

**EPIDEMIC PNEUMONIA. With special
reference to an outbreak occurring
in the Boys' Protestant Industrial
School, Leith.**

THESIS

by

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October, 1905

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P N E U M O N I A

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Osler (1), in the latest edition of his "Principles and Practice of Medicine" (1905), thus defines pneumonia:- "An infectious disease characterised by inflammation of the lungs, toxæmia of varying intensity, and a fever that terminates abruptly by crisis: secondary infective processes are common: the micrococcus lanceolatus of Fränkel is present in a large proportion of the cases."

As a disease, pneumonia has been gradually growing in importance, till now it claims even more victims than tuberculosis, and has earned for itself the title, once applied to that disease, of "Captain of the Men of Death".

According to Dr. Hector McKenzie, out of 30 millions of people, 200,000 are each year affected with pneumonia, and of these 32,000 die annually from its ravages.

Dr. Reynolds, comparing the number of cases of pneumonia with those of tuberculosis during the last twenty years for the whole of the United States, says

that, during that time, the deaths from tuberculosis have decreased by 20.7%, while those from pneumonia have increased by 7.4%.

Taking Chicago alone, in 1860 there were from tuberculosis 25 deaths in every thousand of the population, while in 1900 there were only 15 deaths per thousand of the population from this cause.

But from pneumonia, while in 1860 there were 4.40 deaths per thousand of the population, in 1900 this number had increased to 10.

As in the past we have attacked tuberculosis and have already reduced the death rate from phthisis by exactly one half, is it not time to set ourselves to combat this increasingly grave disease, and may we not go forward with the hope that pneumonia, at least in epidemic form, will at no distant date be quite wiped out? Already in America steps are being taken against it, on the same lines as against tuberculosis.

Dr. Darlington, Health Commissioner of New York, has issued a circular of instruction to indicate preventive measures for opposing the spread of pneumonia and other infectious diseases.

Reynolds of Chicago considers it a highly contagious disease, due to inhalation of its germ. He

advises that great care should be taken of the sputum, as in tuberculosis: that the patients room should be carefully cleaned and ventilated: that houses should be better ventilated, especially in winter when there is more crowding: that laymen are to be taught cleanliness, and the young and the aged are to be carefully guarded.

He writes in his Bulletin (6) dated November 1903: "Pneumonia is a disease of civilization; it is begotten of overhousing, overcrowding, overclothing, over-eating and drinking, overcoddling - all the hygienic defects of civilized life which make for the weakening of vital resistance."

Anders has compiled a table which shows that pneumonia is more or less limited to centres, and those correspond in the main to the most densely populated areas, with their allied conditions of squalor and poverty. He is convinced of the necessity of isolating our cases of tonsillitis, bronchitis and pneumonia, and of nursing them after the manner of a contagious disease.

In Chicago the disease has, I believe, been made notifiable, and in New York a commission has been appointed, to enquire into the subject.

PNEUMONIA was recognised in the early days both

by Hippocrates and Galen. Morgagni identified the clinical features of the disease with solidification of the lungs. Laennec, Cruveilhier and Rokitansky completely described its pathological anatomy, separating it from pleurisy with which it had been confused; and its diagnosis by auscultation was one of the most important results of Laennec's great discovery. Addison proved that the exudation took place into the air vesicles, not into the interstices of the lung, and Rokitansky described the fibrinous character of this exudation, and gave to the disease the specific term "croupous", as opposed to the catarrhal or lobular form. More recently Bennett wrote his classical work on pneumonia, and sought to influence physicians against the blood-letting treatment, which had been reintroduced by Sydenham and was then in vogue. After his time the introduction of the thermometer further aided our knowledge in giving the characteristic temperature curve of the disease.

In 1882 Friedländer discovered an oval-encapsuled micro-organism in the rusty sputum of pneumonic patients, and in 1883-5 Talamon, Klein and Sternberg found a lanceolate organism, and their researches were confirmed by Fränkel and Weichselbaum, the former of whom has given his name to the most characteristic

organism of the disease. the pneumococcus of Fränkel.

From the older idea of a disease localised in the lung, explained by Wilson Fox in Reynold's "System of Medicine" (18), as an inflammation of its vesicular structure, we have passed to the conception of a specific fever, often infectious, with protean manifestations, it may be a lung consolidation, an empyema, or a peritonitis, it may be only a bronchial catarrh, or even a slight sore-throat.

Opinion has been educated slowly. and the difficulty of finding a position for pneumonia among the classified diseases was well exemplified by Sturges, who said: "It is both a local inflammation and a "special form of fever. For a full recognition (he would not say for its essential existence) lung inflammation is necessary, but the presence of such by "no means secures the presence of pneumonia. Its "position of isolation is further secured in that the "lung itself does not actively participate in the "changes that occur within it, and therefore the "pneumonic process is in fact special and sui generis."

Bacteriology has greatly aided us in our conception of pneumonia as a systemic disease. Rosenow, Baduel and Gargano have found that an invasion of the blood stream by the pneumococcus, takes place in all

cases of pneumonia, and that with more efficient methods of culture and taking larger quantities of blood, the organism can be recovered in every case. We are not to take this phenomenon as a specially grave sign, as some have done, but as an ordinary feature of the disease. One of the most striking examples of the invasion of the system by the diplococcus is reported by Spitta, M.D., D.P.H. (16) in the B.M.J. November 15th 1902. It is that of a child aged 17 months who took pneumonia; five days after the crisis she had an inflammatory exudation into the left elbow-joint, six days later an empyema. In the sputum, the exudation from the joint, the pus from the pleura, as well as in the cerebro-spinal fluid and the blood, the diplococcus pneumoniae was found. Death took place seven weeks after the onset of the pneumonia, and again the pneumococcus was found in the fluid squeezed from the lungs, and in the elbow joint.

In the New York Medical Journal 1904, Willson speaks thus strongly of pneumonia:- "In spite of "modern teaching with regard to the acute infectious "form of the disease, the old idea seems still to dominate the minds of the profession as well as of the "laity that pneumonia is an inflammation of the lungs "due to exposure to cold and wet, and that it occurs

"except in rare instances, in damp and cold weather,
"also that in different cases recovery or death occurs
"without reference to one another. It is an infection
"of the general system in which the lungs primarily
"suffer. The fatality in pneumonia is not due to involvement of the lungs so much as to the general systemic infection and to the crippled cardiac action, which may finally give way altogether. It is one of the contagious diseases."

As to the infectious character of pneumonia, that has been coming more and more into prominence. For many years outbreaks of pneumonia in epidemic form have been reported, but the difficulty in dealing with these is that often some other form of disease such as influenza or enteric fever has been present, and one cannot say therefore whether these epidemics have been primary, or only secondary to the other diseases.

Hirsch, however, gives a record of 187 outbreaks in which the pulmonary inflammation is primary, and which can be explained by no known etiological factors. These occurred from the 16th to the 19th centuries, in Italy, France and in North America. Only six are assigned to the British Isles.

In Switzerland an epidemic form of pneumonia occurs at the time of the melting of the snow and ice

masses of the Alps, and is called the "Alpenstich".

As early as 1877 the anatomical lesions of a severe type of infectious pneumonia occurring in Florence are given by Banti. The main features of the morbid anatomy of these cases were a dark colour and fluidity of the blood, fatty degeneration of the cardiac muscle, swelling and softening of the spleen.

In his "Collective Records", Professor Humphrey (17) classifies the outbreaks of pneumonia thus:-
(a) "epidemic" or presumably one cause affecting many people at the same time: (b) "pythogenic", or due to sewer gas: (c) "infectious", where the disease can be distinctly traced from one to another.

Dr. Finlayson records an interesting localised outbreak which occurred in 1879.

An old lady resided at Garelochhead with her daughter. In the spring of the year she invited her married daughter, Mrs. C., and her four children to stay with her - these arrived on 10th April.

On 30th April the eldest child took ill with feverish cold and a little coryza. On the sixth day there was dulness and faint tubular breathing over the lung, and the same day the crisis occurred. There was some enlargement of liver and spleen, and the child recovered completely.

On 5th May two of the other children and the grandmother became ill. The latter had signs of pleuro-pneumonia at the left base, and some left otitis media. Progress was slow but satisfactory. In the two children the disease was short and sharp, lasting four or five days. There were no signs of consolidation, but there was double otitis media in one case, and earache and deafness in both. Vomiting was a marked feature at the outset.

The mother, Mrs. C., had accompanied her children to Garelochhead on 10th April. She was however in Glasgow from the 16th to the 23rd April; but returned to the house of the grandmother, and took her children back to town on the 8th of May. She herself felt well, though perhaps slightly run down.

Suddenly on the evening of 10th May, she became sick and vomited, complained of violent headache and pains in the back, had a high temperature and delirium. On 16th May, slight dulness was made out over the upper lobe of the right lung, both in front and behind, which became more marked two days later, but there was no tubular breathing. Earache in the right ear was also complained of. On 19th May she died.

At the post mortem examination, typical grey hepatisation was found in the upper lobe of the right

lung, which had a coating of recent lymph, and there were some soft adhesions.

No further illness occurred in the same house, and the successive inmates have remained healthy. There were no other cases in Garelochhead at the time to throw light on this epidemic.

Three other cases occurring in a Roman Catholic family in Leith may also prove of interest.

The first was that of a girl of about six years, who was admitted to Hospital with peritonitis. She died and the diplococcus was found in the peritoneal pus.

Shortly afterwards her brother, aged four years, was admitted with empyema, and the same organism was found in the pus: after operation, he recovered.

At the same time the baby, aged about ten months, was suffering from a bronchial catarrh, which in all probability was also due to the pneumococcus.

