These have been arranged according to the duration of illness, and the day of death varied from 2nd day to about 42nd day.

The same stages of acute congestion, mottled red and grey consolidation, and massive grey consolidation that have been described in secondary broncho-pneumonia were seen here also.

A full description would therefore be mainly a reiteration of the appearances of the last group, so I intend to point out only a few possible differences.

Naked Eye: -

Appearances at various stages correspond exactly with those of secondary broncho-pneumonia. Three showed abscesses, and several recent or old pleural adhesions.
Slide No 60
Stain H. E.
X 103 diam.

Watercolour drawing showing the

THICKENED VASCULAR PLEURA

in a case of primary broncho-
pneumonia

Slide No 58
Stain H. E.
X 103 diam.

Microphotograph showing appearances of
PRIMARY BRONCHO-PNEUMONIA
Microscopically: - Pleura: -

The appearances in the first two stages resembled those of secondary broncho-pneumonia. In those sections corresponding to the third stage of massive grey consolidation, however, thickening of the pleura was certainly more common that in the secondary broncho-pneumonia. Thus of the six primary broncho-pneumonias dying after the 14th day, four showed extreme thickening, and one slight thickening, usually accompanied by dilatation of the blood vessels and infiltration with small round cells.

Alveoli: -

The appearances at the various stages again agree in the main with those of secondary broncho-pneumonia. The consolidation though frequently patchy did not seem to be of a greater severity in the alveoli around the bronchioles as was noted in the secondary broncho-pneumonia. Only two sections showed a definite peribronchial distribution, though many were "patchy". The cell found in the exudate was of the same type, and fibrin was of the same frequency. Alveolar thickening was of more common occurrence, being seen in five of the six cases classed
Watercolour drawing showing the
FIBROUS OVERGROWTH
in a case of
PRIMARY BRONCHO-PNEUMONIA.

Slide No. 58
Stain H & E.
X 400 deams.
in the stage of massive grey consolidation.

Bronchioles:

The bronchioles showed distinctly less severe lesions than in secondary broncho-pneumonia. The mucosa was broken up and shed in patches, but seldom completely as was so frequent in the secondary type. The walls showed little or no dilatation of blood vessels, and only a mild infiltration with cells, but fibrosis was of about the same frequency.

The method of spread from a capillary bronchitis to a broncho-pneumonia is probably both through the tube wall, and down the tube. The milder lesions of the bronchioles in primary broncho-pneumonia suggest that in this the spread is down the tube rather than through, and explains why alveolar involvement is more widespread. In secondary broncho-pneumonia, I think the spread is more through the tube wall, for here one can often trace a gradual change from the muco-purulent contents of the bronchiole to the leucocytic exudate in the alveoli around.
Patchy consolidation
Fibrous of alveolar wall

PRIMARY
Broncho-
Pneumonia

Fibrous of exudate

x 90
diams.

Slide No. 59.
Stain H & E.
Blood Vessels: -

Fibrosis in conjunction with other fibrous overgrowth referred to was common. It occurred in six of these twelve sections and was very noticeable in three.

Thus the chief histological points in which a primary broncho-pneumonia differs from a secondary broncho-pneumonia are: -

(1) More severe pleurisy.

(2) Less tendency to involvement of alveoli around the bronchioles.

(3) Milder inflammatory processes in the bronchioles themselves.

(4) More frequent fibrous thickening in the blood vessels.
V. Lobar Pneumonia.

(Cases 62 - 63)

The death rate from lobar pneumonia being so low only four fatal cases are included in the series, and of these only two were examined post mortem.

Death occurred on 6th and 14th days respectively.

Naked Eye: -

The first example was in the stage of red hepatization. Only one lobe was solid and the line of demarcation was sharply marked. The other lobes showed congestion. The solid part was friable, and on section was of a uniform red granular appearance. On squeezing no mucop- pus exuded, but only a little blood-stained serum.

The second example was in the stage of grey hepatization. This showed a similar distribution of the consolidation, but the colour was reddish grey. On section the lung was very friable, and had a granular appearance.

Microscopically: -

Pleura: - Normal in the example of red hepatization. Infiltrated with small round cells in the example of grey hepatization.
Watercolour drawing showing microscopical appearances for Lobar Pneumonia.

Slide No. 63
Stain H+E.
X 460 direct.
Alveoli: -

Both cases showed a wide-spread uniform consolidation. The exudate was composed of fibrin and leucocytes, the fibrin being more delicate than the exudate of broncho-pneumonia, and occurring in five strands. In the former case the exudate completely filled the alveoli; in the latter case it was retracted from the alveolar wall, and was less transparent. In both cases the alveolar walls were thickened, and in the second showed cellular infiltration.

Bronchioles: -

The bronchioles showed a destruction of the mucosa, and an infiltration of the wall with small round cells. No fibrosis or destruction of the wall was found, and there was no increase in the severity of inflammatory process in the alveoli immediately around the bronchioles.

Blood Vessels: -

Normal.

Thus the most important points in the histology of lobar pneumonia are: -
(1) Wide spread uniform exudate.
(2) Exudate mainly fibrinous.
(3) Some mild bronchitis.
(4) No fibrous overgrowth.

---------------------

VI. Tuberulicous Lungs.

(Cases 64 - 78)

This class exhibited varying microscopical appearances. In three of the cases (Nos: 64-66) the sections showed no disease, although at the autopsy some tuberules were seen in the lungs. One (case No. 67) showed ordinary broncho-pneumonia although from the history, and presence of naked eye tuberules in other organs, the diagnosis of tuberculosis of lung made post mortem was probably correct.

Of the remaining eleven cases which all showed tuberculosis with the microscope, eight showed acute lesions, and three chronic lesions.

As these cases were included mainly to demonstrate the amount of fibrous tissue present in tubercle, a short description will suffice.
Naked Eye:

The lungs were usually congested, especially in the acute forms. Pale gelatinous greyish nodules usually with yellowish soft centres stood out prominently from the cut surfaces. In some these had fused forming larger yellowish patches. In the more chronic examples the tuberculous foci were surrounded by distinct fibrous tissue, and there was an obvious excess of fibrous tissue in the lung substance. The pleura was frequently thickened and sometimes had dense adhesions between the two surfaces.

The Bronchial Glands were usually enlarged and caseous, and evidence of tuberculosis was frequent in other organs.

Microscopically:

Pleura: Only included in five of the eleven sections showing definite tuberculosis. Of these two showed normal pleura, two some thickening, and one infiltration with small round cells.

Alveoli: Scattered tuberculous foci were seen in all sections. Case 68 showed indefinite cellular patches, but they were undoubtedly
caseating tubercle

fibrous tubercle

giant cell formation

Slide No 70
Stain H&E
X 103 views

Slide No 78
Stain H&E
X 103 views

Watercolour drawings showing the microscopic appearances of tuberculosis of lungs.
tuberculous in nature. Three sections showed caseous nodules without any giant cell formation; three showed the same caseation with giant cells. In six sections there was a definite thickening of the alveolar walls, which may thus be regarded as a frequent occurrence in tuberculosis. One section showed scattered fibrous nodules, and the three (76 - 78) in which tuberculosis had been present a long time, showed tuberculous fibrous nodules with giant cell formation and a spread of the fibrosis to the surrounding tissue of the lung.

Apart from the evidences of tubercle the sections showed collapse, emphysema, and congestion, and three exhibited concurrent simple acute bronchopneumonia.

Bronchioles: - These showed varying changes. In two the mucosa was intact, in one the cells of the mucosa were swollen, in two it was partially shed, in four it was shed completely. Some congestion of the blood vessels, and cellular infiltration were seen as in other sections. A definite fibrosis was only present in three sections, and in only one (case 72) was it advanced. This case was
complicated by secondary broncho-pneumonia, to which the fibrosis may have been due.

**Blood Vessels:** Most sections showed a definite but slight thickening of the walls of the blood vessels, some being infiltrated with small round cells. In case 72, referred to above, extreme fibrosis was seen.

Thus the most important points in the histological appearances of tuberculosis of the lung in children are:

1. Scattered nodules of caseous material usually containing some giant cells.
2. Fibrosis around the nodules with a thickening of the alveolar walls.
3. Mild inflammatory processes in the bronchi-oles, without much fibrosis.
4. Slight thickening of the blood vessels.

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**Conclusion:**

The preceding descriptions of the various histological appearances of the seventy-eight lungs examined thus demonstrate

**Firstly,** the amount of fibrous tissue normally
present in a child's lung.

Secondly, the gradual transition possible between an oedematous congested lung and an early case of broncho-pneumonia.

Thirdly, the common pathological course of a secondary broncho-pneumonia.

Fourthly, the points of possible difference between a primary broncho-pneumonia and a secondary broncho-pneumonia.

Fifthly, the definite difference between a lobar pneumonia and either forms of broncho-pneumonia and

Sixthly, the amount of fibrous tissue present in tuberculosis.

**Fibrosis.**

An excess in the fibrous tissue present in an inflamed lung is without doubt of great importance. A normal amount of fibrous tissue is necessary as a supporting framework to the lung substance, but as the total bulk of the lung is not increased where fibrosis is present, an excess of fibrous tissue means an encroachment upon the more vital part of the lung, viz. the alveoli.
Slide No 49
Stain H+E.
X 90 diams.

Fibrosis
in Broncho-Pneumonia.

Slide No 58
Stain H+E.
X 90 diams.
Such a fibrosis may be mild or severe. The severe form is commonly recognised as the chronic interstitial pneumonia following acute broncho-pneumonia. The milder form seems to have received but little attention.

In the 51 cases of pneumonia examined microscopically a definite fibrous overgrowth was seen in no less than 30 cases, in 10 of which the overgrowth was very noticeable.

This fibrosis occurs in both forms of secondary broncho-pneumonia, but is far more severe in the primary type.

In the secondary type it is more severe after the prolonged broncho-pneumonias secondary to infective enteritis, and pertussis, than in those secondary to measles.

In the majority of sections showing fibrosis, the distribution of the fibrous overgrowth is widespread, though the bronchioles are not affected unless there has been severe concurrent bronchitis, as is seen in the broncho-pneumonias secondary to pertussis.

In practically all cases the pleura is involved, and in those in which the alveolar thick-
Slide No. 59
Stain H&E
× 300 diam.

Slide No. 27
Stain H&E
× 250 diam.

Fibrosis
in Broncho-Pneumonia.
ening is of recent date the pleura usually shows signs of acute inflammation.

Thus of the 30 sections showing fibrosis, Pleura was thickened in 23 cases. Alveolar wall was thickened in 25 cases. Bronchiole wall was thickened in 15 cases. Blood vessels were thickened in 21 cases.

The examination of these sections thus proves conclusively that some increase in the fibrous tissue of the lung is a very common occurrence in broncho-pneumonia, and I maintain that the presence of this fibrous tissue has much to do with the high mortality of the disease.

By encroaching upon the more important alveoli it destroys the real lung tissue and when there is an exacerbation of the inflammatory process, and a relapse in the disease occurs, the lung can no longer react to the inflammation, and the patient, whose vitality is already weakened by prolonged illness, rapidly succumbs.
IV. SUMMARY.

Clinical Results: -

By the study of 169 cases of pneumonia in children, it has been shown that there are three distinct types of the disease, namely:

- Lobar pneumonia,
- Primary broncho-pneumonia, and
- Secondary broncho-pneumonia.

The relative frequency and the age incidence of these diseases have been calculated from the cases studied, and an attempt has been made to construct typical charts by taking averages of the pulse rates, respiration rates, and temperatures.
The summary of the results obtained were given on page 22(a), and are repeated here:

<table>
<thead>
<tr>
<th>Lobar</th>
<th>Primary Bron:</th>
<th>Secondary Bron:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative frequency</td>
<td>38%</td>
<td>17%</td>
</tr>
<tr>
<td>Age incidence</td>
<td>1yr. - 3 yrs.</td>
<td>(6 months - 2 yrs.</td>
</tr>
<tr>
<td>Previous History</td>
<td>78.5% healthy</td>
<td>80% healthy</td>
</tr>
<tr>
<td>Site affected</td>
<td>Usually only one</td>
<td>53% affect</td>
</tr>
<tr>
<td></td>
<td>of the lower lobes</td>
<td>both lower lobes.</td>
</tr>
<tr>
<td>Physical signs</td>
<td>massive consolidation</td>
<td>patchy consolidation</td>
</tr>
<tr>
<td>Disappearance</td>
<td>11th day</td>
<td>15th day</td>
</tr>
<tr>
<td>Pyrexia</td>
<td>101 - 103.4</td>
<td>100.5 - 103.8</td>
</tr>
<tr>
<td>Duration</td>
<td>Crisis on 7th day</td>
<td>Crisis or steady lysis on 12th day</td>
</tr>
<tr>
<td>Pulse</td>
<td>130 - 156</td>
<td>135 - 160</td>
</tr>
<tr>
<td>Minimum convalescent pulse</td>
<td>94</td>
<td>100</td>
</tr>
<tr>
<td>Respiration</td>
<td>40 - 56</td>
<td>45 - 60</td>
</tr>
<tr>
<td>Pulse respiration ratio</td>
<td>2.9 : 1</td>
<td>2.7 : 1</td>
</tr>
<tr>
<td>Complications</td>
<td>Rare</td>
<td>Infrequent</td>
</tr>
<tr>
<td>Mortality</td>
<td>6.1%</td>
<td>50%</td>
</tr>
</tbody>
</table>
Histological Results:

From the results of the microscopical examination of 78 lungs, it has been possible to compare the fibrous tissue present in normal or congested lungs with that present in broncho-pneumonia or tuberculous lungs.

By the study of sections from the lungs of 51 children dying from pneumonia after illnesses of varying duration, the actual pathological changes that occur in the lungs have been closely followed, and the various stages in the disease traced.

It has been shown that in secondary broncho-pneumonia there are three distinct stages, the following table being based upon the results obtained:
<table>
<thead>
<tr>
<th>Naked eye appearances</th>
<th>Stage A</th>
<th>Stage B</th>
<th>Stage C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congested with angular purplish patches of consolidation.</td>
<td>Mottled congestion. Extensive consolidation.</td>
<td>Greyish consolidation. On section, small greyish patches surround the bronchioles, which are filled with mucopurulent material.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Microscopical appearances</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleura</td>
<td>Normal</td>
<td>(frequent mild pleurisy)</td>
<td>(frequent pleurisy)</td>
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<tr>
<td>Alveoli</td>
<td>(a) patchy consolidation</td>
<td>(a) extensive consolidation</td>
<td>(a) patchy or extensive consolidation</td>
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<tr>
<td></td>
<td>(b) congestion of alveolar capillaries</td>
<td>(b) some alveolar thickening</td>
<td>(c) exudate a mixture of endothelial cells and leucocytes</td>
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<td></td>
<td>(c) exudate of endothelial cells</td>
<td>(c) exudate a mixture of endothelial cells and leucocytes</td>
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<tr>
<td>Bronchiolar</td>
<td>(a) tracheal mucosa extensively destroyed.</td>
<td>(a) tracheal extensively destroyed.</td>
<td>(a) tracheal extensively destroyed.</td>
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<td>(b) Wall infiltrated with small round cells</td>
<td>(b) Wall fibrotic or destroyed in parts</td>
<td>(b) Wall fibrotic or destroyed in parts</td>
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<tr>
<td>Blood</td>
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<td>Normal</td>
<td>Fibrous thickening</td>
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<td>Vessels</td>
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IT HAS BEEN SHOWN that primary broncho-pneumonia differs very slightly from the above description, the most important points of differentiation being:

(1) More severe pleurisy.
(2) Less tendency to involvement of alveoli immediately around the bronchioles.
(3) Milder inflammatory processes in the bronchioles.
(4) More frequent fibrous thickening of blood vessels and interstitial tissue of the lung.