The study of the bacteriology of pneumonia teaches us that not all pneumonias are due to the same organism, though the diplococcus is most usually the cause. Some, as the Middlesborough epidemic (10), are due to Klien's bacillus, and some to the pneumo-bacillus of Friedlander. The epidemic coming under my own notice was due in all probability to the diplococcus, and an account of it is given below.



Boys' School.

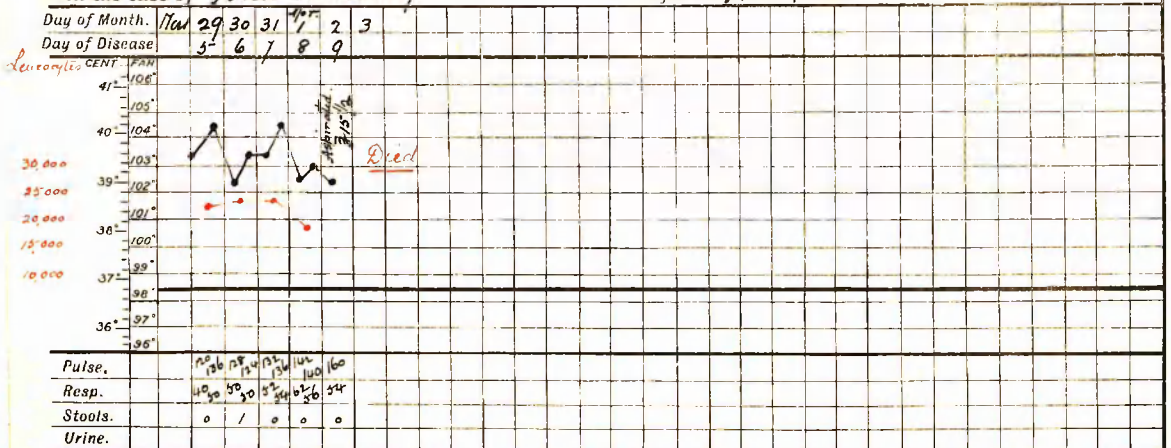
Right Apical and Middle Lobar Pneumonia R. Empyema, Purulent Pericarditis, Death

Records of Temperature, Pulse, Respiration, Stools and Urine, from 29th Day of March

1902

In the case of *John McKinley*

Aged 16 yrs Occupation



LEITH INDUSTRIAL SCHOOL EPIDEMIC

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1. On the 29th of March 1902, there was admitted to Leith Hospital from the Protestant Industrial School for Boys, John McKinley aet. 16 years. Four days previously, the 25th March, he had shivered and complained of severe pain in the right side of his chest. On the 26th March, the pain became worse, and he had a short dry cough. On the 28th, he began to expectorate thick tenaceous mucus. As he had not slept since the beginning of his illness and was getting worse, the visiting doctor sent him to Hospital. On admission it was seen that he was a boy of poor physique, narrow chested, and growing fast. The family history showed the mother had died of consumption. On examination on the fifth day of illness, he was slightly cyanosed, temperature 103.2° , pulse 120, of low tension, respirations 40. He still complained of pain over the lower lobe of the right lung, had a short cough and a tenaceous rusty expectoration. The physical signs pointed to consolidation of the lower lobe of the right lung. Restlessness and cyanosis increased, the temperature rose to 104.4° , the

leucocytes numbered 23,000 per cubic millimetre. On 1st April, the eighth day of illness, the right pleural cavity was aspirated and $13\frac{1}{2}$ oz. of fluid withdrawn, of which the first ounce was almost pure pus, the rest was clear fluid. Shortly afterwards he sank, the pulse numbered 160, was very soft and dicrotic; and early on 2nd April, the ninth day of illness, he died.

POST MORTEM REPORT, 2nd April

The right pleural cavity contains about $1\frac{1}{2}$ oz. of purulent fluid. Recent lymph is adherent to the surface of the pleura.

Right Lung. The upper and middle lobes are in an advanced stage of red hepatisation; the lower lobe is congested. The left pleural cavity is normal.

Left Lung is congested, but crepitant throughout.

Pericardial Sac contains about $1\frac{1}{2}$ oz. of purulent fluid. Recent lymph is adherent to the pericardial surfaces. There are numerous petechial haemorrhages into the pericardium.

Heart. Antemortem clot is present in the right ventricle, extending into, but not adherent to the pulmonary artery.

Spleen contains recent red infarcts numerous and large.

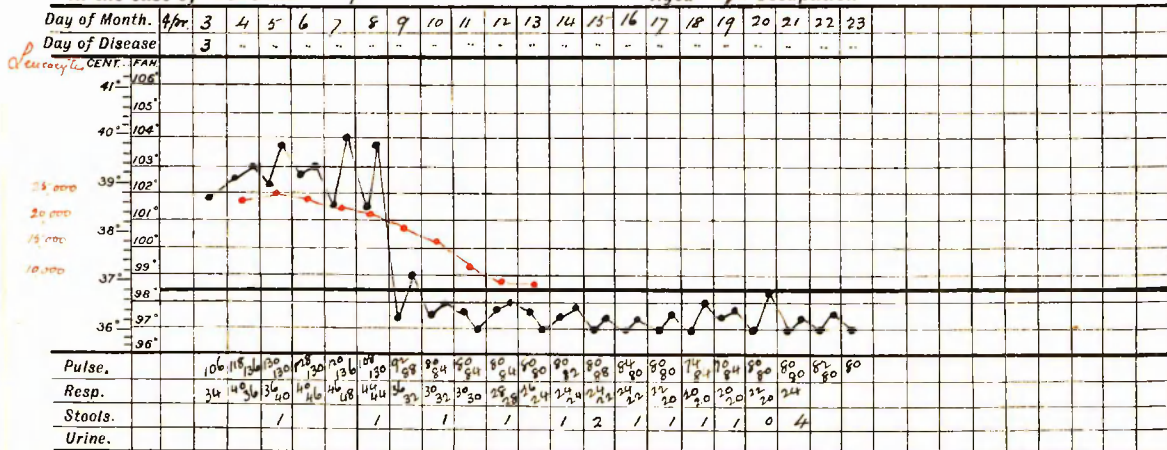
Liver is in a condition of cloudy swelling.

2.

Right Basal Pneumonia. Recovery

Records of Temperature, Pulse, Respiration, Stools and Urine, from 3rd Day of April
In the case of Robert Eagle Aged 15^{yr} Occupation

1902



BACTERIOLOGICAL EXAMINATION

Films from (a) pericardial pus contain many ^eGram positive cocci, mostly in pairs, and of well marked lancet shape: a few of the cocci are in short chains.

From (b) Heart-blood - no bacteria visible.

From (c) Splenic pulp, a moderate number of round cocci in pairs or short chains of six to eight members, one or two short bacilli.

From (d) Purulent fluid from right pleural cavity, many ^eGram positive cocci mostly of definite lancet shape, and in pairs. A few arranged in chains of not more than eight members.

Cultures (a) from purulent fluid in right pleura - a pure culture of diplococcus pneumoniae in abundance. The colonies on agar, small "dew-drop" colonies consisting of ^eGram positive oval cocci. Bouillon sub-culture was rendered diffusely turbid, and there was no growth in gelatine slab sub cultures.

(b) From pericardial pus. Scanty growth of colonies of diplococcus pneumoniae in pure culture.

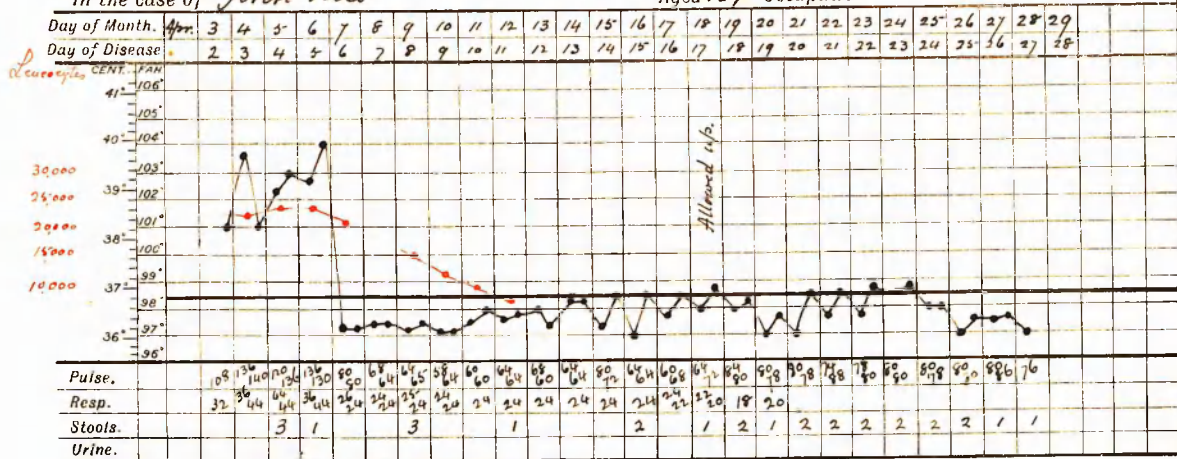
2. On 3rd April, five days later, two patients were admitted to Hospital from the Industrial School. The one Robert Eagle, aet. 15 years, had felt sick and had vomited three days previously, i.e. 31st March.

Bronchial Catarrh. Recovery.

1802

In the case of John Ross

Aged 12 yrs Occupation



YOUNG, J. SPENTLAND, PUBLISHER, EDINBURGH & LONDON.

Diagnosis

Leguminosae

As we move

May 29/22

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11

11

4.