IT HAS BEEN SHOWN that lobar pneumonia differs widely from both the preceding forms in its pathological changes. The most important points of differentiation are:

(1) Uniform consolidation.
(2) Fibrinous exudate.
(3) Mild affection of the bronchioles.
(4) No fibrous thickening.
LASTLY IT HAS BEEN SHOWN that a mild fibrosis is a very common accompaniment of both forms of broncho-pneumonia, that it can occur quite early in the disease, and that in many instances its presence probably accounts for the fatal termination; this fact being borne out by the frequent presence of an exudate that is typical of an early inflammation.

In other words, a relapse has been fatal, because the lung tissue has been devitalised by a fibrosis.
APPENDIX A.

LIST OF CASES WITH CLINICAL, POST-MORTEM, AND HISTOLOGICAL NOTES.
NORMAL.

CASEx 1-3.
I. NORMAL LUNGS.

Case 1. Gunall Pickett (3½ years).

History: Bad scald on buttock. Admitted 3.10.12 not suffering much from shock. Condition got rapidly worse, with vomiting and diarrhoea. Later nervous manifestations.

Died 7.10.12.

P.M.: Lungs: Normal. A little dark in colour at the bases posteriorly.

Meninges and brain: Congested.

Intestines: Thickening of mucosa, and a few submucous haemorrhages.

Microscopically: Pleura: Normal.

Alveoli: Some emphysema. Elsewhere the capillaries in the alveolar wall are congested, and there is an occasional desquamated epithelial cell in the air spaces.

Bronchicle: No change.

Blood vessels: Healthy.

Summary: Normal lung. Death from shock of the burn. A little terminal congestion seen microscopically, not sufficient to cause obvious congestion to naked eye.
Case 2. Mary Howard (3 months).

History: Breast fed baby with diarrhoea and vomiting for 8 days.

Admitted 6.10.12 in collapsed condition. Improved at first, but stools continued to be frequent and on 10.10.12 child started to run a temperature. Maximum 102.4. Got gradually worse. Nothing found abnormal in lungs.

Died 14.10.12.

P.M. Lungs: Normal except for slight hypostatic congestion of both lower lobes.

Intestines: Submucous haemorrhages and other lesions of enteritis.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: A few patches of collapse. Walls normal and no congestion of capillaries. Occasional endothelial cell seen in air spaces.

Bronchioles: A little proliferation of the cells of the mucosa, with a few desquamated cells lying in the lumen. A little cellular infiltration of walls of bigger bronchioles, but no change is sufficiently marked to diagnose a bronchitis.

Blood vessels: Normal.

Summary: Normal lung. Death probably due to the toxaemia of the enteritis. Had death been delayed the mild changes noted in the bronchioles would probably have gone on to a definite bronchitis and later a secondary broncho-pneumonia.
Case 3. Edward Rands (2 years 9 months).

**History:** Diarrhoea and vomiting for 24 hours. Stools green and offensive.


Died within one hour of admission.

**P.M.**

**Lungs:** Normal.

**Intestines:** Some ulceration of Peyer's patches and catarrh of colon.

**Mesenteric glands:** Enlarged, pale on section. No evidence of tuberculosis.

**Microscopically:**

**Pleura:** Normal.

**Alveoli:** Some emphysema. Slight collapse just under pleura. Capillaries in alveolar walls are congested, and a few endothelial cells with an occasional red blood corpuscle present in air spaces.

**Bronchioles:** Mucosa normal. Some congestion of blood vessels in the bronchiolar wall.

**Blood vessels:** Normal.

**Summary:** Normal lung. Child died from very acute toxaemia of intestinal origin. The slight congestion in lungs seen by microscope is simply a terminal change.
CONGESTED OEDEMATOUS AND COLLAPSED LUNGS.

CASES 4-10.
CONGESTION, OEDEMA, AND COLLAPSE.

Case 4. William Newton (2 months).

History: Developed a rash when 3 weeks old. Otherwise been healthy. Doubtful snuffles. Nothing in fam. hist.

Admitted 20.10.12. Covered X scaly rash; but hands and feet fairly free. No other signs of congenital syphilis. Wassermann negative.

Was treated with mercury and improved.

Died 2.11.12 quite suddenly without obvious cause.

P.M. Lungs: Both lower lobes showed congestion, oedema and collapse. Floated in water.

Heart: Muscle pale and friable.

Liver: Fatty - no cirrhosis.

Other organs: Healthy.

Microscopically: Pleura: Healthy but a little congestion just deep to it.

Alveoli: Some collapse and a good deal of emphysema. Capillaries in alveolar walls are congested. A few alveoli contain some desquamated epithelial cells, not sufficient to be termed an exudate. Best seen near surface.

Bronchioles: Mucosa broken in places. No debris in lumen.

Blood vessels: Healthy.

Summary: Normal lung from a weakly child, showing a little congestion and collapse of the edges of the lungs, probably a terminal change just before death.
Case 5. Alf Woods (8 months).

History. Diarrhoea and vomiting of sub-acute type for a fortnight.

Admitted 1.10.12 and improved under treatment, though stools persistently contained blood and mucus. After 3 weeks, vomiting returned and stools became undigested. Gradually became exhausted.

Died 24.10.12, with long respiratory failure before heart stopped.


Heart: Muscle soft.
Liver: Extremely fatty.

Microscopically (Section 5a) all cells full of fat. In most a single globule pushing the nucleus to one side. Some cells show discrete globules.

Kidneys: Congestion and cloudy swelling.
Intestines: Marked enteritis, especially in lower ileum.

Microscopically. Pleura: Normal.

Alveoli: Some collapse well seen just under pleura. Large patches of emphysema. Some swelling of cells in alveolar wall, but no congestion of the capillaries. Occasional endothelial cell in air spaces.

Bronchioles: Some swelling of the cells of the mucosa, and congestion of the blood vessels of the wall.

Blood vessels: Normal.

Summary. A very mildly congested lung. Death from the exhaustion of prolonged enteritis and colitis, with great toxæmia as evidenced by the condition of the abdominal organs.
Microphotograph of Slide No. 6

x 90 drawn.
Case 6. Florence Strange (5 months).

History. Child was typical mongol. Was the 14th child, mother and father both 47. Had severe diarrhoea and vomiting 24 hours.

Admitted 9.9.12 in very collapsed state. Revived slightly with saline and stimulants. Nothing abnormal found in lungs before death.

Died 9.9.12, ten hours after admission.

P.M. Lungs: Oedema congestion and collapse of both lower lobes.

Intestines: Slight ulceration of great intestine. Transverse colon dilated.

Meninges: Congested.

Other organs: Normal.

Microscopically: Pleura: Normal thickness. Some roughening on the surface, but it suggests a blood contamination at the autopsy, and not an acute pleurisy.

Alveoli: Capillaries in alveolar walls are congested. Some endothelial cells lying in a granular substance (serum) seen in air spaces. Nowhere plentiful enough to term an exudate.

Bronchioles: Mucosa healthy. Some dilatation of blood vessels in the bronchiole wall. A few show desquamated cells in their lumen.

Blood vessels: Normal. Some large ones seen, and these have fibrous tissue around, though not in excess of normal amount.

Summary. Death from the toxaemia of enteritis. Terminal congestion of the lung. If child had survived longer the lung was in such a condition that it would readily have become inflamed, yet on the present condition there is nothing that could be described as the earliest stage of broncho pneumonia.
Case 7. Albert Wells 4½.

History: Blow on the head 24 hours ago. Restless during the night and vomited several times. "Heavy" last 3 hours.

Admitted 14.10.12 unconscious. No localising signs of pressure.

Died suddenly 14.10.12, four hours after admission.

P.M.: Lungs: Marked congestion of both lower lobes.

Skull: Transverse fracture across the base. No haemorrhage.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Some collapse with compensatory emphysema. The capillaries in alveolar walls are intensely congested. Some air cells show desquamated cells.

Bronchioles: Normal.

Blood vessels: Normal.

Summary: Death from head injury. Lungs healthy but show marked terminal congestion from a lingering death.
Case 8. Lilian O'Neill 4 months.

History: Was a "blue baby" at birth and has always been a bad colour. Usually constipated, but had diarrhoea for last 3 days.


Died 29.9.12 within 12 hours of admission.

P.M.: Lungs: Massive collapse of both bases. Some congestion.


Liver: Fatty.

Other organs: Normal.

Microscopically: Pleura: Blood vessels in deeper layers well formed and congested.

Alveoli: Some normal, some collapsed, some show congestion of capillaries. Desquamated endothelial cells in the air spaces.

Bronchioles: Mucosa shed in patches. Some debris of mucosa and endothelial cells in their lumina. Congestion of the blood vessels in the wall. Definite increase in fibrous tissue.

Blood vessels: Definite increase in fibrous tissue in the walls of both large and small vessels.

Summary: Death from toxaemia of enteritis. Lungs show excess of fibrous tissue as a result of the prolonged congested caused by the congenital heart. No suggestion of broncho pneumonia.

**History:** Had icterus neonatorum, and has always had bad stools since.

Admitted 23.8.12. Feeble child, skin brownish pigmentation. Diarrhoea of greenish stools about six in 24 hours. Did not react to treatment and died 15.9.12, after having a temperature for four days.

**P.M.:** Lungs: Congestion, oedema, and collapse at both bases.

Intestines: Congestion of Peyer's patches and some submucous haemorrhages.

Other organs: Normal.

**Microscopically:** Pleura: Slightly thicker than normal.

Alveoli: Some collapse, well seen just under the pleura. Congestion of the capillaries in the alveolar walls. Air spaces contain some desquamated endothelial cells. Not plentiful enough to term an exudate.

Bronchioles: Mucosa shed in patches. Little cellular infiltration or congestion of capillaries.

Blood vessels: Markedly congested. Slight increase in fibrous tissue of the wall.

**Summary:** Death from prolonged exhaustion of enteritis. Congestion of the lungs probably of two or three weeks duration. This may account for the slight excess of fibrous tissue found in the blood vessels. No broncho-pneumonia.
Case 10. Alice Whiting, 14.

History: Case of old standing mitral stenosis. Had frequent attacks of dippnoea and palpitation due to temporary cardiac failure.

Admitted 17.11.12 in such an attack. Presystolic and systolic mitral, systolic tricuspid murmurs. Some moist coarse rales over bases posteriorly. Condition improved under treatment.

Died 19.11.12 in another attack.

P.M.: Lungs: Intense congestion and oedema of both lungs. Excised portions floated. Right lung showed old infarct in upper lobe.

Pleura: Old adhesions.


Liver: Nutmeg liver.

Other organs: Normal except for some congestion.


Alveoli: Intense congestion of capillaries of alveolar wall, and a definite increase in interstitial tissue. There is a distinct fibrous band in the walls of the smallest alveoli. Some air spaces contain desquamated endothelial cells in a granular material (serum) but insufficient to term an exudate.

Bronchioles: None seen. The walls of infundibula are definitely thickened.

Blood vessels: Slight fibrosis.

Summary: Death from cardiac failure. Intense congestion due to this, and a definite fibrous overgrowth caused by repeated and prolonged congestion. No broncho-pneumonia.
SECONDARY BRONCHO-PNEUMONIA.

Stage I.

"RED CONGESTED PNEUMONIA"

Day 1 - 4.

Cases 11 - 15.
Case 11. Doris Burke. 2 weeks.

**History:** Strong baby. Swollen leg 24 hours.

Admitted 26.10.12 with severe erysipelas, involving right leg and spreading upwards. Temperature 104° and child very toxic.

Died 27.10.12.

**P.M.:** Lungs: Oedematous, congested and collapsed. No broncho pneumonia distinguished. Excised portions floated.

Heart: Muscle soft.

Intestine: Congestion of all coats. No real peritonitis.

Spleen: Soft.

Other organs: Normal.

**Microscopically:** Pleura: Slight increase in vascularity and some round celled infiltration. Just sufficient to term "early pleurisy".

Alveoli: Much emphysema. Alveolar wall swollen and shows cellular infiltration. Air spaces contain desquamated endothelial cells, and red blood corpuscles lying in a granular basis (serum). Quite a definite exudate of broncho pneumonia.

Blood vessels: Definite infiltration by round cells. No fibrosis.

**Summary:** Death from the toxaemia of erysipelas. Lungs show definite broncho-pneumonia, but at the earliest stage, so early as not to be detected at all by the naked eye.

Broncho-pneumonia probably less than 48 hours duration.

Exudate endothelial, and red blood corpuscles.
Case 12. Alf Read (5 months).

History: Weakly child, bad cough for three weeks. Worse for last week, and difficulty in breathing. Convulsions day of admission.

Admitted 7.11.12 with signs of widespread bronchitis. Had convulsion. Bad colour and fitted frequently.

Died 8.11.12.


Mesenteric glands: Some early tuberculous foci.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Much emphysema, but some of the breaking of alveolar walls is probably due to tearing of section. Capillaries in alveolar walls are congested. Air spaces contain definite exudate composed mainly of endothelial cells.

Bronchioles: Mucosa shed in patches, and lumen of tube blocked by desquamated endothelial and polynuclear cells. Marked cellular infiltration of walls and tissue around.

Blood vessels: Normal.

Summary: Death in earliest stage of broncho-pneumonia secondary to bronchitis of larger tubes in a weakly child.

Exudate mainly desquamated endothelium and small in extent.
Case 13. Simon Cohen (4 years).

History: Sore throat 3 days.
Died 22.10.12.

P.M.: Lungs: General congestion and oedema. Small patches of airless tissue at left apex. On section exuded oedematous fluid. Thought to be early broncho-pneumonia.

Trachea: Membrane covering cords and extending down into bronchi especially on left apex.

Heart: Large antemortem clots.

Intestines: Opaque greyish foci in the mucous membrane.

Other organs: Normal.

Microscopically: Pleura: Some irregularity on the surface, probably due to tearing during preparation of the slide.

Alveoli: Some emphysema. Definite patches of consolidation in peribronchial distribution. Capillaries of alveolar walls are congested and air spaces contain an exudate almost entirely cellular. Cells mainly endothelial but some leucocytes and red blood corpuscles. Many large cells containing pigment.

Bronchioles: Mucosa shed in patches. Little blocking of lumen. Cellular and pigment infiltration of the wall. Some slight increase in fibrous tissue.

Blood vessel: One shows a little fibrosis.

Summary: Severe secondary broncho-pneumonia of diphtheria with death on the 4th day. Endothelial cell predominating in exudate.

Cause of the fibrosis unknown.
Microphotograph of Slide No. 14

x 90 Dreams

History: Vomiting within half an hour of each feed since age of 3 weeks.

Admitted 13.3.12 with definite pyloric stenoses. Weight 7 lbs. 2 ozs. Progress satisfactory except for mild attacks of diarrhoea. Weighed 13 lbs. on 2.10.12. Then had acute attack of bronchitis and developed broncho pneumonia. Lost weight rapidly.

Died 23.10.12.

P.M.: Lungs: Both congested, oedematous, and collapsed. No definite broncho-pneumonia distinguished.