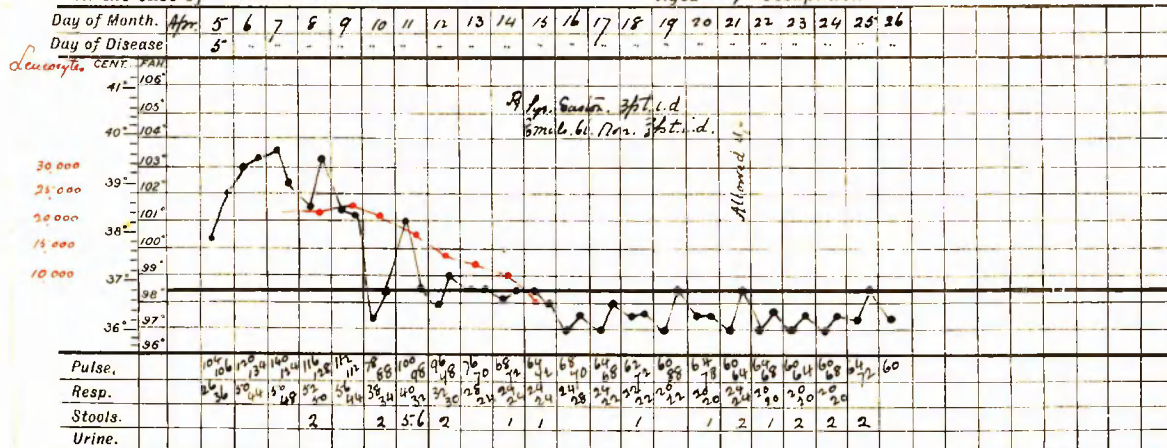
Bronchial Catarrh. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 5th Day of April

1902

In the case of William MacCoven

Aged 15 1/2 Occupation



YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Distance

Lyonesse

Lyones

...

On 1st April he had been seized with severe pain in the right side of the chest and back. The same day he developed a short cough and a reddish sputum.

3. The other John Ross, aet. 12 years, had shivered and vomited the day before admission, i.e. 2nd April. On the 3rd, he began to suffer from pain in the right axillary region, and to expectorate thick mucus streaked with blood. Herpes appeared on the lips and nose, more marked on the right side. On admission both boys looked ill. Temperature 101° - 102° , pulse 106, respirations 34. Both had furred tongue, but took nourishment well. The physical signs in the case of Robert Eagle were definite, and consisted of dulness and tubular breathing over the whole lower lobe of the right lung, with expectoration of the prune-juice type. In the case of John Ross, the physical signs were indefinite, and the expectoration streaked with blood. The temperature in the former case after reaching 104° , fell to normal on the evening of the eighth day; in the latter it fell on the 5th day. In neither did it rise again, and in both convalescence was uninterrupted. The leucocytes became normal on the 13th and 11th days of illness respectively.

4. On the 5th of April, two days later, there was admitted another boy from the School, William Macewen

5.

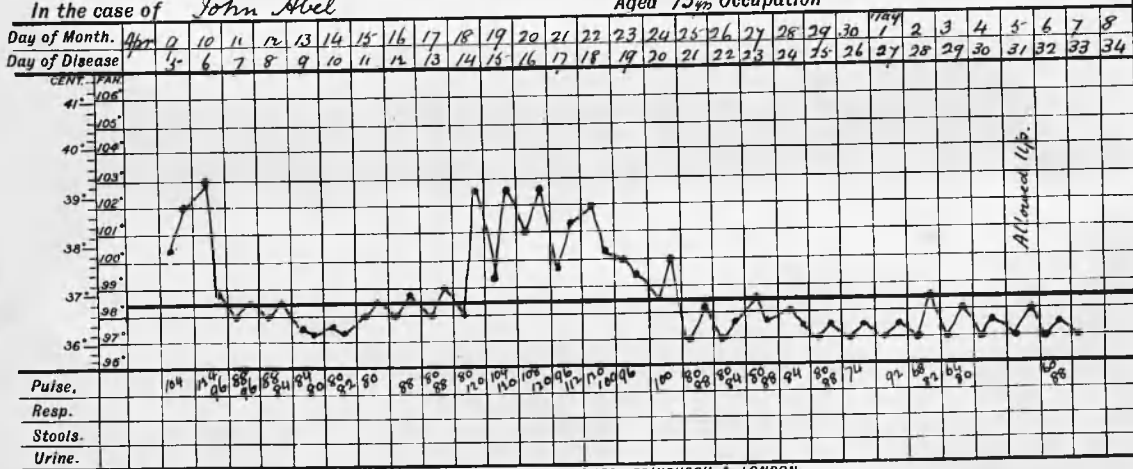
Double Basal Pneumonia. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 9th Day of April

1902

In the case of John Abel

Aged 15^m Occupation



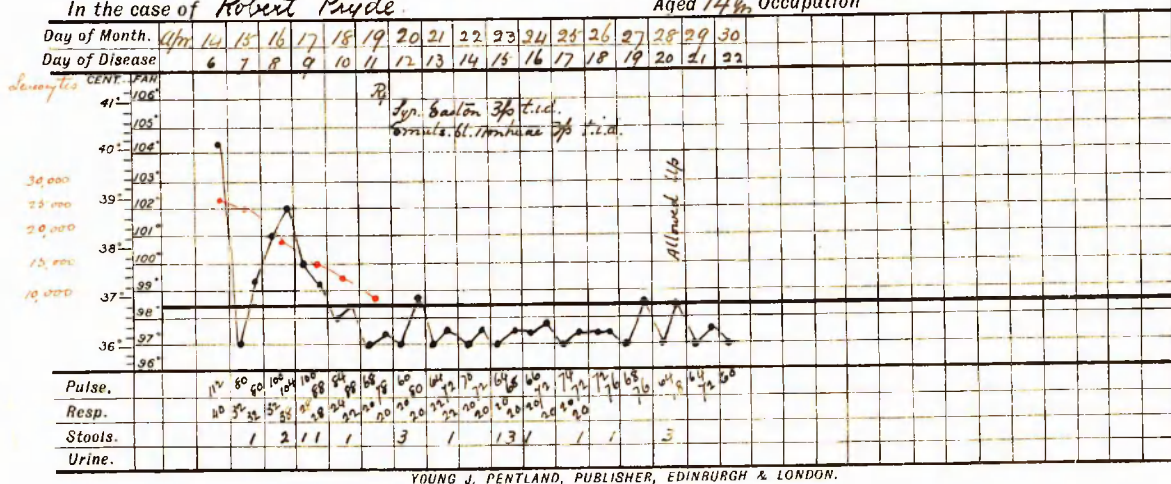
YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

aet. 15 years. Four days previously he had had a rigor and vomited once. The following day he began to suffer from a short cough. On admission he had flushed face, herpes on both sides of the lips and the right cheek. His tongue was furred, temperature 102° , pulse 110, respirations 48. There was short cough, with rusty tenaceous expectoration, but no definite physical signs in the chest. The temperature fell to normal on the ninth day of illness: it rose again to 101° on the 11th, but after that became normal. and convalescence was uninterrupted.

5. On the 9th April, four days later, John Abel, aet. 15 years, also an Industrial Schoolboy, was admitted. His illness had started four days previously with pain in the right side of the chest. On admission he had signs of consolidation - dulness and tubular breathing - over the lower lobe of the right lung. On the morning of the sixth day of illness, the temperature was 103° , but the same evening he had a crisis, the temperature fell. and remained normal for eight days. A patch of pneumonia then appeared at the base of the left lung, with recrudescence of temperature for seven days: after which convalescence was interrupted.

Left Basal Pneumonia. Recovery.

1902

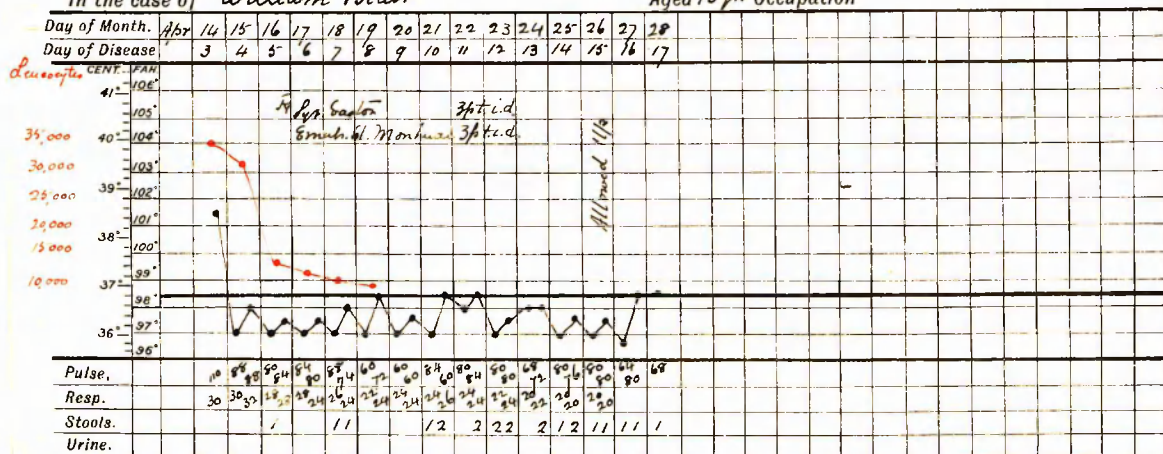


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7.

Left Basal Pneumonia. Recovery.