Stomach: Dilated and pylorus markedly hypertrophied and constricted.

Other organs: Normal.

Microscopically: Pleura: Only small piece seen but it seems normal.

Alveoli: Much emphysema. Capillaries in alveolar wall congested, and many air spaces contain a definite broncho pneumonic exudate consisting mainly of endothelial cells. Alveoli around the bronchioles show this change well.


Blood vessels: Normal.

Summary: Death from early broncho pneumonia secondary to bronchitis occurring in weakly child.

Exudate mainly endothelial cells.
secondary broncho-pneumonia, but the former survived for three days after the onset of the distension. In this case the abdominal symptoms were so severe as to mask the underlying broncho-pneumonia, and the abdomen was opened by an experienced surgeon as an "acute peritonitis". It was not till nearly four hours after the operation that any signs of broncho-pneumonia could be detected.

The occurrence of purpuric spots is a sign of the gravest importance in prolonged broncho-pneumonia. It is, of course, most frequently associated with tuberculosis, but it occurred in four fatal cases in which no evidence of tuberculosis could be found post mortem.

Mortality: - The great difference in the mortality of the various types is very striking.

The following table is worked from the cases under study -

<table>
<thead>
<tr>
<th>Type</th>
<th>Mortality</th>
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<tbody>
<tr>
<td>Lobar. Prim. bronc.</td>
<td>6.1%</td>
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<tr>
<td>Sec. bronc.</td>
<td>50%</td>
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<tr>
<td>Mortality</td>
<td>68.4%</td>
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In lobar pneumonia the death rate is exceedingly small. The four fatal cases in my series of sixty-one cases were all under two years of age, and of these four, one had had several previous attacks of
Broncho Pneumonia

Secondary B and PN.

Stage II.
Mottled red and grey Pneumonia

Day 5 - 14.

Cases 16 - 37.
Case 16. Ada MacFarlane (1 year).

History: Measles rash 3 days ago. Cough and breathing rapidly since.

Admitted 8.11.12. Very ill. Breathing distressed and signs of broncho-pneumonia at both bases.

Died 9.11.12.

P.M.: Greyish red patches of pneumonic consolidation surround the bronchioles in each lobe. Tendency to confluence, best marked in right lower lobe of which excised portions sank. Oedema, congestion, collapse, and compensatory emphysema also present.

Pleura: Some adhesions on the left side.

Trachea and Bronchi: Congested, and full of mucop-nus.

Heart: Right side dilated.

Other organs: Nil.

Microscopically: Pleura: Normal (see P.M.)

Alveoli: Widespread pneumonic consolidation, confluent exudate in places. In alveoli around the bronchioles the exudate is mainly composed of leucocytes, in those alveoli further away the exudate is mainly endothelial cells with some fibrin.


Blood vessels: Normal.

Summary: Death on the 5th or 6th day of a broncho-pneumonia secondary to measles.

Shows widespread involvement that may be present at this early date, and also the greater severity around the bronchioles. No increase in fibrous tissue.
Microphotograph of Slide No 17

X 90 diams.
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Case 17. Wm. Trinder (1 year).

History: Ill 3 days. Developed rash day of admission.

Admitted 4.11.12 with typical measles, and signs of early broncho-pneumonia at both bases. Following day signs more evident but no extensive consolidation.

Died 6.11.12.

P.M.: Lungs: Patches of reddish grey broncho-pneumonic consolidation at both bases, separated by areas of congested and oedematous lung. Some bluish depressed areas of collapse. Right lower lobe shows severest affection, and excised portions from here sank in water.

Heart: Right side dilated. A little thickening of mitral cusps.

Bronchial glands: Congested, but not enlarged.

Liver: Fatty.

Kidneys: Cloudy swelling.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Widespread broncho-pneumonic consolidation separate by areas of emphysema. Capillaries in alveolar walls are congested, and air spaces contain exudate composed mainly of leucocytes but with some endothelial cells. Predominance of leucocytes even more marked in exudate of alveoli around the bronchioles.

Bronchioles: Complete destruction of mucosa. Cellular infiltration of the wall. No fibrosis.

Blood vessels: Normal.

Summary: Death about 6th day of a broncho-pneumonia secondary to measles. Pneumonia probably commenced with the invasion of the disease. Shows a greater severity of the lesion in those alveoli around the bronchioles. Exudate mainly leucocytic. No fibrosis.
Case 18. Wm. Meager (2 years).

History: Had broncho-pneumonia when aged 1 yr. and pertussis at 1 yr. 5 mths.

Admitted 6.10.12 with fever and ulcerated phimosis. Nothing abnormal determined in chest. Circumcised. On 9th developed signs of lobar consolidation in right upper lobe. On the 13th signs of fluid. Exploration revealed pus and a rib was resected. On 15th child developed a measles rash. On the 19th empyema... wound broken down and signs of widespread broncho-pneumonia.

Died 22.10.12.

P.M.: Lungs: confluent greyish consolidation in all lobes, except left upper lobe where it is patchy with some emphysema.

Pleura: Empyema... over right lower and middle lobes, and adhesions over right upper lobe.

Other organs: Normal.

Microscopically: Pleura: Swollen and some inflammatory cells.

Alveoli: Widespread pneumonic consolidation. Exudate composed of endothelial cells lying in a fibrinous network, with many leucocytes in the denser parts. Some places show a dense collection of small round cells suggesting early abscess formation.

Bronchioles: Mucosa entirely shed. In some wall destroyed and replaced by early abscess formation.

Blood vessels: Normal.

Summary: Death on 6th day of a broncho-pneumonia secondary to measles. Early abscess formation associated with empyema.

Excess of fibrin in exudate probably accounted for by recent lobar pneumonia.
Case 19. Ellen Williamson (12 years).

History: Pains in legs, yellowness, and shivering attacks for 1 week.

Admitted 29.10.12 looking very ill and with mitral presystolic murmur. Temperature very irregular. On 1.11.12 developed signs of broncho-pneumonia. Colour got more yellow, purpuric spots appeared, spleen became enlarged and child became delirious. Died of malignant endocarditis.

Died 7.11.12.

P.M.: Lungs: Small scattered patches of reddish grey consolidation separated by areas of red congested lung tissue. Some depressed areas of collapse, and some oedema.

Pleura: Recent adhesions on both sides.
Heart: Recent vegetations on mitral valve.
Pericardium: Generalised adhesive pericarditis.
Liver: Early "nutmeg".
Spleen: Large, soft.

Alveoli: Patchy broncho pneumonic consolidation separated by areas of emphysema. Alveolar walls a little thick. Exudate composed almost entirely of endothelial cells.
Bronchioles: None seen.
Blood vessels: Some inflammatory swelling of outer coats.

Summary: Death on about the 7th day of a broncho-pneumonia secondary to malignant endocarditis.

Shows exudate mainly endothelial and of patchy distribution.
Shows thickening of alveolar walls and blood vessels associated with pleurisy.
Case 20. Thos. Porter (3 months).

**History:** Measles rash 5 weeks ago. Cough for 2 weeks. Distressed breathing and feverish for 1 week.


Died 20.1.13.

**P.M.:** Lungs: All lobes showed greyish patches of broncho-pneumonia, surrounded by red congested lung. Dilated bronchiole from which pus could be squeezed in centre of each patch. Some confluence of patches in right lower lobe.

Pleura: Some adhesion on both sides.

Bronchial Glands: Enlarged and congested.

Heart: Large ante-mortem clot.

Other organs: Normal.

**Microscopically:** Pleura: Marked fibrous thickening with many blood vessels. A layer of fibrinous lymph on the surface.

Alveoli: Patchy pneumonic consolidation with emphysema in between. Alveolar wall definitely thickened in places. Cells in exudate mainly endothelial but some leucocytes, and also some fibrin.

Bronchioles: Little change, the mucosa seems flattened out. A little fibrous overgrowth but no marked cellular infiltration.

Blood vessels: Slight fibrosis.

**Summary:** Death about 7th or 8th day in a broncho-pneumonia secondary to measles.

Patchy distribution of the pneumonia. Early fibrosis associated with pleurisy.
Case 21.  Alfred Day (1 year 9 months).

History: Weakly baby with chronic cough. Vomiting, cough worse, and breathing distressed for 3 days.

Admitted 14.11.12. Rickety child, breathing rapid and distressed, cyanosed. Poor air entry and signs of broncho-pneumonia at both bases. Did not respond to treatment at all.

Died 15.11.12.

P.M.: Lungs: Right lower lobe showed widespread patchy broncho-pneumonia, in parts becoming confluent. Excised portions sank in water. On section bronchioles dilated and full of pus, and in most cases formed the centre of a broncho pneumonic patch.

Left lower lobe congested, oedematous and collapsed.

Pleura: A few adhesions on the right side.

Trachea and bronchi: Full of frothy mucus.

Other organs: Normal.

Microscopically: Pleura: None shewn (see P.M.)

Alveoli: Much emphysema. Many alveolar walls show a definite thickening with fibrous tissue. In some air spaces there is an exudate of broncho pneumonia, composed mainly of endothelial cells in granular basis (serum).

Bronchioles: Mucosa partially or entirely destroyed. Cellular infiltration of walls, and a definite increase in fibrous tissue around. No blocking of the lumina by debris.

Blood vessels: Normal.

Summary: Death about 8th day in broncho-pneumonia secondary to bronchitis of the larger tubes in a rickety child.

The P.M. appearances showed scattered broncho-pneumonia, so the section must have been taken from a part not yet extensively involved, as the alveoli are but slightly affected.

The severe lesions of the bronchioles from chronic bronchitis probably account for the fibrous overgrowth seen in the section.
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**Name**: Joseph Cunnrow

**Date of Disease**: By Admission

**Temperature** (°F):
- 98.6
- 99
- 100
- 101
- 102
- 103
- 104
- 105
- 106
- 107

**Pulse**
- 68
- 76
- 80
- 68
- 76
- 76
- 78
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- 76
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- 68

**Respiration**
- 160
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**Sick**
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Case 22. Joe Cunnew (5 years).

History: Developed pertussis 10 days ago. Breathing rapid and distressed for 4 days.

Admitted 12.12.12. with signs of widespread broncho-pneumonia, confluent consolidation at left base. Reacted well to treatment but died suddenly.


P.M.: Lungs: Large, firm, greyish and nodular in parts. On section whole of posterior part of left lung infiltrated with yellowish grey areas from which pus exuded. Similar areas of less extent in other lobes.

Bronchial Glands: Enlarged and show small purulent areas of softening.

Other organs: Normal.

Microscopically: Pleura: Thick, with layer of fibrin and inflammatory cells.

Alveoli: Extensive broncho-pneumonic consolidation. Walls of alveoli definitely thickened and infiltrated with round cells. Exudate varies in type. In some places it is very densely and mainly composed of leucocytes. Elsewhere epithelial cells and fibrin predominate.

Bronchioles: Mucosa entirely shed. Wall frequently destroyed and replaced by mass of small round cells, both polynuclear and mononuclear. No fibrosis.

Blood vessels: Cellular infiltration of the outer wall.

Summary: Death about 8th day of a broncho-pneumonia secondary to pertussis. Shows the early fibrosis associated with pleurisy and especially common in pertussis. Exudate leucocytic endothelial and fibrinous. Bronchioles severely affected.
Name: Henry Cook 6 months

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Temperature:

- 98.6°F

Pulse:

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| 30 | 26 | 10 | 26 | 10 | 26 | 10 | 26 |
| 142 | 160 | 156 | 160 | 156 | 156 | 156 | 156 |
| 60 | 60 | 60 | 60 | 48 | 48 | 48 | 48 |
| 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |

Sick:

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|---|---|---|---|
| 1 | 3 | 2 | E1 |

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Note: The graph shows a temperature chart with temperatures recorded for each day and time.
History: Had bad cough for one month, and been "whooping" for one week.


Died 2.10.12.

P.M. Lungs: Right lower lobe showed patchy broncho-pneumonia. Left lower lobe confluent broncho-pneumonia. This was airless, on section muco-pus was squeezed from the bronchioles, and excised portions sank in water.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Widespread broncho-pneumonic consolidation. Some collapse and an apparent thickening of alveolar walls due to congestion of alveolar capillaries. Exudate composed of both endothelial cells and leucocytes.

Bronchioles: Mucosa either shed in patches or completely destroyed. Only slight cellular infiltration of the walls. No fibrosis. Lumina blocked with endothelial and pus cells.

Blood vessels: Slight fibrosis.

Summary: Death about the 8th or 9th day from widespread broncho-pneumonia secondary to pertussis.

Severe lesion of the mucosa due to the primary disease.

Parts around the bronchioles not more severely affected than other parts.

Exudate extensive and a mixture of endothelial cells and leucocytes.

No definite fibrous overgrowth.
Name: George Earl, 5 months

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Sept 7.6

History: Feeble child, been wasting many weeks. Green frequent and watery stools for 2 days.

Admitted 10.9.12. very collapsed and with signs of scattered broncho-pneumonic consolidation at both bases. Did not react to treatment at all.

Died 16.9.12.

P.M.: Lungs: Patches of greyish broncho-pneumonic consolidation separated by reddish congested lung tissue. Pus could be squeezed from the bronchioles.

Intestines: Mucosa thickened and many submucous haemorrhages.


Alveoli: Marked broncho-pneumonic consolidation with some emphysema. Exudate composed mainly of endothelial cells, but there is a little fibrin and a few leucocytes. Congestion of alveolar capillaries.

Bronchioles: Severe destruction of the mucosa, and wall left is thin without fibrous overgrowth. Slight cellular infiltration. Lumina blocked with desquamated cells and pus cells.

Blood vessels: Normal.

Summary: Death on about the 9th day of broncho-pneumonia secondary to infective enteritis.

The severe lesions in the bronchioles suggest an antecedent bronchitis as well.

Exudate endothelial leucocytes and fibrinous.
Case 25. Margaret Griggs (1 year 2 months).

History: Measles and broncho-pneumonia 6 weeks ago. Nasal discharge for 3 weeks. Cough for 3 days.

Admitted 7.1.13 with nasal discharge from which bac. diphtherial was cultivated, and with signs of early broncho pneumonia at both bases. On the 10th patchy consolidation noted at left base. On the 13th breathing very distressed.


P.M.: Lungs: Raised greyish granular patches of pneumonic consolidation separated by congested and oedematous lung tissue. Pus squeezed from central bronchioles. All lobes markedly involved. Excised portions sank.

Pleura: Recent adhesions on both sides.
Trachea: No membrane.
Bronchial Glands: one enlarged.
Heart: Dilated.
Other organs: Normal.

Microscopically: Pleura: Normal (see P.M.).

Alveoli: Widespread broncho-pneumonic consolidation. Exudate consists of endothelial cells and leucocytes, the latter predominating in those alveoli around the bronchioles, which also contain some plugs of fibrin. There is a definite thickening of the walls of some alveoli.

Bronchioles: Mucosa but slightly affected. Cellular infiltration of the walls and of tissue around. Congestion of blood vessels in the wall.

Blood vessels: Normal.

Summary: Death about the 9th day of a broncho-pneumonia secondary to diphtheria. Lesions more severe in those alveoli around the bronchioles. Exudate endothelial and leucocytic. The thickening of the alveolar wall is partly fibrous and probably the result of the broncho-pneumonia 6 weeks previously.
Case 26. Violet Rand (9 months).