1902



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6. Five days later, on 14th April, two boys were admitted from the School, Robert Pryde and William
7. Blair, aet. 14 and 10 years respectively. Pryde's illness had begun five days previously with vomiting and pain in the left side of the chest just below the nipple. Blair had had a rigor two days previously, and also complained of pain in the left side of the chest, worse on breathing deeply or on coughing. His temperature on admission was 101.4° , pulse 110, respirations 30. He had slight dulness over the lower lobe of the left lung, and sonorous ronchi were heard on auscultation over the dull area. The same evening, the third of the illness, he had a crisis, the temperature coming down and remaining subnormal till his discharge, twelve days later, The leucocytes did not fall to the normal number till the seventh day of illness, or four days after the crisis. Pryde's illness was of a more severe type. On admission his temperature was 104.2° , pulse 112, respirations 40. There were signs of consolidation over a small area of lung covered by the left scapula, but no expectoration. The same evening, the sixth of his illness, the temperature fell to subnormal, but on the eighth day it had again reached 102° . It fell again to normal on the 10th day. The leucocytes did not reach the average number till the eleventh day. Convalescence was

Right Apical Pneumonia. Empyema. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 28th Day of April

In the case of James Hislop

Aged 94m Occupation

In the case of <u>James Aslop</u>		Aged <u>9 1/2</u> Occupation	
Day of Month.	<u>Apr 28</u>	<u>29</u>	<u>30</u>
Day of Disease	<u>2</u>	<u>3</u>	<u>4</u>
Pulse.	132	140	140
Resp.	36	40	44
Stools.			
Urine.			

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Right Apical Pneumonia. Empyema. Recovery

Records of Temperature, Pulse, Respiration, Stools and Urine, from 28th Day of May

1802

in the case of James Hislop (continued)

Aged 94m. Occupation

[illegible]

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uninterrupted.

There now occurred an interval of fourteen days, and it was hoped that the epidemic had ceased.

8. On the 28th of April, however, another Industrial Schoolboy, James Hislop, aet. 9 years, was admitted to Hospital, having on the previous day vomited and complained of pain in the right side of the chest in front. On admission he had a short cough, scanty expectoration, and signs of a small patch of pneumonia at the right nipple, with pleuritic friction over it. His temperature, which was 102.6° on admission, fell to normal the same night, but rose to 103° the following day, and remained at that level for a week. During the following week the temperature was somewhat lower, and on the thirteenth day of illness it reached normal. The leucocytes, however, had kept during this time at about 20,000 per cubic millimetre, and on the fourteenth day of illness, the aspirating needle was inserted over the dull area in the second right interspace, and some thin greenish pus withdrawn. A second aspiration on the 29th day of illness gave no result, but as the temperature had assumed a hectic character, the needle was inserted for the third time, on the 34th day, the $1\frac{1}{2}$ oz. of greenish pus withdrawn. Resection of the fourth rib was performed on the 36th

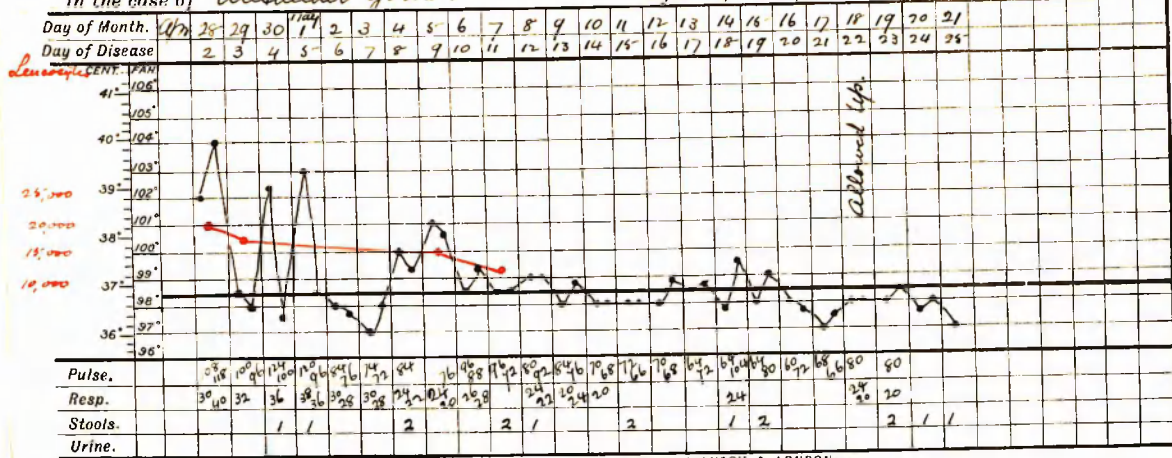
9.

Bronchial Catarrh. Recovery.Records of Temperature, Pulse, Respiration, Stools and Urine, from 28th Day of April

1902

In the case of Alexander Gordon

Aged 13 1/2 Occupation



YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

day and $2\frac{1}{2}$ oz. of pus, and a pus clot evacuated. After this, recovery was uninterrupted, the patient being sent to the country after an illness of fully two months' duration. In the first sample of pus submitted to bacteriological examination, many cocci were found. all extracellular, all ~~g~~^gram positive diplococci. Some were lancet-shaped, others oval, others rounded in form. Also many small round ~~g~~^gram negative bodies were found, possibly cocci, possibly degenerated fragments of pus cells. The culture on agar resulted in a pure growth of a bacillus of the coli group, which did not ferment glucose. In the second sample of pus. cultures on serum-agar showed a pure culture of diplococcus pneumoniae.

9. On the same day as the last case, namely 28th April, another boy from the Industrial School was admitted, namely Alexander Gordon, aet. 13 years. He also had taken ill the day previously with rigor, vomiting and pain in the right side of the chest. The physical signs were indefinite, but the temperature, which had reached 104° on the evening of admission, became normal on the following day, the third of the illness. It rose again, however, and oscillated between 103° and normal until the tenth day, after which it remained normal. The leucocytes had not quite

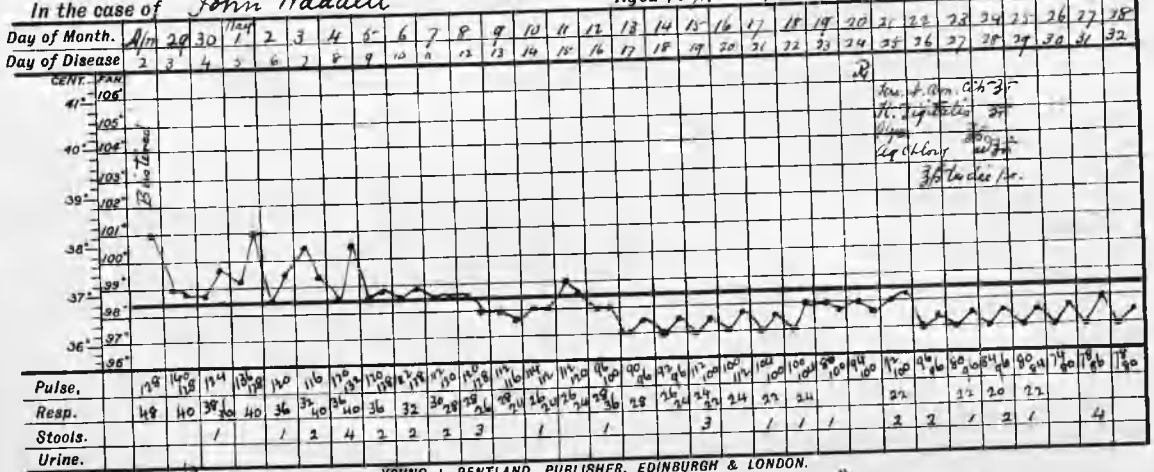
Left Basal Pleuropneumonia. Pericarditis. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 29th Day of April 1902

1902

In the case of John Waddell

Aged 10⁴7, Occupation



come down to their average number on the eleventh day, the last on which a blood count was made. After the tenth day, convalescence was uninterrupted.

10. Also on the 28th April, John Waddell aet. 10 years, was admitted from the School with dyspnoea and praecordial pain. Temperature was 101° . The illness had begun the day previously with rigor and vomiting, and he complained of breathlessness and pain over the praecordium. On admission he was found to have recent pericarditis and pleurisy at the base of the left lung. There was evidence of old endocarditis. The temperature came down to normal on the third day of illness, but oscillated between 101° and normal till the ninth day, after which it remained normal or sub-normal. He was discharged convalescent on the forty-sixth day.

After this came an interval of fifteen days, during which time search was made as to the probable cause of the epidemic. The school was disinfected, Dr. Robertson, the Medical Officer of Health for Leith, himself inspecting the School, and the food stores altered, in the hope of destroying the specific cause. Four more cases, however, occurred towards the end of May, after which the epidemic ceased.