History: Cough, and distressed breathing for 5 days. Measles rash yesterday.

Admitted 13.11.12 with a measles rash. Colour bad, and signs of widespread broncho-pneumonic consolidation. Grew worse rapidly and had severe convulsions on the 15th.


P.M.: Lungs: Grey patches of broncho-pneumonia separated by congested lung tissue. Present in all lobes, but most marked in left lower lobe.

Bronchial Glands: Enlarged and congested.

Liver: Fatty.

Other organs: Normal.

Microscopically: Pleura: Thick and fibrous. Thin layer of lymph on surface.

Alveoli: Extensive solid consolidation. Exudate composed mostly of leucocytes, but also many endothelial cells and some fibrinous plugs. The alveolar walls are thick and show slight but definite fibrinous overgrowth.

Bronchioles: Mucosa partially or entirely shed. Marked round-celled infiltration of the wall. Lumina full of desquamated cells and pus cells.

Blood vessels. Some cellular infiltration of the wall.

Summary: Death on 9th day of broncho-pneumonia secondary to measles. (Involvement of lung with the invasion of the disease).

Shows thickening of alveolar wall associated with pleurisy.

Exudate leucocytic, endothelial and fibrinous.
Case 27. Fred Mullins, (1 year 6 months).

History: Had pertussis 1 month ago, and cough never entirely gone. Convulsions on day of admission.

Admitted 6.10.12 very rigid, and marked head retraction. Signs of broncho-pneumonic consolidation at both bases. Cerebro-spinal fluid turbid, under increased pressure, and gave growth of B. influenzal. Gradually got worse. Thecal space wasted out daily with sterilised normal saline solution.

Died 11.10.12.

P.M.: Lungs: Extensive greyish confluent broncho-pneumonic consolidation at left base. Scattered patches with red congestion elsewhere.

Pleura: Creamy layer of fibrinous lymph over left lower lobe.

Brain: Ventricles dilated and full of turbid fluid.

Menenges: Thick pus over base of brain, scattered elsewhere.

Microscopically: Pleura: Thick and containing many dilated blood vessels, and well formed connective tissue cells. Thick layer of fibrin on the surface.

Alveoli: Patchy broncho-pneumonic consolidation. In parts confluent. Some collapse, and congestion of alveolar capillaries. Exudate made up of leucocytes and endothelial cells. Leucocytes predeominate in exudate of alveoli surrounding the bronchioles.

Bronchioles: Mucosa entirely shed. Great infiltration of wall with small round cells. Lumina blocked with desquamated cells and pus cells.

Blood vessels: Definite fibrosis.

Summary: Death about the 9th day of a broncho-pneumonia secondary to pertussis.

Shows severe involvement of the bronchioles and an increased severity of the pneumonia in those alveoli immediately around the bronchioles. Early fibrous overgrowth associated with pleurisy.

Exudate leucocyte and endothelial.
Case 28. John Cocklen (2 years 6 months).

History: Measles rash 7 days ago. Breathing rapidly and feverish for 2 days.

Admitted 27.3.13. greatly distressed and colour very bad. Signs of widespread broncho-pneumonic consolidation. Got rapidly worse with cardiac failure.

Died 28.3.13.

P.M.: Lungs: Reddish grey patches of broncho-pneumonic consolidation surrounded the bronchioles, and were separated by areas of reddish congested lung tissue.

Trachea and Bronchioles: Full of muco-pus.

Bronchial Glands: Enlarged and congested.

Heart: Pale. Full of ante-mortem thrombus

Liver: Slightly fatty.

Microscopically: Pleura: A little fibrous thickening.

Alveoli: Broncho-pneumonic consolidation surrounding the bronchioles, and separated by considerable emphysema. Exudate mainly endothelial cells in those air spaces away from the bronchioles, and mainly leucocytes in air spaces immediately around the bronchioles.

Bronchioles: Mucosa mostly destroyed. Dilation of blood vessels, and infiltration with small round cells makes the wall appear thick. Lumina blocked with pus cells.

Blood vessels: Some thickening.

Summary: Death about the 9th day of a broncho-pneumonia secondary to measles.

Exudate patchy, leucocytic and endothelial of peribronchial distribution.

Bronchioles show severe lesions.

Slight excess of fibrous tissue.
Case 29. Wolfe Galen (10 months).

History: Cough and distressed breathing for 1 wk.

Admitted 29.9.12, fat short necked child, breathing with stridor. Marked nasal discharge (diphtheritic). Signs of widespread broncho-pneumonic consolidation, becoming confluent at left base. Tracheotomy performed next day.

Died 1.10.12.

P.M.: Lungs: Reddish grey patches of broncho-pneumonic consolidation, confluent in left lower lobe. Right lung much less affected than the left.

Pleura: Fibrinous lymph over the left lower lobe.

Trachea: Thick membrane over the vocal cords. (None on the tonsil)

Bronchial Glands: Enlarged and soft.

Heart: Fatty.

Kidneys: Cloudy swelling.

Microscopically: Pleura: Outer layer separated (? fibrinous) cellular infiltration.

Alveoli: Confluent broncho-pneumonic consolidation. Exudate consists of leucocytes and endothelial cells in about equal proportions with a little fibrin. In some places a definite thickening of the alveolar wall. In some parts air cells are empty, but as there is no emphysema this is probably due to the plug of exudate having fallen out during the preparation of the slide.

Bronchioles: None seen.

Blood vessels: Definite fibrosis and cellular infiltration.

Summary: Death about 10th day of a broncho-pneumonia secondary to diphtheria. Shows early fibrosis associated with pleurisy.

Exudate leucocytic and endothelial.
Case 30. Doris Fayers (1 year 4 months).

History: Weakly child with chronic cough. Feverish for 24 hours. Lump in neck since birth.


Died 15.12.12.

P.M.: Lungs: Widespread greyish patches of broncho-pneumonia. Right upper lobe contained an abscess (the size of a walnut).

Trachea: Full of septic matter. Found to communicate with gland in neck already referred to.

Bronchial Glands: Enlarged.

Microscopically: Pleura: Some congestion of the blood vessels.

Alveoli: Widespread broncho-pneumonic consolidation. Exudate composed mainly of endothelial cells. Around bronchioles however there are some plugs of fibrin and some leucocytes. The alveolar wall is thick.

Bronchioles: Mucosa almost entirely shed. Congestion of capillaries in wall, and infiltration with small round cells.

Blood vessels: Normal.

Summary: Death on about 10th day of a broncho-pneumonia secondary to measles, terminating with a violent septic bronchitis and abscess formation.

Exudate endothelial leucocytic and fibrinous.
Case 31. Esther Stein (8 months).

History: Acute diarrhoea and vomiting for 6 days.

Admitted 12.10.12 in collapsed condition with signs of broncho-pneumonia at both bases. Gradual downhill course.

Died 15.10.12.

P.M.: Lungs: Greyish patches of broncho-pneumonic consolidation becoming confluent in right lower lobe. Some depressed bluish areas of collapse and much red congestion.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Extensive broncho-pneumonic consolidation, confluent in places, and composed mainly of leucocytes.

Bronchioles: Mucosa shed in patches. Dilatation of blood vessels and some cellular infiltration of wall. Lumina blocked with desquamated cells and pus cells.

Blood vessels: Normal.

Summary: Death on about 10th day of broncho-pneumonia secondary to infective enteritis.

Exudate widespread and mostly leucocytic.

No fibrous overgrowth.
Case 32. Geo. Hopkins (4 years).

History: Severe cough, diarrhoea and distressed breathing for 3 days. Child had had many previous attacks of bronchitis.

Admitted 24.1.13., with signs of patchy broncho-pneumonia at both bases. Next day measles rash appeared which became haemorrhagic and child was delirious. On the 27th confluent consolidation at left base.

Died 30.1.13.

P.M.: Lungs: Extensive greyish broncho-pneumonic consolidation, confluent at both bases. Patches of bluish depressed collapse, and some reddish congested lung.

Bronchial Glands: Enlarged and congested.

Microscopically: Pleura: Slightly thickened. Dilated blood vessels under pleura and some yellow patches around (? haemorrhage.)

Alveoli: Extensive broncho-pneumonic consolidation with some emphysema. Capillaries of alveolar walls much congested. Exudate composed mainly of leucocytes. Some endothelial cells and some red blood corpuscles present. Around the bronchioles some alveoli contain plugs of fibrin. In many there are large round cells filled with carbon pigment.

Bronchioles: Mucosa shed in patches. Infiltration of wall with small round cells. Lumina blocked with desquamated and pus cells.

Blood vessels: Normal.

Summary: Death on about 10th day of broncho-pneumonia secondary to measles. Some haemorrhages into lung are possibly connected with the haemorrhagic character of the rash and due to the intense toxaemia.

Slight change in the lung from the previous bronchitis.

Exudate leucocyte, endothelial and fibrinous.
Case 33. Margarter Priestly (9 weeks).

History: Child had a cough for 5 days. Not sleeping, constipated, and vomiting a lot.

Admitted 20.12.12, breathing shallow and colour bad. Left lower lobe probably consolidated, but air entry poor.

Died within a few hours of admission.

P.M.: Lungs: Widespread broncho-pneumonic consolidation. Confluent in left lower lobe of which excised portions sank in water.

Pleura: Fibrinous lymph covers left lower lobe, and left pleural cavity contained about 3 ozs. of pus.

Trachea: Full of frothy mucus.

Bronchial Glands: Enlarged and congested.

Kidneys: Marked pallor and cloudy swelling.

Microscopically: Pleura: Markedly thickened pleura, with round celled infiltration and a layer of fibrinous lymph on the surface. Blood vessels numerous, large, and filled with blood.

Alveoli: Some collapse at the surface and alveolar capillaries markedly congested. Widespread broncho-pneumonic exudate. Exudate entirely cellular, round bronchioles the leucocytes predominate, away from the bronchioles endothelial cells predominate. In two small patches lung tissue is replaced by mass of small round cells probably early abscess formation.


Blood vessels: Normal.

Summary: An advanced broncho-pneumonia probably later than 10th day in spite of the mother's history. Shows early abscess formation. Child weakly and under-fed, so probably a broncho-pneumonia secondary to a bronchitis of the larger tubes. The inflammatory process is further advanced round the bronchioles than elsewhere.
Case 34. Zillick Duboisky (7 months).

History: Had whooping cough for 2 weeks. Breathing distressed for about 1 week.

Admitted 11.10.12 with signs of widespread broncho-pneumonia becoming confluent at the left base. Later developed some confluent consolidation at right apex, and some friction at the left base.

Died 15.10.12.

P.M.: Lungs: Widespread broncho-pneumonic consolidation confluent at right apex and left base.

Pleura: Thin layer of fibrinous lymph on left base.

Heart: Markedly dilated.

Other organs: Normal.


Alveoli: Confluent broncho-pneumonic exudate, composed of endothelial cells, leucocytes, and fibrin. Fibrin more plentiful than in other sections. Around bronchioles leucocytes predominate. The alveolar walls show slight but definite thickening.

Bronchioles: Mucosa destroyed in patches. Lumen blocked with endothelial and pus cells. Some definite increase in fibrous tissue.

Blood vessels: Some fibrosis.

Summary: Death about 11th day of broncho-pneumonia secondary to pertussis.

Shows the early fibrosis associated with pleurisy, especially common in pertussis.

Exudate leucocytic, endothelial and fibrinous. Greatest severity of inflammation seen around the bronchioles.
Case 35. Arthur Brewster (10 months).

History: Rickety child with frequent bronchitis. Severe cough and rapid breathing for one week.


P.M.: Lungs: Patches of greyish broncho-pneumonic consolidation in all lobes becoming confluent in both lower lobes, from each of which excised portions sank in water. On section plugged bronchus at the centre of each patch, so closely studded as to resemble miliary tubercle.

Heart: Marked dilatation.

Microscopically: Pleura: Thick with infiltration of small round cells. No lymph.

Alveoli: Widespread broncho-pneumonic consolidation. Alveolar walls show an increased number of connective tissue cells. Exudate consists mainly of endothelial cells in the alveoli away from the bronchioles, and leucocytes and plugs of fibrin in the alveoli around the bronchioles.

Bronchioles: Mucosa shed in patches. Cellular infiltration and a definite excess of fibrous tissue in wall.

Blood vessels: Slight fibrosis.

Summary: Death on about 11th day of a broncho-pneumonia secondary to chronic bronchitis in a rickety child.

Shows excess of fibrous tissue, and a greater severity of the disease around the bronchioles.

Exudate endothelial, leucocytic, and fibrinous.
Case 36. Eliza Potts (10 months).

History: Acute diarrhoea and vomiting started 2 days ago.

Admitted 8.1.13. in very collapsed condition with a few high pitched crepitations audible at both bases. Improved temporarily with saline subcutaneously. On 12th signs of widespread broncho-pneumonia but temperature subnormal and breathing not distressed.

Died 17.1.13.

P.M.: Lungs: Greyish patches of broncho-pneumonia in all lobes, confluent at both bases. Pus squeezed from the bronchioles on section.

Intestines: Catarrhal colitis.

Liver: Fatty.

Other organs: Normal.


Alveoli: Widespread broncho-pneumonic consolidation. Exudate composed mainly of leucocytes but some endothelial cells. No increased severity of inflammation around bronchioles.


Blood vessels: Normal.

Summary: Death on about the 11th day of a broncho-pneumonia secondary to infective enteritis.

Exudate widespread and mainly leucocytic.

No fibrous overgrowth.
Case 37. Ida Dudley (1 year 6 months).

History: Offensive discharge from ear for 4 months.


On 4.11.12 signs of broncho-pneumonia at both bases. Still foul aural discharge.

Died 19.11.12.


Other organs: Healthy.


Alveoli: Very extensive broncho-pneumonic consolidation, confluent in places. Exudate dense and composed mostly of leucocytes. Some thick bands run through the lung substance breaking it up into lobules, (probably an exaggeration of the normal septa).

Bronchioles: Mucosa entirely shed. Infiltration of wall with small round cells. Lumina blocked with desquamated and pus cells.

Blood vessels: Normal.

Summary: Death on about 14th day of broncho-pneumonia secondary to bronchitis of weakly child.

Exudate mainly leucocytic.

Some fibrosis.

Section shows condition to be more advanced than naked eye examination suggested. Section taken from patch severely affected.
SECONDARY BRONCHO-PNEUMONIA
SECTION BR. PN.

Stage III.
Solid grey Pnémonia
Day 15 upwards.

Case 38 - 49.
Case 38. Geo. Mansfield (1 year).

History: Always a weakly child. Chronic cough. Discharged from London Hospital 2 weeks ago after broncho-pneumonia. Still coughing and breathing badly.

Admitted 20.1.13 bad colour and signs of broncho-pneumonia at both bases. Rapidly got worse.

Died 24.1.13.

P.M.: Lungs: Greyish patches of broncho-pneumonic consolidation in both lungs becoming confluent at left base.

Pleura: Some adhesions both sides.

Bronchial Glands: Enlarged and congested.

Liver: Fatty.

Heart: Markedly dilated.

Microscopically: Pleura: Loose fibrous tissue with a few connective tissue cells and some thin walled capillaries (i.e. organising lymph.)

Alveoli: Patchy broncho pneumonic consolidation with much emphysema under the pleura and some collapse deeper in. Exudate in alveoli around bronchioles composed mainly of leucocytes in other alveoli endothelial cells.