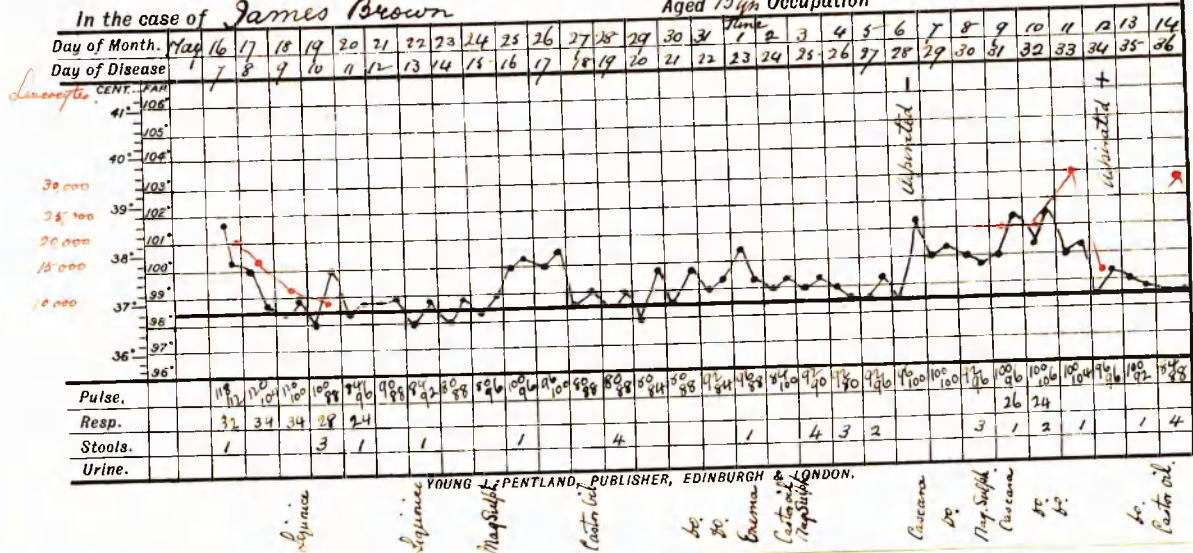
Left Basal Pneumonia Empyema. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 16th Day of May

1902

In the case of James Brown

Aged 15^{yr} Occupation



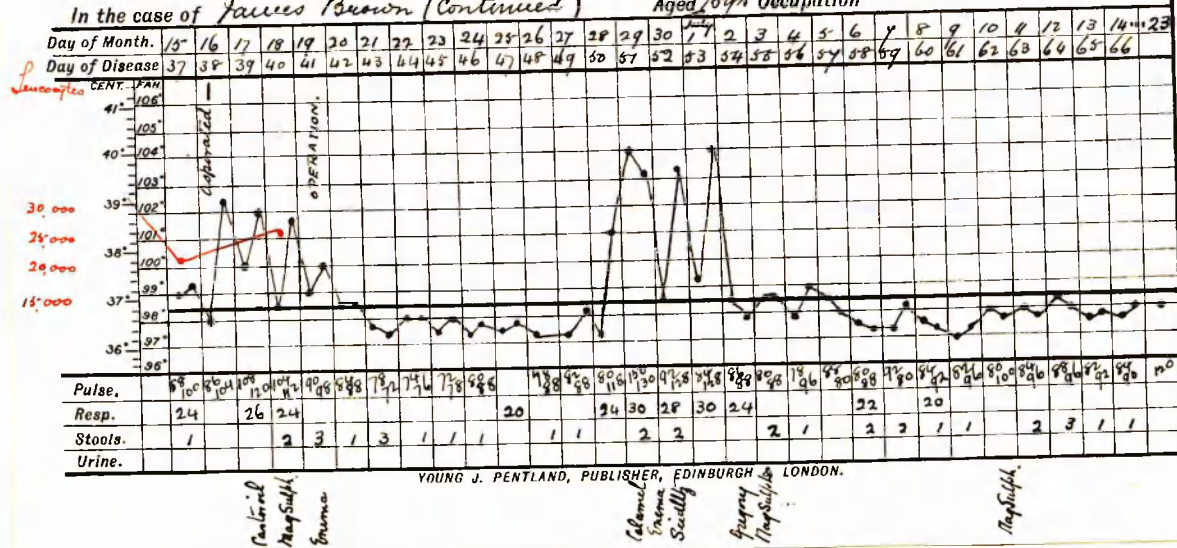
Left Basal Pneumonia. Empyema. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 15th Day of June

1902

In the case of James Brown (Continued)

Aged 16 yrs Occupation



11. On the 16th May, James Brown, aet. 15 years, was admitted from School to Hospital. His illness had started seven days previously with sickness, vomiting, and pain over the lower lobe of the left lung. As he had improved on the fifth and sixth days of illness, he had been allowed up. The day before admission, however, the pain had increased in severity, and he was sent to Hospital. There had been no cough. On admission temperature was 101.8° , and there were signs of consolidation at the base of the left lung, with possibly a small amount of fluid in the left pleural cavity. His temperature became normal on the eighth day of illness, and the leucocytes which had reached 20,000 in number, came down to the average number on the tenth day of illness. From the eleventh to the fifteenth day the temperature remained normal, but rose to 100° during the sixteenth and seventeenth days, falling again on the two succeeding. As it fluctuated, however, between 99° and 100° from the twentieth to twenty-eighth, the left pleural cavity was explored with a negative result. The temperature now began to fluctuate, reaching 101.2° on several occasions, and the leucocytes now numbered 25,000 per cubic millimetre. On the thirty-fourth day of illness an aspirating needle was again inserted at the angle of the left

scapula, and 2 oz. of pus withdrawn. This contained diplococci. The temperature remained normal for three days after aspiration, and on the thirty-eighth day of illness the needle was again inserted, this time with a negative result. As the temperature, however, became hectic in type, he was transferred to the Surgical Ward, where, on the forty-first day of illness, a resection of part of the seventh rib on the left side was performed. A very small quantity of pus was found in the left pleural cavity, but the superjacent tissues had become infiltrated with pus, presumably from the previous aspiration. Convalescence was uninterrupted except for a rise of temperature lasting three days, due to some inflammatory reaction round the wound. The patient was discharged well on the seventieth day. A culture made from the pus obtained from the pleural cavity, resulted in a pure culture of the *diplococcus pneumoniae*.

12. The next case was admitted one week later, namely on 23rd May. It was that of James Boyne, aet. 16 years. He had been at his usual work in the Industrial School till six o'clock on the previous evening, 22nd May. At night he had a rigor. On the morning of the 23rd he complained of giddiness and pain in the back of his head. He was delirious and vomited at intervals.

Temperature 103° . About 6.30 p.m. he became unconscious and was brought to Hospital. On enquiry, the patient was said to enjoy fair health, but to suffer from frequent attacks of cold in the head. On admission he was unconscious, but very restless, rolling his head from side to side on the pillow. The face became alternately pale and flushed. The pupils were dilated and equal, the abdomen retracted, the reflexes normal. There was no aural discharge. Pulse 80. Temperature 104° , respirations 40. Shortly after admission he vomited two ounces of greenish fluid. The examination of the chest was negative. He died at 11 p.m. the same evening.

POST MORTEM REPORT, 26th May

Head. Dura is tense. There is well marked purulent lepto-meningitis covering the whole vertex of the brain, more marked on the left side, less marked at the base. No signs of tubercular disease are present in the Sylvian fissures or at the base. The brain substance is soft and oedematous.

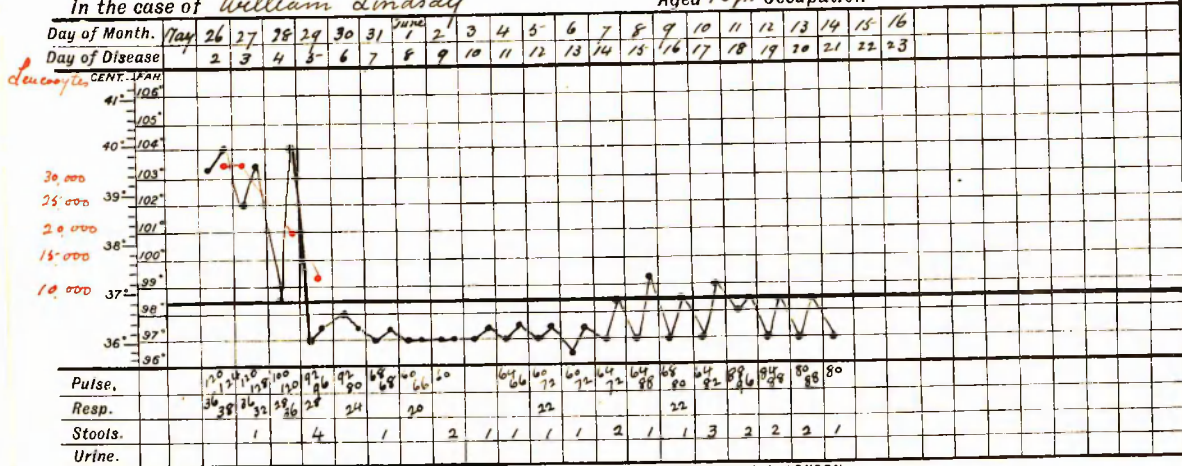
Spinal Cord. The superficial vessels are congested. Round the dura is a thin gelatinous substance apparently due to congestion. Purulent lepto-meningitis is especially marked in the upper half of the cord.

Bronchial Catarrh. Recovery.

Records of Temperature, Pulse, Respiration, Stools and Urine, from 26th Day of May

1802

In the case of William Lindsay Aged 13 yrs Occupation



YOUNG J. PENTLAND, PUBLISHER, EDINBURGH & LONDON.

Expenses

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The other internal organs are congested - the spleen is semidiffluent. The thymus is enlarged, and there is some considerable enlargement of lymphatic glands in the mesentery, and of lymph follicles in the small intestine. and especially in the caecum.

BACTERIOLOGICAL EXAMINATION

Several films from both the spinal and cerebral meningeal pus were taken: the appearances are in both cases identical. Outside the pus cells are many cocci, most of which are of well marked lancet shape and in pairs; a few in short chains of six cocci are present; all the cocci are ^Lgram positive, and on special staining, capsules are seen round the diplococci. There are no intracellular bacteria. Cultures on agar and blood serum both show pure cultures of diplococcus pneumoniae, which does not grow on gelatine at room temperature.

13. On the 26th May 1902, three days later, William Lindsay, aet. 13 years, was admitted from the Industrial School. At 2 p.m. on the previous day, he awakened with frontal headache and vomiting. The former persisted 12 hours, the latter 30 hours. The same day he had cough, but no expectoration; there was no pain in the side. The following day his temperature was 103°, and he was sent to Hospital. On admission,

the temperature was 103.6° , pulse 128, respirations 32, leucocytes 32,000 per cubic millimetre. There was some bronchial catarrh, but no evidence of lung consolidation. On the evening of the third day of illness, the temperature fell to normal, but the leucocytes still numbered 20,000 per cubic millimetre, and the temperature rose again to 104° the same evening. The next morning, however, the fifth day of disease, the temperature fell to 97° , and convalescence was uninterrupted, although the bronchial catarrh did not subside for a few days. A blood culture taken about the sixth day of illness proved negative, and he was discharged well on the twenty-second day. This patient had had pneumonia two years previously.