Bronchioles: Mucosa of one entirely shed. Most show a swelling or flattening out of superficial cells. Some infiltration of wall by small round cells. Lumina blocked with desquamated and pus cells.

Blood vessels: Slight fibrous overgrowth.

Summary: Death about 20th day of a broncho-pneumonia secondary to chronic bronchitis in a weakly child. Child died about 8th day of a relapse and exudate similar to original disease at this stage.

Shows peribronchial involvement well.
Case 39. Roland Hoy (1 year 5 months).

History: Measles rash on 17.8.12. Cough and distressed breathing for 24 hours.

Admitted 21.8.12 with signs of widespread broncho-pneumonic consolidation at both bases. Signs in the chest cleared considerably, but there was severe diarrhoea and child gradually got worse.

Died 8.9.12.


Bronchial Glands: Enlarged congested.

No tuberculosis.

Intestines: Some superficial erosion of the mucosa.


Alveoli: Widespread broncho-pneumonic consolidation denser in some parts than in others. Exudate composed mainly of leucocytes. Some endothelial cells and some fibrin. In parts there is some disintegration of the inflammatory cells suggesting a tuberculous process, but there are no tubercles or giant cells.

Bronchioles: Mucosa entirely shed. Wall infiltrated with small round cells and in parts destroyed.

Blood vessels: Walls swollen and infiltrated with small round cells.

Summary: Death on about the 21st day of a broncho-pneumonia secondary to measles. Probably a very early tuberculous broncho-pneumonia. Child recovering from the simple broncho-pneumonia when attacked by tubercle.
Case 40. Maurice Donovan (5 years).

History: Admitted 22.9.12 with lobar pneumonia (right lower lobe). Developed empyema and operation on 11.10.12. Discharged with healed wound on 1.11.12.

Readmitted 7.11.12 with pertussis and signs of early broncho-pneumonia. Wound broke down and broncho-pneumonia spread.

Died 25.11.12.

P.M.: Lungs: Both lower lobes greyish solid, airless and excised portions sank in water. On section bronchioles gaped and mucopurulent exudate was squeezed from them. Bands of fibrous tissue radiating from the bronchioles. Upper lobes showed scattered greyish patches of consolidation with red congested lung tissue in between.

Pleura: Enormously thickened over right lower lobe. Dense adhesions. No pus.

Bronchial Glands: Enlarged and congested.

Microscopically: Pleura: Markedly thickened. Large dilated blood vessels and recent fibrinous lymph on the surface.

Alveoli: Patchy broncho-pneumonic consolidation. Exudate composed mainly of leucocytes. Some parts show endothelial cells and around bronchioles there are plugs of fibrin. There are some strong fibrinous bands running into lung tissue, probably an exaggeration of the normal septa.

Bronchioles: Mucosa shed in patches. Some infiltration of wall with small round cells, and dilatation of the blood vessels.

Blood vessels: Slight fibrosis.

Summary: Death on about the 21st day of a broncho-pneumonia secondary to pertussis.

Fibrous overgrowth associated with pleurisy mostly accounted for by the recent empyema.

Exudate mainly leucocytic.
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Name: Eva Taufrane
Case 41. Eva Vengreve (1 year 2 months).

History: Cough and rapid breathing for 4 days.

Admitted 8.11.12 early measles rash, and signs of widespread broncho-pneumonia. By the 14th there was definite consolidation at both bases. Complicated by severe diarrhoea.

Died 26.11.12.

P.M.: Lungs: Extensive greyish broncho-pneumonic consolidation in both lower lobes. On section bronchioles exude pus, and are surrounded by raised granular patches of consolidation. Some emphysema. Excised portions from both lower lobes sank in water.

Pleura: Interlobar adhesions of slight and recent character on both sides.

Trachea and Bronchi: Full of blood-stained frothy mucus.

Bronchial Glands: Enlarged and congested.

Other organs: Normal.

Microscopically: Pleura: Thickened, blood vessels congested, and some cellular infiltration.

Alveoli: Widespread broncho-pneumonic consolidation, denser in some parts than in others. Some patches of collapse. Alveolar walls thickened and capillaries congested. Exudate composed mainly of endothelial cells, but where it is dense leucocytes are numerous.

Bronchioles: Mucosa entirely shed. Blood vessels congested and infiltration of wall with small round cells.

Blood vessels: Normal. Thick fibrous bands with small round celled infiltration and separation of fibres(? from cedema) intersect lung tissue. Probably an exaggeration of normal septa.

Summary: Death on about 22nd day of a broncho-pneumonia secondary to measles.

The prolonged course has caused a definite increase in fibrous tissue. The exudate mainly endothelial is like the exudate of an early stage of the disease and suggests that the fatal termination was due to an exacerbation of the inflammation on lung tissue devitalised by fibrous overgrowth.
Case 42.  Nat. Hitchcock, 3 months.

History: Bottle fed baby, never strong. Vomiting and some diarrhoea. Severe cough for 5 days. (Desquamming but Wassermann negative)

Admitted 7.10.12. Weakly child with signs of widespread bronchitis. On the 9th definite broncho-pneumonia at both bases, and respiration greatly distressed. Improved slightly, but continued with patchy signs of broncho-pneumonia in both lungs for 2½ weeks. Severe prolonged attacks of coughing. Gradual decrease in weight.

Died 25.10.12.

P.M.: Lungs: Both lower lobes shewed patches of broncho pneumonia, though most of the lesion could be best described as congestion, oedema and collapse. Frothy fluid not purulent was squeezed from the bronchi-oles. Excised portions of lung tissue floated in water. Changes most marked on left side.

Trachea and Bronchi: Congested and full of frothy mucus.

Heart: Dilatation of right side. Otherwise normal.

Microscopically: Pleura: Normal.

Alveoli: Some collapse with compensatory emphysema. Capillaries of alveolar wall intensely congested. Desquamated endothelial cells, and some red blood corpuscles seen in air spaces. Slight but definite thickening of alveolar walls around the bronchioles.

Bronchioles: Some swelling of cells of mucosa. Little cellular infiltration of walls but some excess of fibrous tissue in outer layers.

Blood vessels: Healthy.

Summary: Death from the exhaustion of prolonged broncho-pneumonia (probably about 24th day) in weakly child. The section does not show disease in its greatest severity, but still is very instructive. The excess of fibrous tissue around bronchioles and in alveolar walls of contiguous air cells is almost certainly the result of broncho-pneumonia here. A mild fibrosis probably present during the resolution of all broncho pneumonias.
Case 43. Emily Masson (11 months).

**History:** Whooping cough for 3 weeks.

Admitted 9.10.12 with definite pertussis and signs of early broncho-pneumonia at both bases. On the 16th confluent consolidation over left upper lobe. On 1.11.12 child developed measles rash and signs in lung increased.

Died 7.11.12.

**P.M.** Lungs: Greyish patchy broncho-pneumonic consolidation confluent in places in left lung, but separated by areas of congestion in right lung.

Pleura: Tough adhesions between left lower lobe and the diaphragm.

Heart: Pericardium much thickened and contained a quantity of creamy granular pus which could hardly have been detected with an exploring needle.

**Microscopically:** Pleura: None seen (see P.M.)

Alveoli: Broncho-pneumonic consolidation not extensive most marked around the bronchioles and separated by areas of emphysema. Exudate mainly endothelial cells in granular material (serum). Capillaries of alveolar wall are congested. No fibrosis of alveolar wall.

Bronchioles: Mucosa shed almost entirely. Wall infiltrated with small round cells. Little blocking of the lumina. No fibrosis.

Blood vessels: Definite fibrosis.

**Summary:** Death about the 30th day of a broncho-pneumonia secondary to pertussis and complicated by measles.

Section taken from part of lung showing disease only slightly. Exudate mainly endothelial and probably due to an exacerbation of the disease caused by the measles.

Death ultimately due to pyopericardium. The tendency to fibrosis is only seen in the blood vessels, suggesting that the fibrosis seen in other sections is localised to parts where the disease is severe.
Case 44. Minnie Primack (2 years 9 months).

History: Fever and cough 6 days.

Admitted 4.1.13, with fading measles rash. Widespread signs of broncho-pneumonia. On the 5th septic spot at angle of mouth, scraped and touched with pure carbolic acid. On 11th confluent consolidation at both bases. Child ran prolonged course with subacute noma, slow spreading ulceration on face and buttock.

Died 29.1.13.

P.M.: Lungs: Widespread greyish broncho-pneumonic consolidation, confluent at both bases. Remains of a small abscess beneath pleural surface of left upper lobe.

Pleura: A few ounces of pus in left pleural cavity.

Bronchial Glands: Enlarged, congested, pale and firm.

Microscopically: Pleura: Patches of loosened fibrous tissue.

Alveoli: Patchy broncho-pneumonic consolidation with areas of emphysema. The alveolar wall is definitely thickened and fibrous. Exudate composed mainly of endothelial cells, with plugs of fibrin seen around the bronchioles.

Bronchioles: Mucosa partially or completely destroyed. Some shew congestion of the blood vessels and a fibrous overgrowth. Others a great cellular infiltration with destruction of the wall suggesting early abscess formation.

Blood vessels: Definite fibrosis.

Summary: Death about the 30th day of a broncho-pneumonia secondary to measles. Excess of fibrous tissue from the prolonged course associated with abscess formation and empyema.

Exudate mainly endothelial suggests a terminal exacerbation of the inflammatory process.

Bronchioles and peribronchial alveoli show the most severe lesions.
Case 45. Annie Hyman (1 year 2 months).

History: Fever and distressed breathing for 3 days. Severe diarrhoea for 24 hours.


Died 28.1.13.

P.M.: Lungs: Widespread greyish patches of consolidation surround the bronchioles. Excised portions sank in water.

Intestines: Patchy erosion in ileum.

Heart: Markedly dilated.

Microscopically: Pleura: A little thickened in places, but broken in preparation of slide.


Bronchioles: Mucosa shed in patches. Congestion of blood vessels of wall and in some places a destruction of the wall. No fibrosis.

Blood vessels: Definite fibrosis.

Summary: Death on about the 31st day of a broncho-pneumonia secondary to measles complicated by severe enteritis.

Prolonged course has caused some fibrous overgrowth, but only a little, as lungs were clearing up well before the relapse.

Exudate of endothelial cells and red blood corpuscles suggests early type; probably this exudate has only been present since the relapse.
Case 46. Ernest Stendella (10 weeks).

History: Cough, diarrhoea, and vomiting for one month.

Admitted 19.8.12 and was having 8-10 green offensive stools in the day. Subacute broncho-pneumonia. No temperature, no distress, but a few signs at both bases. Intestinal antiseptics and lavage only gave temporary improvements.

Died 26.9.12.


Intestines: Submucous haemorrhages and ulceration of Peyer's patches.

Other organs: Normal.

Microscopically:
- Pleura: Extremely thick and fibrous with large blood vessels. No cellular infiltration, thus suggesting old thickening.

- Alveoli: Dense bands of fibrous tissue run through the section. These have large congested blood vessels and show cellular infiltration. These bands surround and obliterate certain alveoli. The capillaries of the alveolar walls are congested, and the air spaces contain an exudate made up of endothelial cells, red blood corpuscles, and leucocytes.


- Blood vessels: Marked fibrosis.

Summary: Death from exacerbation of inflammatory process in a lung where a prolonged subacute broncho-pneumonia (probably 35 days) has caused extreme fibrosis. Child already in an exhausted condition.
Case 47. Nathan Stone, 7 months.

History: Some diarrhoea for last 3 months. Was in-patient London Hospital with broncho-pneumonia for a fortnight and discharged six days ago. Still coughing, some frequency of bowels, and often sick. Had a convulsion 2 days ago, and one just before admission.

Admitted to E.L.H.C. 5.12.12 with signs of broncho-pneumonia at both bases. Stools frequent green and offensive. Child got steadily worse, though signs in the chest disappeared. Lungs clear before death, but intestinal condition more severe.

Died 22.12.12.

P.M.: Lungs: Both lower lobes congested, oedematous, and collapsed.

Heart: Dilatation of right side,

Liver: Fatty.

Intestines: Submucous haemorrhages, and other lesions of severe enteritis.

Other organs: Normal except for some congestion.

Microscopically: Pleura: Thickened.

Alveoli: Some collapse and much emphysema. Alveolar wall shows a definite though slight fibrous overgrowth. Most marked in the alveoli around the bronchioles. In many air spaces there is an exudate composed of desquamated epithelium. Only an occasional leucocyte present.

Bronchioles: Mucosa is shed in patches. All show marked congestion of blood vessels, and great cellular infiltration. Slight fibrosis around merging into the fibrosis of the alveolar wall already referred to.

Blood vessels: Normal.

Summary: Death from the toxaemia of the enteritis. Lung shows effect of a resolved broncho-pneumonia. (The acute broncho-pneumonia started 37 days before death, there was a relapse 17 days before death - and lungs were clear 7 days before death.) The broncho-pneumonia has left slight thickening of the alveolar wall. The exudate in the air spaces is probably mostly terminal.
Case 48. Florence Pocock (1 year 8 months).

History: Had pertussis 8 months ago. Good recovery. Had infective enteritis 1 month ago. Diarrhoea still persisting.


Died 28.10.12.

P.M.: Lungs: Extensive greyish consolidation with many small yellowish grey nodules standing out prominently. Impossible to tell whether tubercle or not from naked eye examination.

Heart: Dilated.
Liver: Fatty.
Spleen: Normal.

Intestines: Mucosa thickened and congested with submucous haemorrhages.

Microscopically: Pleura: Not seen.

Alveoli: Widespread broncho-pneumonic consolidation of varying density. Alveolar walls are in places definitely thickened, and elsewhere show congestion of their capillaries. Exudate composed mainly of leucocytes but where it is less dense, endothelial cells and some fibrin present.

Bronchioles: Mucosa completely destroyed. Cellular infiltration and engorgement of blood vessels in the wall. Lumina blocked with desquamated and pus cells. In places a row of columnar cells lying in patch of pneumonia, suggesting a complete destruction of wall.

Blood vessels: Some fibrous thickening.

Summary: Death about 6th to 7th week of a broncho-pneumonia secondary to infective enteritis. Subacute course and purpura.

Shows a definite fibrosis.
Exudate very widespread, and mainly leucocytic.
Case 49. Nora Goodman (1 year 1 month).

History: Frequent attacks of convulsions for last 9 weeks. As many as 12 in the day but none for last 10 days. Severe diarrhoea and vomiting 1 month ago. Diarrhoea still present.

Admitted 27.7.12 in very neglected condition and signs of broncho-pneumonic consolidation at both bases. Stools undigested, frequent and offensive. Ran a pro-longed course with periods of improvement followed by relapses. Right lower lobe cleared up but consolidation remained at the left base. Diarrhoea very persistent.

Died 24.9.12.

P.M.: Lungs: Left lower lobe showed complete consolidation. On section was studded with softened areas looking exactly like miliary tubercle. Smear showed no T.B. Bluish-grey and solid, apparently unresolved pneumonia, and collapse.

Bronchial Glands: Enlarged but no evidence of tuberculosis.

Other organs: Normal.

Microscopically: Pleura: Thick and fibrous.
Blood vessels dilated.

Alveoli: Mostly collapsed.
Alveolar walls thick and fibrous, and bands of fibrous tissue run through the section. Most air spaces do not contain an exudate, but some have a few desquam-mated endothelial cells.

Bronchioles: Mucosa intact but cells greatly swollen. Infiltration of the wall with small round cells.

Blood vessels: Extreme fibrosis.

Summary: Death in about the 12th week of a broncho-pneumonia secondary to infective enteritis. Left lower lobe has not resolved and is markedly collapsed. Fibrous overgrowth from prolonged course is extreme, and best marked in the blood vessels.
PRIMARY BRONCHO-PNEUMONIA.

Cases 50 - 61.
Case 50. Maurice Garadosky (3 weeks).

History: Strong baby. Cough, bad colour and breathing distressed for 24 hours.

Admitted 19.12.12 hardly breathing and very cyanosed. Had many repeated collapses and died 20.12.12

P.M. Lungs: Right showed raised reddish patches of broncho-pneumonic consolidation. Left congested and oedematous.

Trachea: Full of frothy mucus.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Pneumonic consolidation in patches, with emphysema in between. Alveolar capillaries are congested and air spaces contain exudate of endothelial cells with a few leucocytes.

Bronchioles: Mucosa shed in patches. Slight cellular infiltration of the walls. No fibrosis.

Blood vessels: Slight fibrosis.

Summary: Death from primary broncho-pneumonia at very early stage, probably second or third day.

Consolidation patchy.

Exudate mainly endothelial.

The slight excess of fibrous tissue in the blood vessels unaccounted for.

Alveoli more severely affected than the bronchioles.
Watercolour drawing showing the **engorged capillaries** in superficial part of lung.

Slide No. 51
Stain H & E
x 460 drains.
Case 51. Doris Walker (1 year).

History: Strong child. Cough and distressed breathing for two days. Convulsions on day of admission.

Admitted 16.1.13 in collapsed condition. Revived with stimulants but died suddenly in the night.


Spleen: Soft and congested.

Other organs: Normal.

Microscopically: Pleura: Normal.

Alveoli: Patches of broncho-pneumonic consolidation, well seen round infundibula. Capillaries of alveolar walls are intensely engorged especially in superficial alveoli where there is some collapse. Exudate composed of endothelial cells and red blood corpuscles in a granular basis (serum).

Bronchioles: Mucosa shed in patches. Some cellular infiltration of walls.

Blood vessels: Normal.

Summary: Death from primary broncho-pneumonia at very early stage, probably third or fourth day.

Consolidation patchy.

Exudate mainly endothelial and R.B.C.'s

Alveoli more severely affected than the bronchioles.

In this section (from left lower lobes) the collapse is more evident than the broncho-pneumonia.
Case 52. Ellen Leary (1 year 6 months).

History: Healthy child. Shivery 2 days ago. Breathing hard and coughing since.

Admitted 20.11.12 with signs of broncho-pneumonia at right base. On the next day signs definite all over. Colour got bad and heart gradually failed.

Died 23.11.12.

P.M. Lungs: Patches of reddish grey broncho-pneumonic consolidation scattered through all lobes tending to confluence at the right base. On section the bronchioles stood out conspicuously, each forming the centre of a patch of consolidation, and on squeezing mucus poured from them.

Pleura: Recent adhesions between the lobes of the right lung.

Trachea and Bronchi: Congested and full of mucus.

Other organs: Normal.

Microscopically: Pleura: Nil (see P.M.)

Alveoli: Widespread broncho-pneumonic consolidation. Exudate is composed of both endothelial cells and leucocytes. No increase in severity of lesion in those alveoli around the bronchioles. Capillaries of alveolar wall are congested.

Bronchioles: Mucosa entirely destroyed. Cellular infiltration of wall and dilatation of blood vessels. No fibrosis.

Blood vessels: Normal.

Summary: Death on 5th day of a primary broncho-pneumonia.

Shows coincident bronchitis but no peribronchial distribution of the inflammatory process in the lung.

Exudate endothelial and leucocytic.
Case 53. Sidney Saxby (1 year 6 months).

History: Healthy child. Developed cough and fever suddenly five days ago. Getting worse and becoming delirious.

Admitted 4.1.13 in collapsed condition with signs of scattered broncho-pneumonia at both bases. Died within an hour of admission.

P.M. Lungs: Patches of reddish grey broncho-pneumonic consolidation scattered through both lungs. Extensive but no tendency to confluence. Some depressed bluish areas of collapse.

Pericardium: Some clear fluid.

Other organs: Normal.


Alveoli: Peribronchial distribution of broncho-pneumonic consolidation with much emphysema in between. Exudate in alveoli around the bronchioles is mainly composed of leucocytes, and a gradual transition to a predominance of endothelial cells in the exudate of alveoli away from the bronchioles can easily be traced.

Bronchioles: Mucosa shed in patches. Marked cellular infiltration of the wall.

Blood vessels: Some inflammatory oedema of the outer coat.

Summary: Death on 5th day of a severe primary broncho-pneumonia.

Unlike most sections this shows a greater severity of the inflammatory process in the alveoli around the bronchioles.

Exudate both endothelial and leucocytic.

No fibrous overgrowth.
Case 54. Chas. Satton (3 years 9 months).

History: Measles 6 weeks ago. Good recovery. Pains in abdomen and breathing rapidly for 4 days. Had pertussis at age of 4 months.

Admitted 12.11.12 very ill with widespread bronchitis but no definite patches of broncho-pneumonia. Heart dilated and systolic murmur. Next day some broncho-pneumonic consolidation on right side. Temperature low, but toxaemia very great. Comatose for some hours before death.

Died 15.11.12.

P.M. Lungs: Patches of broncho-pneumonic consolidation in right lung becoming confluent in the lower lobe, from which excised portions sank in water. Left lung dark reddish congestion, excised portions floated in water. On section of right lung bronchioles exuding muco pus stood out at the centres of the consolidated patches.

Pleura: A few frail adhesions over the right lower lobe, and a little clear fluid in the right pleural sac.

Trachea and Bronchi: Congested and full of frothy mucus.

Bronchial Glands: Enlarged and congested.

Liver: Fatty.

Microscopically: Pleura: Thick and rough on the surface.

Alveoli: Widespread broncho-pneumonic consolidation. Walls of alveoli, especially of those near surface, show definite thickening. Capillaries in wall are congested. Exudate mainly endothelial cells, with some plugs of fibrin.

Bronchioles: Mucosa partly destroyed. Some cellular infiltration.

Blood vessels: Normal.

Summary: Death on about 8th day of primary broncho-pneumonia.

Shows a thickening of the alveolar wall associated with pleurisy.

Exudate endothelial and fibrinous.
Case 55. Herbert Bonnet (1 year).  

**History:** Breathing rapidly and coughing for 1 week.

Admitted 22.1.13. Rickety but otherwise strong child. Widespread broncho-pneumonia confluent at left apex. Gradual downhill course.

Died 28.1.13.

**P.M.** Lungs: Widespread patches of broncho-pneumonic consolidation becoming confluent in places. Some congestion, oedema, and collapse.

Other organs: Normal.

**Microscopically:** Pleura: not seen, normal to naked eye.

Alveoli: Patchy broncho-pneumonic consolidation, with some emphysema and some collapse. Exudate in parts especially around bronchioles confluent and composed mainly of leucocytes. Elsewhere mainly endothelial with some red blood corpuscles.

Bronchioles: Mucosa shed in patches in a few intact. Infiltration of wall with small round cells. Lumina blocked with desquamated and pus cells.

Blood vessels: Some fibrous overgrowth.

**Summary:** Death on about 13th day of primary broncho-pneumonia.

Increased severity of inflammation around bronchioles, but the tubes comparatively little affected, i.e. the greatest severity of the disease is on the alveoli.

Exudate mainly leucocytic.
Case 56. John Martin (10 years).

History: Strong boy. Sudden onset of pain in chest and abdomen, with cough and rapid breathing 1 week ago.

Admitted 28.3.13 with signs of broncho-pneumonic consolidation at both bases. Later became confluent, and severe diarrhoea was a complication.

Died 7.4.13.

P.M. Lungs: Widespread greyish areas of broncho-pneumonic consolidation in both lower lobes, with patches of reddish congestion.

Pleura: Adhesions both sides.

Bronchial glands: Enlarged and soft.

Intestines: Congested and contained much mucoid material.

Microscopically: Pleura: Great fibrous thickening with dilatation of the blood vessels in deeper layers, and much cellular infiltration.

Alveoli: Patches of broncho-pneumonic consolidation separated by areas of emphysema. Exudate of endothelial cells and leucocytes. Alveolar walls show some fibrous thickening.


Blood vessels: Some fibrosis.

Summary: Death about the 17th day of a primary broncho-pneumonia.

Shows patchy consolidation (probably more extensive in other parts).

Fibrous overgrowth associated with pleurisy.
Case 57. Sarah Watts (1 year 9 months).

**History:** Screaming and irritable for a few days.

Admitted 24.9.12 in lethargic but irritable condition. Lungs clear. Cerebro-spinal fluid normal. Reflexes normal. On 26th signs of broncho-pneumonia developed at right base. Ran a prolonged course with cerebral symptoms, and developed a pneumothorax 24 hours before death.

Died 10.10.12.

P.M. Lungs: Right contracted and carneous. Large abscess in lower lobe scattered broncho-pneumonia in other lobes.

Pleura: A little thin brownish pus on right side.

**Microscopically:** Pleura: Thick and fibrous. Much infiltration with small round cells.

Alveoli: Widespread broncho-pneumonic consolidation. Alveolar walls thick and show cellular infiltration. Exudate composed mainly of leucocytes, but those around bronchioles show plugs of fibrin. In many places there are patches of small round cells replacing lung tissue and suggesting early abscess formation.

Bronchioles: Mucosa shed almost completely and walls densely infiltrated with small round cells. Lumina blocked with pus cells.

Blood vessels: Definite fibrosis.

**Summary:** Death on about the 18th day of a primary broncho-pneumonia complicated by abscess in the lung, and pyopneumothorax.

Early multiple abscess formation in the lung.

Exudate leucocytic and fibrinous.

Excess of fibrous tissue in conjunction with super-added sepsis.
Microphotograph of Slide No. 58
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Reg No
Case 58. Emma Breden (1 year 9 months).

History: Measles 5 weeks ago. Good recovery and well till 2 days ago when fever and cough started.

Admitted 26.11.12 with signs of early broncho-pneumonia at right base. Within a few days patchy consolidation everywhere, confluent at right base. Ran a prolonged course with severe toxaemia.

Died 15.12.12.

P.M. Lungs: Greyish patches of broncho-pneumonic consolidation, confluent on right side, scattered with congestion and collapse on left side.

Heart: Markedly dilated and much ante-mortem clot.

Other organs: Congested.

Microscopically: Pleura: Normal.

Alveoli: Widespread broncho-pneumonic consolidation. Alveolar walls definitely thickened. Exudate consists of leucocytes, endothelial cells and fibrin. Fibrin not in excess round bronchioles, but widespread.

Bronchioles: Mucosa breaking up in patches. Infiltration of the wall with small round cells. Definite increase in fibrous tissue.

Blood vessel: Some fibrosis.

Summary: Death on about the 21st day of a primary broncho-pneumonia. Child had had measles, but not recently enough to call pneumonia secondary.

The prolonged course has caused a definite increase in fibrous tissue. The exudate of endothelial cells, leucocytes and fibrin is like the exudate of an early stage, and suggests that the fatal termination was due to an exacerbation of the disease on a fibrosed lung.

The alveoli show a greater severity of the disease than the bronchioles.
Formation of definite connective tissue cells in organizing exudate

Slide No. 59
Stain H&E
Microphotograph x 360 diam.
Case 59. Hilda Tobachmann (1 year 6 months).

History: Strong child "Out of sorts" for 2 weeks. Vomiting and fever for 2 days.

Admitted 25.2.13 with signs of bronchitis. Next day definite broncho-pneumonia at the right apex. Ran a prolonged course, signs becoming more widespread, and child developed some ulcerative stomatitis.

Died 19.3.13.

P.M. Lungs: Right upper lobe uniform dull grey consolidation. Bronchioles dilated and full of offensive pus. Two abscesses (size of beans). Walls ragged and communicated with a bronchus. All other lobes showed patches of greyish broncho-pneumonic consolidation separated by areas of red congested lung tissue. Right middle lobe contained three small abscesses.

Pleura: Adhesions over right upper lobe. Bronchial glands: Enlarged and congested. One very soft on section.

Other organs: Normal.

Microscopically: Right upper lobe.


Alveoli: Widespread broncho-pneumonic consolidation. Alveolar walls show fibrous thickening. Exudate mainly endothelial cells, with some leucocytes and fibrin. In some of the air spaces the exudate shows an organisation with definite connective tissue cells.


The left upper lobe (Slide 59a) showed widespread broncho-pneumonia of varying density. Exudate leucocytes, endothelial cells and some fibrin. Bronchial mucosa shed in patches and lumina blocked with pus. Only very slight fibrous thickening (if any) of the alveolar walls, bronchioles or blood vessels.

Summary: Death about the 24th day of a primary broncho-pneumonia.

Right upper lobe shows a marked fibrosis present in all parts, and which is not seen in other parts of the lung. Fibrosis associated with abscess formation and pleurisy.
Case 60. Sarah Weiner (1 year 6 months).

History: Strong child. Cough and fever for 2 days.

Admitted 12.9.12 with patchy consolidation at left base. Few patches on right side. On 18th confluent consolidation at left base, and temperature swinging 40°C daily. Explored several times. On 27th pus localised and rib resected. Abscess in lung found. Child brought up pus by mouth, and abscess drained through chest wall. On 1.10.12 draining freely but very foul (growth of B. coli from pus). Wound showed no signs of healing.

Died 17.10.12.

P.M. Lungs: Left lower lobe: Widespread greyish-yellow broncho-pneumonic consolidation. On section pus squeezed from bronchioles. Depressed area of lung opposite chest wall wound limited by adhesions. Other lobes show earlier broncho-pneumonic changes, greyish patches in red congested lung tissue.


Bronchial glands: Enlarged and soft. One shows area of acute focal necrosis.

Kidney and liver: Cloudy swelling.

Spleen: Firm.

Microscopically: Pleura: Enormously thickened. Superficial layer of fibrinous lymph. Thin walled capillaries and connective tissue cells deeper in. Fully formed fibrous tissue deeper still, i.e. inflammatory products becoming organised.

Alveoli: Patchy broncho-pneumonic consolidation. Alveolar walls thickened. Exudate mainly endothelial cells. In some alveoli the exudate appears to be undergoing organisation, and a ring of inflammatory products is seen lining the alveoli apparently thickening the wall. Alveoli around bronchus contain some leucocytes.

Bronchioles: Mucosa entirely destroyed. Dilatation of blood vessels and infiltration of the wall with small round cells. In some dense fibrous tissue around. One bronchiule shows destruction of the wall.

Blood vessels: Marked fibrosis.

Summary: Death about the 40th day of a primary broncho-pneumonia complicated by abscess of the lung. Shows extreme fibrosis caused by the prolonged course associated with suppuration. Exudate mainly endothelial and suggests an exacerbation of the inflammatory condition fatal in a fibrotic lung.
Name: Jesse L. Wallacher
Reg. No.

Date of Disease

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- 102°F
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- 98°F
- 97°F
- 96°F
- 95°F

Pulse:

- 100
- 110
- 120
- 130
- 140
- 150
- 160

Respirations:

- 15
- 20
- 25
- 30
- 35

Sick:

- 0
- 1
- 2
- 3
- 4

B.O.:

- 0
- 1
Case 61. Jessie Wallaker (1 year 6 months).