14. On the 27th of May, the last case of the epidemic admitted from the School and treated in Leith Hospital, occurred, namely Colin McKenzie, a van-driver, aet. 15 years. The same morning he had wakened with frontal headache and pain in the left side of the chest. Half an hour later he vomited, and when seen by the medical officer, had a temperature of 103° . He was immediately sent to Hospital. His brother was at the time in the Children's Hospital, Edinburgh, with pneumonia. On admission, temperature was 101.4° , but the same evening it rose to 103° . The patient

was drowsy, had a slight cough, and tenacious blood-stained expectoration, which contained numerous pneumococci. There were no definite physical signs. The temperature, and also the number of leucocytes, became normal on the fourth day, and remained so for ten days, when a slight relapse took place lasting four days. There were the usual febrile symptoms, but no localised disease, and the patient was discharged well on the 31st day.

- These were all the Cases treated in Leith Hospital, but another case occurred in Glasgow. Charles Gardner, one of the Leith Industrial School boys, went to Glasgow to spend a day with his mother, towards the end of June. While there, he became suddenly ill, and was taken to the Workhouse Hospital, where he passed through an attack of pleuro-pneumonia ending by crisis. In due time he returned to Leith School quite recovered.
16. Another case, already referred to, namely Alexander McKenzie, aet. 4 years, brother to Colin McKenzie, took pneumonia while living at home with his mother in Leith. He was admitted to the Children's Hospital, Edinburgh, on the 16th May 1902, complaining of vomiting, pain in the stomach, diarrhoea, and cough, of five days' duration. On examina-

tion he had signs of pneumonia at the apex of the left lung; on the ninth day of illness the crisis occurred, and he was discharged well on the twenty-fourth day.

T A B L E I

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EPIDEMIC OF PNEUMOCOCCAL INFECTION OCCURRING IN BOYS' PROTESTANT INDUSTRIAL SCHOOL, LEITH, 1902

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No.	Name	Age	Date of Admission	Day of Illness	Date of Discharge	Days in Hospital	Diagnosis and Complications	Maximum Leucocytosis	Bacteriology	Result
1	John McKinley	16 yrs.	29 Mar.	5th	Died 2 Apr.	4	Right Apical Pn'ia, Right Empyema, Purulent Pericarditis	(1) 24,000 p. cmm.	(1) Pure culture diplococcus pneumoniae	<u>Died</u>
2	Robt. Eagle	15 "	3 Apr.	3rd	23 Apr.	20	Right Basal Pneumonia	(2) 25,000 "	(2)	Cured
3	John Ross	12 "	3 Apr.	2nd	29 Apr.	26	Bronchial Catarrh	(3) 24,000 "	(3)	"
4	Wm. Macewen	15 "	5 Apr.	5th	26 Apr.	21	" "	(4) 23,000 "	(4)	"
5	John Abel	15 "	9 Apr.	5th	7 May	28	Double Basal Pneumonia	(5)	(5)	"
6	Robt. Pryde)	14 "	14 Apr.	6th	30 Apr.	16	Left Basal Pneumonia	(6) 27,000 "	(6)	"
7	Wm. Blair)	10 "	14 Apr.	3rd	28 Apr.	14	Left Basal Pneumonia	(7) 35,000 "	(7)	"
8	Jas. Hislop	9 "	28 Apr.	2nd	2 July	65	Right Apical Pneumonia Empyema	(8) 22,000 "	(8) (1. Bacillus of Coli group (2. Diplococcus Pneumoniae	"
9	Alex. Gordon	13 "	28 Apr.	2nd	21 May	23	Bronchial Catarrh	(9) 20,000 "	(9)	"
10	John Waddell	10 "	28 Apr.	2nd	12 June	45	Left Basal Pneumonia, Pericarditis	(10)	(10)	"
11	James Brown	15 "	16 May	7th	23 July	68	Left Basal Pneumonia, Empyema	(11) 20,000 "	(11) Pure culture diplococcus pneumoniae	"
12	James Boyne	16 "	23 May	2nd	23 May	2 hrs.	Purulent Cerebro-spinal Leptomeningitis	(12) 20,000 "	(12) " "	<u>Died</u>
13	Wm. Lindsay	13 "	26 May	2nd	14 June	19	Bronchial Catarrh	(13) 32,000 "	(13) Blood culture negative	Cured
14	Colin McKenzie	15 "	27 May	1st	26 June	30	Bronchial Catarrh	(14) 27,000 "	(14) (Pneumococcus in sputum) (Blood culture negative)	"
15	Chas. Gardner		25 June (?)	2nd	15 July		Pleuro-pneumonia			"
16	Alex. McKenzie	4 "	16 May	6th	4 June	19	Left Apical Pneumonia			"

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CAUSES OF THE EPIDEMIC

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The Leith Industrial School for Boys is a Protestant Institution, situated in Lochend Road, one of the higher parts of the seaport. It has a garden in front, and a playground behind. The space opposite the school is occupied by the railway at a considerably lower level, so that there is a very large surrounding air-space, the only buildings quite near being the row of houses on each side of the Institution.

Most of the recorded cases of somewhat similar outbreaks have occurred in Roman Catholic Institutions for Boys, as for example, that occurring in the St. Mary's Roman Catholic Industrial School, Glasgow, in 1888, reported by Dr. J. B. Russell (8), and, more recently, an outbreak in the Tranent Roman Catholic Industrial School, reported by Dr. Haldane.

Few epidemics seem to have occurred in the girls' Schools, the standard of comfort in these being considerably higher than among the boys, and the girls probably less exposed to the inclemency of the weather.

The Leith School contains from 130 to 140 boys,

and the work is carried out on the half time system, one half of the boys doing lessons in the morning, while the other half is occupied in the workshops, and vice-versa in the afternoon.

The work rooms and dormitories are clean and well ventilated, but the single beds occupying the latter are too closely placed, so that, in spite of a fine cross ventilation, there is some overcrowding.

Next the dormitory is the lavatory, containing a row of wash hand basins, and a plunge bath: but the waterclosets, which are of the trough system, are placed outside in the yard, so that all the soil pipes, except those from the lavatories of the officials, are placed outside the building.

The health record of the school, both before and after the epidemic, is good, no other outbreak having occurred, and only an occasional case of diphtheria or enteric ^{fever} appearing during the winter months.

The food, like that of Industrial Schools in general, is monotonous, and costs on an average 4½d per head per diem. Here is the menu:-

	<u>Breakfast</u>	<u>Dinner</u>	<u>Supper</u>
Sun.	Porridge & Milk	Rice & Milk, Bread	Cocoa, Bread, Butter
Mon.	"	Broth, beef, Bread	Cocoa, Bread, Syrup
Tues.	"	Pea Soup	" Cocoa, Bread, Butter
Wed.	"	Irish Stew	" Cocoa, Bread, Syrup
Thurs.	"	Broth, beef	" Cocoa, Bread, Syrup
Fri.	"	Suet Pudding	" Cocoa, Bread, Butter
Sat.	"	Cocoa, Bread & Cheese	Cocoa, Bread, Syrup

That the food had no direct influence on the course of events, is shown by the fact that, after the first ten cases occurred, a general survey of the situation was made, and new food materials obtained, the governor fearing that in some way the stock of provisions had become infected. Two weeks later, however, the disease broke out anew.

That the food, however, may have had an indirect influence on the epidemic must be admitted. Although sufficient to keep the boys in health under average circumstances, and probably better than most of them were accustomed to at home, nevertheless it was scarcely adequate to counteract the chilling effects of prolonged exposure to severe cold.

So far then, the only points of importance we

have found in regard to the causation of the epidemic are, first, the overcrowding in the dormitories, a factor which conspires to chest troubles of all kinds, and, second, the lack of variety and of fat in the food.

On asking the governor, an intelligent man who took a great personal interest in the boys, what he considered the cause of the epidemic, he said at once "football". Several of the boys attacked were in the football team, and the others played football frequently.

The boys as a whole are of poor physique, and at their play are subject to alternating extremes of heat and cold. The spring of 1902 was very cold, and the east winds of Midlothian are notorious for their severity.

Professor Humphry (17) in his "Collective Records" 1884, speaks of pneumonia as prone to occur in exposed situations subjected to the east or south west winds, and in cold wet seasons: and Ollerton, after ten years' experience, says the chief causes of pneumonia are a constitutional debility or local lung weakness, and then exposure to the east wind.

Ross gives instances of pneumonia following chilling of the body when overheated, and Ashby and

Wright (2), in their "Diseases of Children", give as the typical mode of onset of that disease, the case of a school-boy exposed to a cold east wind after getting hot, and developing in a few days an acute pneumonia.

Dr. Scott, in reporting on an outbreak of febrile disease which occurred in the Roman Catholic Reformatory for boys at Westhorn, concludes that during intensely cold weather the boys have to be watched with extreme care; "many of them are constitutionally unhealthy. and from the state of their health they seem to be quite unable to stand severe cold".

Here then was a set of boys of poor physique, unsupported by a generous diet, exposed when fatigued by a vigorous game to the chilling blasts of an east wind, and returning to spend the night in a crowded dormitory: are they not fitting hosts for such germs as the pneumococcus?