History: Strong child. Cough and distressed breathing for one week.


Died 29.10.12.

P.M. Lungs: Greyish patches of broncho-pneumonic consolidation in all lobes, confluent on right side, but separated by areas of red congested lung tissue on left. Left upper lobe shows bluish depressed areas of collapse. On section pus exuded from bronchioles and excised portions from both lower lobes sank in water.

Pleura: Adhesions on right side. Easily broken down without tearing lung.

Trachea and Bronchi: Full of frothy mucus.

Bronchial Glands: Enlarged, soft, and congested.

Liver: Fatty.

Kidneys: Cloudy swelling.

Microscopically: Pleura: Thickened and marked cellular infiltration.

Alveoli: Widespread broncho-pneumonic consolidation. Exudate denser in some parts than other. Where it is denser it is composed mainly of leucocytes. Elsewhere composed of endothelial cells and fibrin. Dense fibrous bands intersect lung tissue: probably an exaggeration of normal septa. These bands show infiltration with small round cells.

Bronchioles: Mucosa almost entirely destroyed. Cellular infiltration and dilatation of blood vessels. Little fibrosis.

Blood vessels. Marked fibrosis.

Summary: Death on about the 42nd day of a primary broncho-pneumonia. Prolonged course has caused very marked fibrosis everywhere. The results of the inflammation have been most marked on the alveoli, but not particularly on those alveoli around the bronchioles.

The exudate is mainly endothelial and suggests that the fatal termination was due to an exacerbation of the inflammation on a fibrosed lung.
LOBAR PNEUMONIA.

CASES 62 & 63.
Case 62. Emily Dettonon (1 year 4 months)

History: Had pneumonia twice before. Cough and fever with rapid breathing for 2 days.

Admitted 26.9.12 with lobar consolidation of left base. - Ran a typical course for four days.

Died 30.9.12 suddenly.

P.M. Lungs: Left lower lobe solid, firm and excised portions sink in water. On section uniform granular appearance of lobar pneumatic consolidation. Bloodstained serum obtained on squeezing. Large infarct present. Other lobes congested but no consolidation.

Heart: Dilated. No valvular disease.

Liver: Fatty.

Microscopically: Pleura: Normal.

Alveoli: Most crowded with red blood corpuscles. In one place definite lobar consolidation seen. Alveolar walls thickened and air spaces filled with a uniform exudate of fibrin and leucocytes. Fibrin plentiful, leucocytes vary in number.

Bronchioles: None seen.

Blood vessels: Normal.

Summary: Death on 6th day of lobar pneumonia, with infarct in lung. Section unfortunately mostly composed of infarct, but definite uniform lobar consolidation can be detected. Exudate fibrinous and leucocytic. No fibrous overgrowth.
Case 63. Phoebe Buckley (1 year 9 months)

History: Strong child. Fever and cough for 3 days.

Admitted 26.8.12. with complete consolidation of left lower lobe. No consolidation elsewhere. Ran a prolonged course of lobar pneumonia till 9.9.12 when she developed a sore throat. A few spots of membrane on tonsils from which B. diphtherial were cultivated.

Died 10.9.12 of sudden heart failure.

P.M. Lungs: Left lower lobe firm, solid, and excised portions sank in water. On section friable, reddish grey, granular mottling, uniform lobar consolidation with no patchy consolidation around the bronchioles.

Left upper lobe congested and patches of congestion and collapse on right side.

Microscopically: Pleura: Torn in places. Infiltrated with small round cells.

Alveoli: Widespread lobar consolidation. All alveoli filled with fibrinous exudate containing some leucocytes. Exudate contracted from wall in most alveoli. Alveolar wall thick and infiltrated with small round cells.

Bronchioles: Mucosa entirely destroyed. Walls infiltrated with small round cells, but no spread to surrounding alveoli.

Blood vessels: Normal.

Summary: Death of lobar pneumonia complicated by diphtheria. Prolonged course with unresolving lung probably weakened the heart so much that death occurred from cardiac failure soon after diphtheria developed, and before any secondary broncho-pneumonia could occur. Exudate uniform fibrinous and leucocytic.

No fibrous overgrowth.
TUBERCULOUS.

CASES 64-78.
Case 64. Catherine Christmas (3 years).

History: Pain in head and vomiting for one day.


Died 26.9.12.

P.M. Lungs: Left upper on section showed a patch of gritty tubercles (up to a millet seed in size). All lobes showed some oedema, were red from congestion, and had a few bluish depressed areas of collapse. No other tubercle found.

Bronchial glands: Gland at the bifurcation of the trachea contained a caseous encapsulated nodule size of a hemp seed. At the root of the left lung were three glands (the largest the size of a pea) caseous throughout.

Meninges: Tubercles and exudate in interpeduncular space, and along the course of the middle cerebral artery.

Brain: Ventricle dilated.

Mesenteric glands: Four enlarged. Each contained small caseous nodule.

Liver: Fatty.

Spleen and kidneys: No tubercles.

Microscopically: Pleura: Not seen.

Alveoli: Patches of collapse separated by areas of emphysema. Some air spaces contain desquamated endothelial cells insufficient to term an exudate.

Bronchioles: Mucosa shed in patches.

Blood vessels: Normal.

Summary: Death from tuberculous meningitis, in child with widespread tuberculous lesions. The naked eye examination showed tubercle of the lungs, but the section is taken from a part at present perfectly normal.
Case 65. Ernest Nilsom (5 years).

History: Diarrhoea and losing flesh for 1 month.


Died 29.9.12.

P.M. Lungs: Oedema and congestion of both lower lobes. Excised portions floated in water. Right upper lobe contained a few small tubercles.

Pleura: Some old adhesions over the right apex.

Bronchial glands: At the root of right lung, four enlarged and caseous on section.

Intestines: Oedema and thickening of mucosa, with some sub-mucous haemorrhages.

Heart: Dilated. Fatty degeneration (Microscope revealed refractile droplets of fat in the muscle cells).

Liver: Extreme fatty degeneration.

Kidney: Pale (Microscope revealed some cloudy swelling).

Microscopically: Pleura: Not seen.

Alveoli: Patches of collapse separated by areas of emphysema. Elsewhere alveoli normal with well formed walls a little thickened, and a few desquamated cells lying in the air spaces.

Bronchioles: Mucosa partly separated and the cells swollen. Some infiltration with small round cells.

Blood vessels: Slight fibrosis.

Summary: Death from the exhaustion of prolonged diarrhoea in a tuberculous child. Lung showed some old tuberculous lesions to the naked eye, but the section is taken from a part showing no tuberculosis. Changes seen by the microscope could be purely terminal.

Slight fibrous overgrowth.
Case 66. Chas, Harris (3 months).

History: Strong child. Breathing distressed for one week.

Admitted 26.10.12 with signs of extensive patchy broncho-pneumonia. Ran a course of primary broncho-pneumonia, lungs clear on 10.11.12 except for right base which still had patchy consolidation. Child however did not improve.

Died 21.11.12.

P.M. Lungs: Congested, oedematous, and patches of bluish collapse. Both riddled with grey raised tubercles. Most extensive in right lower lobe.

Bronchial glands: Enlarged. One caseous.

Spleen: Riddled with miliary tubercles.

Kidneys: A few sub-peritoneal tubercles.

Mesenteric glands: Enlarged and hard.

Microscopically: Pleura: Infiltration with small round cells.

Alveoli: Scanty exudate, mainly endothelial cells in some air spaces. Elsewhere emphysema and collapse. A definite thickening of the alveolar wall in places.

Bronchioles: Mucosa shed in patches, and infiltration of the walls with small round cells.

Blood vessels: Definite fibrosis.

Summary: Death from acute miliary tuberculosis possibly following on primary broncho-pneumonia. Duration 1 month.

The section (a very poor one) shows no evidence of tuberculosis, but the naked eye examination, and the presence of tubercles in spleen and kidney, is sufficient to justify the classification of the case as tuberculous.

Definite fibrous overgrowth in part of lung showing little other change.
Case 67. Margaret Johnstone (2 years 6 months).

History: Never strong. Abdomen increasing in size for one month.

Admitted 17.6.12 with distended abdomen, enlarged liver, no fluid thrill, and crepitation at both bases. Treated with tuberculia with improvement. On 6.9.12. child developed diphtheretic membrane on tonsils. On the 9th there were signs of widespread broncho-pneumonia. Stools frequent and very offensive.

Died 22.9.12.

P.M. Lungs: Widespread broncho-pneumonic consolidation with some large caseous areas at left base and scattered foci through both lungs thought to be tuberculous.

Pleura: Adhesions and tubercles on the right side.
Brachial Glands: No tubercle.
Spleen: No tubercles.
Intestines: Congested but no ulceration.
Peritonemia: Many scattered tubercules.
Mesenteric glands: Enlarged and adherent making up a single mass of caseating foci.

Microscopically: Pleura: Layer of fibrinous lymph on the surface with alteration to fibrous tissue in the deeper layers. Dilatation of blood vessels, and infiltration with small round cells.

Alveoli: Widespread broncho-pneumonic consolidation of varying density. In those alveoli away from the bronchioles, exudate is composed mainly of endothelial cells. In those alveoli around the bronchioles leucocytes predominate and there are also plugs of fibrin. Bands of fibrous tissue with cellular infiltration run through the section.

Bronchioles: Mucosa mostly destroyed. Cellular infiltration, and in parts definite destruction of the wall.

Blood vessels: Marked fibrosis and infiltration with small round cells.

Summary: Hard to classify. Child had undoubted tuberculosis in abdominal cavity and from presence of signs in lungs at early date and the finding of tubercles on the pleura at the autopsy she probably had some tuberculosis of the lungs.

The section however gives no evidence of tubercle. It is a severe broncho-pneumonia, with increased severity around the bronchioles. From the numbers of leucocytes it might be said that lung was going on to early abscess formation. Thus the softened areas found in the lung naked eye, may be septic not tubercular.

Probably it was death about the 16th day in a broncho-pneumonia secondary to diphtheria occurring in a tuberculous child in which the abdominal tuberculosis was advanced, and the tuberculosis of the lung mild.
Case 68. Lily Welsh (1 year 7 months).

History: Been in hospital one month ago with doubtful tuberculous enteritis. Sent to Convalescent Home and returned with pertussis.


Died 6.10.12.

P.M. Lungs: Widespread greyish patches of pneumonic consolidation. At centre of each patch is a dilated bronchus from which pus can be squeezed. (One of the cases where naked eye differentiation between broncho-pneumonia and tubercle is so difficult) Excised portions sank in water.

Trachea: Congested and some mucous pus.

Mesenteric glands: Enlarged. Not definitely tuberculous.

Other organs: Normal.

Microscopically:

Alveoli: Many indefinite cellular patches, containing numerous giant cells. No definite arrangement into tubercles, but process is certainly tuberculous in nature. Some emphysema especially near the surface. Considerable amount of ordinary broncho-pneumonic consolidation. Congestion of the alveolar capillaries, and air spaces filled with exudate consisting of leucocytes and endothelial cells.

Bronchioles: Mucosa shed entirely or in patches. Congestion of the blood vessels, and cellular infiltration of the wall. Some fibrous overgrowth.

Blood vessels: Slight fibrosis.

Summary: Death on about the 8th day of a broncho-pneumonia in an early tuberculous lung. Shows a mixture of the two conditions.

Some early fibrosis probably due to the tuberculosis.
Case 69. Harry Taylor (3 years 6 months).

History: Infective enteritis 3 weeks ago. Fever and distressed breathing for 1 week. Perspires profusely at night. Had pertussis some months ago.

Admitted 22.10.12 looking very ill, and with signs of widespread bronchitis. Spleen increased in size, oedema of legs developed. Purpura occurred over abdomen. Signs remained the same.

Died 2.11.12.

P.M. Lungs: Congested and packed throughout with greyish yellow tubercles.

Pleura: A little recent pleurisy. No tubercles.

Bronchial glands: Enlarged and extensively caseous.

Spleen: Enlarged and packed with discrete tubercles.

Kidneys: Scattered miliary tubercles in the cortex.

Mesenteric glands: Enlarged, and the majority caseous.

Other organs: Normal.

Microscopically: Pleura: None seen.

Alveoli: Most replaced by patches of caseous tuberculous material, some showing giant cells. Where alveoli are not involved their walls are strong and in some cases there is a definite fibrous overgrowth. Many contain an exudate almost entirely consisting of endothelial cells.

Bronchioles: Mucosa intact. Infiltration of walls with small round cells. Lumina blocked with pus cells.

Blood vessels: Show some cellular infiltration.

Summary: Death about 3rd or 4th week of acute tuberculosis of the lung, following on an infective enteritis.

Fibrous thickening of the alveoli probably too extensive to be the result of the tubercle, and may be due to the previous pertussis.
Case 70. Eliza Hall (1 year 11 months).

History: Always a delicate child with a chronic cough. Rapid breathing, bad colour and feverish for four days.

Admitted 22.2.13 with signs of widespread broncho-pneumonia at both bases. On the 25th confluent consolidation at right base. Child got gradually worse and signs in chest remained the same.

Died 29.3.13.

P.M. Lungs: Both congested, oedematous and showed patches of collapse. On section small caseous nodules stand out prominently. Centre yellowish, periphery grey and gelatinous. Widespread miliary tubercle.

Bronchial glands: Enlarged and congestion. Abdomen: No examination allowed.

Microscopically: Pleura: thickened. Dense infiltration with small round cells. No lymph.

Alveoli: Lung tissue replaced in parts by nodules of caseating tuberculous material. Some fibrosis around, and some giant cells seen. Elsewhere alveoli contain a broncho-pneumonic exudate of varying density. Exudate composed of endothelial cells, leucocytes, and fibrin, and in some tuberculous material seen within the air spaces. Walls of alveoli are definitely thickened and fibrous, with infiltration of small round cells.

Bronchioles: In two places the remains of a bronchial wall is seen in a tuberculous patch, suggesting that the tuberculous process had ulcerated through the bronchial wall.

Blood vessels: Slight fibrous thickening with infiltration of small round cells.

Summary: Death about the 5th week of a tuberculous of the lung with superadded ordinary broncho-pneumonic consolidation.

Caseous softening - grant cells - Definite fibrous overgrowth.
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**Name:** Charlie Woodley, 3 years.

**Date of Disease:** Sept 23

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- 98.6°F
- 101°F
- 102°F
- 103°F
- 104°F
- 105°F
- 106°F
- 107°F

**Pulse:**
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- PM: 44, 46, 46, 48, 54, 56, 56, 56, 56, 56, 56, 56

**RespH:**
- AM: 80, 82, 84, 84, 84, 84, 84, 84, 84, 84, 84, 84
- PM: 80, 82, 84, 84, 84, 84, 84, 84, 84, 84, 84, 84

**Sick:**
- B.O.: 0, 1, 1, 1, 1, 1, 1, 1, 0, 2, 0, 0
Case 71. Charles Woodlay (2 years 11 months).

History: Measles at 2 years. Pertussis at 2 years 3 months. "Severe cold" 1 month ago. Wasting, cough, and loss of appetite since.

Admitted 23.9.12 in wasted condition with signs of widespread involvement of the lung. Vesicular breathing with many moist crepitations everywhere. Ran a very hectic temperature. Developed signs of consolidation in left intercostal region. Rapidly got worse.