The epidemic occurred at a time when pneumonia was prevalent in Leith, indeed in the Medical Wards of the general hospital, there was a case of pneumonia in almost every bed; and we looked round for some source of contagion to explain this serious outbreak in the Boys' School.

That pneumonia is an infectious disease has long

been recognised. That very spring a patient who was admitted to the Surgical Ward of Leith Hospital was suffering from pneumonia. A few days later the sister who nursed him took pneumonia, and passed through a very severe attack.

There was also an old couple living in Leith, and the husband was attacked with pneumonia for the third time. On each of the previous occasions he had been nursed by his wife, she immediately taking the disease when his crisis was over. The old man was again tended by his faithful nurse, but died after a week's illness, and two days later she also became ill, and died of pneumonia.

Mendelsohn records an interesting case. It was that of a typhoid patient who was transferred from the bed he had occupied during the attack, to one on the opposite side of the ward. In a few days he became feverish, and dulness was made out over the lower lobe of the right lung. He died eight days afterwards, and it was found that the typhoid ulcers were healed but that the lung was hepatised in the above-named region. On enquiry it appeared that the bed to which this patient had been transferred had just before been occupied by a very severe case of pneumonia then convalescent, and that the mattress had not been changed.

Professor Humphry (17), in his "Report" dated 1884, records the following cases:- A farmer "took cold" at market ten miles from home: on arrival he had pain in the side, fever and thirst. On the fifth day of his illness his wife and one of the family fell ill; two days later a servant; and then other members of the family were attacked. All were typical cases of pneumonia. The locality is healthy.

In another case, a servant girl was attacked on 4th December 1882 with pneumonia; six days later her mistress fell ill. The latter's husband was attacked with the same disease four days after his wife, at the house of a friend whither he had removed. Eight days later his friend's daughter and later the parents also, were attacked.

Our search, however, for some source of infection outside the school, was unrewarded. None of the boys had been recently admitted, nor had they, so far as our observations went, come in contact with any case of similar disease. True the football team had been playing against other teams, among them Tranent, where at different times epidemics had occurred; but just at this season Tranent seems to have been singularly free from disease.

After the first ten cases occurred, the disin-

fection of the school was carried out under the supervision of Dr. Robertson, the Medical Officer of Health, but the outbreak still continued.

The first boy attacked - John McKinley, aged 16 years - was notably of poor physique, had an ill developed chest, and his mother had died of consumption.

From the researches of Netter, Sternberg and others, we know that the pneumococcus, the commonest cause of pneumonia, is frequently present in the saliva of healthy individuals, and, as Hewlett (5) says: "the generally accepted idea of the relationship of 'catching cold' to an attack of the disease, is explicable on the theory that the action of cold lowers vitality, and renders the tissues vulnerable to the attacks of the organism already in close relationship to them."

Some interesting work has recently been done in America by Christopher and Class, as to the role of the tonsil in pneumococcic infections. Owing unfortunately to the illness of the former investigator, their work has not yet been published. Dr. Class however writes, that they made rather an exhaustive study of pneumococcus sore throat, both bacteriologically and clinically. The cases were mostly in

children, but the observations in adults were similar. Their observations showed that a great number of the transient febrile ailments occurring in childhood, and whose etiological factor had escaped recognition, were in reality cases of pneumococcus infection of the tonsils and pharynx.

Following up this form of investigation, it occurred to him that it was quite possible that the pneumococci might enter the system by way of the tonsils, and in this way cause pneumonia; or, at any rate, that by finding a favourable medium for their growth upon the tonsils, they could here attain such a degree of virulence, that when by some means they entered the lungs, pneumonia would result. His observations of a considerable number of pneumonia cases showed that this tonsillitis very frequently preceded the pneumonia, and that the tonsillitis was of pneumococcus origin. He does not think that sufficient stress has been laid on this preliminary angina.

That tonsillitis often precedes pneumonia has been noted by several observers. Professor Humphry (17) from the "Reports" finds that "the other diseases apt to concur with pneumonia in the same house are "bronchitis and tonsillitis".

A patient admitted recently to Leith Hospital

with severe tonsillitis had definite signs of pneumonia a few days later; and a circumscribed epidemic of pneumonia reported in the British Medical Journal, gives tonsillitis as the initial symptom.

But is it wise always to regard the tonsil as a mischief-making member? May it not be that sometimes it plays a very different rôle from that recorded by the above observers? In how many cases has it not been the effective barrier to the onset of the pneumococcus? Do not those preliminary anginas represent the battles when invading and invaded forces meet, and the ensuing lack of symptoms point to the repulse of the hostile coccus, by the lymphatic tissues of the tonsil?

Although among the Leith Industrial School Boys this early tonsillitis was not discovered, one of the cases illustrates very forcibly the result of invasion by the pneumococcus, when the lymphatic system is not in fighting order, and a focus of diminished resistance is established. James Boyne, aged 16 years, the subject of lymphatism, had been subject to repeated attacks of "cold in the head". After an illness lasting 24 hours, he succumbed to a purulent cerebro-spinal meningitis.

Bearing on this point a very interesting article

on the Pathology of the Infection by the Pneumococcus is contributed to the Lancet 1898 by Brodie Rogers and Hamilton (14). They describe an epidemic of cerebro-spinal meningitis among the Basutos of South Africa, with rhinitis as the initial symptom, and conclude that the diplococcus found in the nasal discharge of their cases is identical with that of Fränkel, but more virulent; that the pneumococcus is the specific factor in the production of the cerebro-spinal meningitis, and that the pneumococcus first affects the nasal mucous membrane, and produces there a local lesion (rhinitis) and that all other subsequent pathological effects - infection of frontal and nasal sinuses, middle-ear suppuration, parotitis, pneumonia, meningitis, etc.. are merely the result of extension of the organism along the blood channels, lymphatics, or by continuity of tissue. The post-mortem appearances of the nasal region which led them in their first observations of the disease, before they had made any bacteriological examination, to name it "acute specific rhinitis", will serve to show how strongly they were convinced of its local origin.

There was only one case of cerebro-spinal meningitis in the Leith outbreak, and it occurred towards the end of the epidemic. One cannot regard it there-

fore as a primary cause of the trouble, or as very greatly assisting in its spread.

On enquiry we find that the epidemic was limited to no one section of the boys, no one dormitory, no one class. The boy of poorer physique was attacked as well as the more robust, the outdoor worker as well as the indoor, the older boys as well as the younger. The only ground common to most of the cases was the football field, and here the influence of cold may have acted on all the boys, or the weaker may first have fallen a prey, passing on the trouble to their stronger neighbours.

The disease itself, when unaccompanied by complications, was short and sharp, and the symptoms suggested rather a specific fever than a pathological process limited to the lung.

CLINICAL SYMPTOMS

The incubation period was difficult to ascertain. At some times a few days, at others an interval of two weeks occurred between the cases. Osler considers that little is known of the incubation period of pneumonia; it is probably very short.

In all the cases the onset was sudden. The most constant symptom was vomiting, which occurred eleven times out of fourteen, and was accompanied by rigor in seven cases. Holt (3) lays great stress on this initial vomiting, and considers that of all the symptoms of onset, it is most frequently seen. Pain in the chest was complained of in all the cases except two, in the meningitis the pain was located in the back of the head. Herpes appeared only three times.

The temperature rose suddenly; when taken on the first day of illness, it was usually 103° ; it remained high, sometimes with remissions of two degrees, and in most cases fell by crisis.

In six cases there was either a rusty or a blood-stained expectoration; in one case it assumed the prune-juice type; in several cases there was no expectoration.

Neither dyspnoea nor cough were marked features; the latter, when it occurred, was usually short, frequent, and restrained on account of pain in the chest.

In nine cases, there was definite consolidation, in four at the left base, in one at the right base, in two at the right apex, and in two at both bases. Five cases had indefinite signs and presented features

of bronchial catarrh, so that, had they not been associated with others showing definite consolidation, their true significance might have been overlooked.

The duration of the illness was short. In one case, which corresponded to what Osler calls the "Larval Form", and which he says is common in children, the crisis occurred on the third day; in two cases it occurred on the fourth, in two on the fifth, in two on the sixth, in one on the eighth day. In three cases the temperature fell by lysis. Recovery in the uncomplicated cases was complete.

The Leucocytes ranged between 20,000 and 30,000 per cubic millimetre, and were of the polymuclear variety. They did not regain their normal number till the third or fourth day after the temperature had fallen.

In the case of James Brown - pneumonia with empyema - the leucocyte count was normal on the tenth day of the illness, but when taken again on the thirty-third day, the number had reached 25,000, and on aspirating the chest, an empyema was found.

In the fatal cases also a fair leucocytosis was present, amounting to 22,000 in the purulent peri-

carditis, and 20,000 in the meningitis. These blood counts did not help therefore in regard to prognosis.

From the time when the number of white corpuscles present in the blood in disease was noted, a high leucocyte count has been interpreted as a high power of resistance in the individual. Rosenow (9), in his recent "Studies in Pneumonia and the Pneumococcus Infection", has borne this out, and the epidemic cases have favored this view. On the other hand, a small number of leucocytes or even a number below the normal is taken as an unfavorable sign, and this is especially so if previously the number has been high, as has been noted in many fatal cases. Rosenow has found that in fatal cases of pneumonia, an increase in the number of leucocytes goes hand in hand with an increase in the number of pneumococci in the blood up to a certain point: again after the leucocytosis has reached its acme, there is first a preliminary drop in both, just as if disintegration of leucocytes caused a destruction of a number of the invading cocci. This suggests that because of the exhaustion of the power of the organism to produce new leucocytes, the pneumococci get the upper hand, and as the leucocytes diminish, the pneumococci increase in number.