Died 5.10.12.

P.M. Lungs: Oedematous, congested, and showing patches of collapse. On section greyish yellow miliary tubercles stand out prominently from cut surface. Also seen under the pleura. Confluent causing caseous patches in parts.

Pleura: Tubercles on both sides.

Bronchial glands: Much enlarged (one the size of a pigeon's egg). Almost wholly caseous.

Liver: A few subperitoneal tubercles.

Spleen: Several scattered tubercles.

Kidneys: Cloudy swelling and a few tubercles.

Mesenteric glands: Enlarged, and numerous early caseous patches.

Microscopically: Pleura: Some cellular infiltration and dilatation of blood vessels in the deeper layers.

Alveoli: Patches of lung-tissue replaced by masses of caseating tuberculous material. Early fibrosis seen around these foci, and fibrous thickening spreading from here to the surrounding alveolar walls. Air spaces contain endothelial cells, leucocytes, and fibrin, with some tuberculous material.

Bronchioles: None seen.

Blood vessels: Infiltration with small round cells. Only slight fibrosis.

Summary. Death about the 6th week of an acute tuberculosis of the lung. Some ordinary catarrhal exudate seen also. Little fibrous overgrowth from the rapidity of the disease.
Case 72. Geo. Anderson (1 year 9 months).

History: Measles rash 7 days ago. Cough and distressed breathing for 2 days.

Admitted 26.10.12 with signs of widespread bronchitis. Spleen enlarged. On 1.11.12 signs of patchy consolidation at left base, and by 5th patchy consolidation very extensive. Child developed great distension of the abdomen, with frequent and offensive stools, and oedema of extremities.

Died 17.11.12.

P.M. Lungs: Scattered patches of greyish broncho-pneumonic consolidation separated by reddish congested lung tissue. A few scattered miliary tubercles, and one caseous area (size of a marble) near surface of right upper lobe.

Pleura: Adhesions on both sides. Some miliary tubercles on left parietal pleura.

Bronchial glands: Much enlarged. Some massive caseating tubercles seen on section.

Liver: Fatty. A few subperitoneal tubercles.

Spleen: Numerous miliary tubercles.

Microscopically: Pleura: None seen.

Alveoli: Patches of broncho-pneumonic consolidation separated by areas of emphysema. In parts lung tissue replaced by nodules of fibrous tissue, no giant cells, no caseation and nothing to indicate tuberculous nature. Alveolar walls thick and exudate composed mainly of endothelial cells.

Bronchioles: Mucosa shed in patches. Infiltration of wall with small round cells. Marked fibrous overgrowth around.

Blood vessels: Extreme fibrosis.

Summary: Death from acute miliary tuberculosis following on measles, probably of 5 weeks standing. There is much ordinary secondary broncho-pneumonia present, but the exudate, mainly endothelial, suggests that it is of recent origin.

Considerable fibrosis. This may be due to the tubercle, or more likely be the result of a secondary broncho pneumonia, which has resolved, the exudate seen being due to a relapse which is so frequently the immediate cause of death in a fibrotic lung.
Case 73.  Victoria Pollard (5 years).

History: Measles 2 months ago. Cough, and pain in side for 1 month.

Admitted 3.12.12 with impairment of note at both bases and many coarse râles. Ran a very irregular temperature, lost weight and signs in chest spread.

Died 8.1.13.

P.M. Lungs: Both densely packed with caseous semi-confluent tubercles.

Pleura: Adhesions on left side.

Bronchial glands: Enlarged (one the size of a hen’s egg) Caseous throughout.

Liver: Many tubercles.

Kidneys: Many tubercles.

Spleen: Packed with tubercles.


Alveoli: Large caseating patches separated by areas of emphysema. Some alveoli contain exudate mainly composed of leucocytes and fibrin. - There is no fibrous thickening of the alveolar walls.

Bronchioles: Mucosa entirely destroyed. Walls thin. No blocking of the lumina.

Blood vessels: Mild fibrous thickening.

Summary: Death from acute miliary tuberculosis following measles, and probably of about 8 - 10 weeks duration.

Caseating patches of tubercle.

Practically no fibrous overgrowth.
Case 74. John Beul (2 yrs. 9 months).

History: Pertussis 6 months ago, and chronic diarrhoea for last 4 months. Pain in abdomen and vomiting for 14 days.

Admitted 28.9.12. Insensible of surroundings, shrieking cry, distended abdomen, oedema of legs. Cerebro-spinal fluid clear and contained tubercle bacilli. Developed petechial haemorrhages all over body, had some 8 - 10 offensive stools each day.

Died 6.10.12.

P.M. Lungs: Congested and showed on section many tubercles about 1 mm. in diameter standing out prominently. Widely distributed throughout both lungs.

Bronchial glands: Normal.

Brain: Glairy exudate and many tubercles.

Intestine: Ileum contained some 20 tuberculous ulcers most numerous near ileo-caecal valve.

Mesenteric glands: Enlarged and caseous.

Liver: Fatty.

Microscopically:

Pleura: Normal

Alveoli: A few tuberculous nodules scattered through the section, one being attached to an interlobular septum. These nodules show some fibrosis with a few giant cells, one or two spots of early caseation, and marked infiltration with small round cells at the periphery. Alveoli elsewhere show much emphysema, and some congestion of capillaries in the walls. Air spaces contain a few desquamated endothelial cells, not sufficient to term an exudate.

Bronchioles: Mucosa shed in patches. Some infiltration with small round cells, and a definite fibrous overgrowth in the wall.

Blood vessels: Definite fibrosis.

Summary: Death from acute miliary tubercle probably following on the pertussis, and of 4 months duration. Terminal tubercular meningitis. A fibrous overgrowth in the lungs. This may be due to the tubercle, or be partly a remains of the pertussis.
Case 75. William Robins (5 years).

History: Wasting, increased appetite, passing a lot of water for 3 months.

Admitted 26.11.12 with diabetes melitus. Diffuse catarrh in chest, most acute left apex. Passing about 100 ozs. of urine a day with 15 grains of sugar to the oz. Signs in chest gradually became more definite and spread.

Died 25.1.13.

P.M. Lungs: Both congested and full of greyish tubercles. Left showed tuberculous abscess which had burst into the pleura.

Pleura: Thick yellow layer of fibrinous lymph over left lung. Stripped easily.

Bronchial glands: Enlarged and caseous.

Spleen: Numerous tubercles.

Kidneys: Scattered tubercles.

Liver: Scattered tubercles.

Pancreas: Normal (Microscope revealed no fibrosis and islets of Langerhaus were normal).

Microscopically: Pleura: Not seen.

Alveoli: Large patches of caseous tuberculous material showing, no giant cells, and little fibrosis. Intervening alveoli collapsed, or contain exudate of endothelial cells, leucocytes, and fibrin. Definite thickening of the alveolar wall.

Bronchioles: Muscosa completely shed, blood vessels of the wall numerous and congested.

Blood vessels: Normal.

Summary: Death from acute miliary tuberculosis complicating diabetes melitus, of about 4 or 5 months' duration.

Caseous tuberculous patches.

Fibrosis of walls of alveoli.
Case 76. Geo. Jones (1 year 5 months).

History: Vomiting, constipated and attacks of screaming for last 10 days.

Admitted 7.11.12, with shallow sighing, respiration, and facial weakness right side. Retracted abdomen. Cerebro-spinal fluid clear under increased tension and containing 52% lymphocytes in cell count. Right arm and right leg became paralysed. On the 9th large section of skull on left side removed. Tension great and miliary tubercles seen. Nothing abnormal found in lungs before death.

Died 9.11.12.

P.M. Lungs: Both lower lobes congested oedematous, and collapsed. Scattered greyish tubercles (size of pin's head) seen on outer surface of left upper lobe, and some isolated ones in the substance of both lungs.

Pleura: Adhesions on left side.

Bronchial glands: Two enlarged and showed caseous foci on section.

Meninges: Exudate and tubercles in interpeduncular space and along the sulci.

Brain: Vessels infected. Ventricles not dilated.

Liver: Fatty.

Spleen: Tubercles on the substance.

Intestines and mesenteric glands: No evidence of tuberculous.

Microscopically: Pleura: None seen.

Alveoli: Lung tissue replaced in parts by tuberculous foci in which fibrosis is occurring and epithelioid and giant cells can be distinguished. Some infiltration with small round cells, but no softening. Elsewhere the alveoli show marked emphysema, and in parts congestion of capillaries of wall, and a definite thickening.

Bronchioles: A little swelling of the cells of the mucosa.

Blood vessels: Normal.

Summary: Death from tuberculous meningitis probably secondary to miliary tubercle of the lungs.

Lesions in lung present some time (from fibrosis and giant cell formation) and there is some fibrosis of the alveolar walls resulting.
Case 77. Alice Limmer (6 years).

History: Wasting, cough, and pain in chest for 6 months. Poor appetite, and night sweats.

Admitted 26.11.12 with signs of widespread pulmonary tuberculosis. Extremely emaciated, colour bad and in great distress.

Died 27.11.12.

P.M. Lungs: Numerous tuberculous foci in both lungs. (Vary in size from pin's head to a pea). Some fibrolic change.

Pleura: Tight adhesions on both sides.

Bronchial Glands: Enlarged and congested. One showed a caseous-calcareous nodule.

Liver: Fatty.

Heart: Fatty.

Intestines: Numerous tuberculous ulcers (Smear showed T.B.) Some subperitoneal tubercles.

Microscopically: Pleura: None seen.

Alveoli: Nodules of fibrous tissue connected by fibrous bands and separated by areas of emphysema and collapse. The nodules show fibrous tissue arranged in rings, and oedematous and loose in the centre. A few show giant cells. In some air spaces there is an exudate of serum and desquamated endothelial cells.

Bronchioles: Mucosa entirely destroyed. Infiltration of wall with small round cells. One shows almost complete destruction of wall.

Blood vessels: No fibrosis. One has lumen filled with loose connective tissue and some cells (organising clot).

Summary: Death from tuberculosis of the lung probably of some 6 months' standing.

Excess of fibrous tissue everywhere.
Case 78. John Driscoll (5 years).

History: Child in hospital from 22.2.12 to 25.4.12 suffering from pericarditis with effusion. Also had pleura effusion thought to be tuberculcous.

Re-admitted 16.5.12 with signs of tuberculcous at left apex at a distended abdomen from which two pints of fluid were withdrawn. Lung condition remained stationary but abdomen filled up again and again. Paracentesis abdominis done on 6.9.12 and tubercles seen on gut and amentum. Parietal drain established. Wound leaked, and then suppurated.

Died 14.9.12.

P.M. Lungs: Left lung showed an area of caseous tuberculcous broncho-pneumonia in middle third of upper lobe with small tubercles at the periphery. Right lung congested and cedematous.

Heart: Hypertrophied, dilated and thickened adherent pericardium.

Bronchial Glands: The one at the bifurcation of the trachea showed tuberculosis.

Spleen: A few subperitoneal tubercles.

Intestines: A few definite tuberculcous ulcers. Many Peyers patches superficially eroded.

Peritoneum: A few tubercles. No evidence of a supplicative peritonitis


Alveoli: Many fibrous tuberculcous nodules with small round celled infiltration replacing lung tissue. Some giant cells seen. In between nodules are patches of emphysema. A few alveoli contain desquamated endothelial cells.

Bronchioles: Mucosa intact. Dilatation of blood vessels in the wall and blocking of lumina with cast off cells.

Blood vessels: Some thickening of the walls of the larger blood vessels.

Summary: Death from general tuberculosis. Lung shows chronic condition with acute terminal spread. Tubercles seen in section are fibrous and show giant cells. No caseation at this part. Some fibrosis best seen in the blood vessels.
APPENDIX B.

SUMMARY OF LITERATURE.
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Though much has been written upon pneumonia in children the frequent classing of primary broncho-pneumonia with secondary broncho-pneumonia makes a comparison of the results of my series with the results of other writers difficult.

Still, I intend to give very briefly the results of some who have worked upon the subject.

1. The frequency of lobar pneumonia in childhood.
   Vere Pearson found 41% of all pneumonia
   Rivière. " 25% " " "
   Holt. " 25% " " "
   This series gave 38% " " "

2. The age at which lobar pneumonia is most frequent.
   Vere Pearson. "in infancy".
   Morse. "under 2".
   Clive Rivière. "in 2nd year".
   Bertram Abrahams. "from 2 upwards".
   Ashby. "from 2 upwards".
   Morril. "from 4-7".
   Holt. "at 5th year".
   This series gave from 1 - 3.
3. **The previous history**

   **In lobar pneumonia**
   
   Holt 82% healthy (500 cases)
   
   This series 78.5% healthy.
   
   **In broncho-pneumonia (279 cases)**
   
   Holt.  
   - Measles 32%
   - Pertussis 23.5%
   - Diphtheria 17%
   - Antecedent Bronchitis 14.5%
   - Infective Enteritis 6.5%
   - Scarlet fever 2.5%
   - Influenza 2%
   - Chicken Pox 1%
   - Erysipelas 1%

4. **Site affected.**

   **In lobar pneumonia**
   
   Dunlop: "left base most frequently".
   Holt: "right base 45.5%"  
   left base 41.5%  
   both bases 13%"  
   This series "right base 39%"  
   left base 31%  
   both bases 8%  
   apices 22%"

   **In broncho-pneumonia**
   
   Dunlop: "both bases in 54%"  
   Holt: "extensive in 82%"  
   This series ("both bases in 53% of primary  
   (" " " 70% of secondary"

5. **Duration of disease.**

   **In lobar pneumonia**
   
   Dunlop: "7 days"  
   This series "7 days".

   **In primary broncho-pneumonia.**
   
   Dunlop: "11 days or death on 12th day".
   This series "12 days".
In secondary broncho-pneumonia.

Dunlop: "23 days"  
This series: "18 days".

6. Mortality:

In lobar pneumonia

Holt: 4%  
This series: 6.1%

In primary broncho-pneumonia

Holt: 49%  
This series: 50%

In secondary broncho-pneumonia

Holt: 25%  
Pepper: 30-50%  
Keating: 65%  
Holt: 65%  
Morse: 75%  
This series: 68.4%

Mortality dependent upon preceding disease.

Holt:  
This series:  
Measles 62.9% 58%  
Antecedent Bronchitis 65.3% 75%  
Pertussis 81.8% 78%  
Infective Enteritis 94.7% 100%  
Diphtheria 100% 100%  
Scarlet fever 100% -  
Influenza 16.6% -  
Chicken pox 100% -  
Erysipelas 100% 100%

7. Bacteriology:

Lister: "never failed to find the pneumococcus. In prolonged cases" (i.e. probably in secondary broncho-pneumonias) "there is mixed infection".

Holt: "pneumococcus alone in lobar pneumonia and primary broncho-pneumonia".

"Mixed infection in secondary broncho-pneumonia, the commonest organisms being streptococcus, staphylococcus, bacillus of Friedlander, and
the special organisms of the primary disease, viz. bacillus diphtherial, bacillus influenza, and bacillus tuberculosis.

8. Lumbar Puncture in pneumonia in children.

Voisin and Nobecourt examined cerebro-spinal fluid in 24 cases with nervous symptoms.

Fluid usually abundant.

In 8 cases contained albumen.

In one half there were no cells.

In one half there was a mixture of polymorphs and lymphocytes.

In two cases contained pneumococci.
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