Kitasato has also shown that in vitro, leucocytes have a definite bactericidal action. The fall in the number of pneumococci coincident with the fall in the leucocytosis points directly to the liberation of pneumococcicidal substances.

Filtrates of bouillon and serum cultures of pneumococci produce in doses of 2-4 cc. a slight rise of temperature and a considerable leucocytosis in rabbits. Sterile bouillon and serum have no such action.

The two fatal cases in the epidemic had a leucocytosis of over 20,000 per cubic millimetre, an increase of 12,000 over the normal, taking that number to be 8,000.

COMPLICATIONS

One of the most constant features of the epidemic was the occurrence of pleurisy; one might rather say the epidemic was one of pleuro-pneumonia, and the pleurisy part of the disease. Holt considers the frequency and severity of the pleurisy a peculiarity of the lesion in children. He states that these cases of pleuro-pneumonia are almost always due to the pneumococcus, are distinguished by the severity of

the constitutional symptoms, and in children over two years, most frequently go on to empyema, which with proper treatment usually ends in recovery. This was borne out by our cases. Out of a total of fourteen, four went on to pus formation, three of these were cases of empyema, one of which was complicated with purulent pericarditis, and the fourth was a purulent cerebro-spinal meningitis.

There were two cases of pericarditis, one, already mentioned, being purulent, where the pleuro-pneumonia was on the right side, the other, fibrinous. where the pleuro-pneumonia was on the left side.

Albutt (4), in his "System of Medicine", gives the percentage of cases of empyema as varying widely in different years. Pearse gives a percentage of three out of 890 cases occurring in Guy's Hospital. In the St. Thomas' Hospital Reports again, out of over 700 cases examined, the percentage was less than one. Contrast this with the Leith Epidemic cases, where the percentage was 21. This high number may have been due to the youthful age of the patients, whose tissues, not yet fully developed, are more prone to pus formation.

Pericarditis, according to Albutt, is both common and dangerous. Most authorities believe it more fre-

quent with a pneumonia of the left side: in the Leith cases it occurred both with a pneumonia of the left, and also of the right, side. The purulent case proved fatal.

The other complication, namely meningitis, is an exceedingly fatal one, probably death results in every case. It is said to be associated with ulcerative endocarditis, but this was not so with the Leith fatal case, in which the meningitis was primary and unaccompanied by consolidation of the lung.

BACTERIOLOGY

In five cases the diplococcus pneumoniae was found, four times in the pus, once in the sputum. Once a bacillus resembling the bacillus coli communis was also found in the pus.

In two examinations of the blood, the result was negative.

The pneumococcus of Fränkel is admitted by all to be the commonest cause of pneumonia, and is notably a pyogenic organism. It has been frequently found in the saliva of healthy individuals, and therefore the detection of the organism in the rusty spit

of a pneumonia patient is by some considered inconclusive evidence of the pneumococcic origin of the disease.

Later researches have shown that with improved technique, and using for inoculation large quantities of blood, the pneumococcus can be recovered in practically all cases of croupous pneumonia, and that in obscure cases of pneumococcus infection, blood cultures may be a diagnostic method of positive value. Also that pneumococcaemia in pneumonia does not mean an especially unfavourable prognosis, but is rather to be regarded as an integral part of the infection.

I regret that we did not make a blood culture in all our cases. It was only towards the end of the epidemic that we did so in two cases, and in both the result was negative. These patients were, however, convalescent at the time of the examination, and, as there seems to be a diminution, either in the number, or viability, or both, of the pneumococci in the blood at the time of crisis, this probably accounted for our lack of success with the cultures.

The other organism found, namely a bacillus resembling the coli group, must, I think, be put on one side, the evidence being greatly in favor of the pneumococcus origin of the epidemic.

That the bacillus, however, is capable of producing an epidemic pneumonia, must be mentioned on account of the classical work done by Klein (10) in the Middlesborough epidemic. Here the microorganism found was of the coli group, as was also that of the Scotter epidemic referred to below.

TREATMENT

This was entirely symptomatic. No drugs were as a rule given in Leith Hospital to pneumonia patients unless special symptoms arose, and the Industrial School Boys were no exception to the rule.

Milk diet, and laxatives as occasion required, were the bases of treatment during the fever, while when the tongue became clean, tonics, usually in the form of Easton's Syrup and Cod Liver Oil emulsion, were administered. On the tenth day after defervescence, the patients were allowed up, and they usually returned to School, or were sent to the country, on the thirteenth or fourteenth day.

The treatment of the cases of empyema is perhaps specially interesting, as shewing the uselessness of aspiration alone. This method has been advocated by

the French, who consider it adequate treatment where localised collections of pus are due to the pneumococcus.

This form of treatment was tried in two cases, and was entirely unsuccessful. In that of James Hislop, with an empyema just over the right nipple, relief of the symptoms was not obtained, until a rib had been resected and a pus clot evacuated.

James Brown's illness did not terminate in spite of pus being removed by the aspirating needle, till he also had had a resection of the rib.

In America the treatment lately advocated for pneumonia is the exhibition of alkalies, those chiefly used in the Chicago Hospitals being bicarbonate of soda 30-170 grains and iodide of soda 10-20 grains, three hourly. Stiner gives calcium chloride "to cause alkalinity of the blood, and combat the toxic symptoms". Auld, in his researches on pneumonic toxins, has separated a proteose and an organic acid (lactic) from the blood and organs of infected animals, and from cultivations of the diplococcus pneumoniae in alkali-albumin the same products were apparently obtained, the alkaline medium soon becoming permanently acid.

The proteose on subcutaneous or intravenous

injection produced some fever, on intrathoracic injection, fever and dyspnoea; and post mortem, pleurisy and consolidation of the lung were found. The organic acid produced slight rise of temperature, but no other symptom.

The treatment by alkalies is therefore introduced to combat the acid produced by the pneumococcus, to which many Americans consider the toxic symptoms are due. The treatment is still subjudice, but is interesting as being the outcome of scientific investigation.

The other form of treatment, namely that of serum therapy, was not attempted by us, and has not been very encouragingly spoken of by Mosney (15) in his "Experimental Researches on Vaccination against Pneumonic Infection and its Cause". His conclusion is that "Contrary to what one had the right to hope, the cure of rabbits primarily infected can be obtained neither by the injection of blood-serum from vaccinated rabbits, nor by the injection of the products of filtration of a maceration of their bruised organs, however close may be the time of this injection to that of the virulent inoculation".

Humphry (17), in his "Collective Records", speaks of pneumonia as a disease little influenced by treatment.

and that was our position as we watched its limited course, and stepped in to relieve only the special symptoms as they arose.

The mortality, however, was high, and equalled 14 per cent. It must be remembered that, although the patients were young, still many of them were poorly developed and incapable of offering much resistance to disease, and this was specially noticed in the fatal cases.

The first of these, John McKinley, was of poor physique. His complications were specially severe - empyema and purulent pericarditis.

The second fatal case, James Boyne, was the subject of lymphatism. Of this condition little is known, but most observers consider that it argues a very much lessened power of resistance in the individual, and many cases of sudden death have been observed, from what might otherwise be regarded as trivial causes. It is characterised by an enlarged thymus containing many necrotic areas, and marked hyperplasia of the germinal centres, and by an enlargement of the lymphoid tissue in the body generally, and of the mesenteric glands, and the intestinal follicles in particular.

In an account of 83 cases of pleuro-pneumonia

occurring in the Morringer Reformatory in 1875, Adolf Kuhn says:- "Post mortem examinations were made in "sixteen cases, some swelling of the intestinal "follicular glands was found in many of these".

Dr. Russell(8) too, in commenting upon the St. Mary's School outbreak, says: "The local disease was "the result of a constitutional infection, which was "capable of killing without the local disease - the "post mortem appearances such as they were, were distinctly lesions of the mesenteric glands, and of the "glandular system of the small intestines".

This subject, however, requires further elucidation, and our fatal case may be considered as due to an exceedingly grave phenomenon, namely meningitis in a subject of lessened resistance.

That cerebro-spinal meningitis of this form is always acute and fatal is supported by Foulerton. He gives a case which may well be compared to that of James Boyne. "A porter, at his work, became sick and "giddy and fell down. He had frontal and occipital "pain. Breathing was labored and Cheyne Stokes in "type. There was no motorparalysis, and the patellar "reflexes were in abeyance. Temperature was 101.6°, "pulse 120. Next day he was unconscious, the left "pupil was larger. He died 66 hours after the onset.

"Post mortem examination showed a purulent infiltration of the pus at the base of the brain, and over the cerebellar surface and down the cord. There was no extension to the Sylvian fissures. The pneumococcus in pure culture was found in the pus, and also in the fluid in the ventricles."

It is a curious coincidence that Dr. Russell (8) in his Report of the St. Mary's School outbreak, should have found that though fewer of the older boys took the disease, of those who took it, the oldest died. Of the Leith boys, John McKinley and James Boyne were both 16 years of age and were the oldest boys admitted from the School to Hospital.

PROPHYLAXIS

This is a subject which, as I mentioned at the beginning of this paper, is daily claiming more and more attention. As the epidemic form of pneumonia attacks especially institutions and the young and debilitated, Dr. Scott's ideas with regard to woollen clothing in winter and fires in the dormitories in cold weather, might with advantage be carried out.

The Americans advocate the isolation of cases

of tonsillitis, and I would suggest also of rhinitis and pneumonia, with disinfection, as after one of the acute specific fevers.

The food of the institutions might well be more varied, and in winter especially, might contain a greater percentage of fat.

That vaccination has as yet little to aid us is borne out by the researches of Mosney (15). He concluded (1) that the pneumococcus determines, in all media in which it is developed, the formation of a substance, which can be isolated: (2) that the injection of this substance renders a rabbit immune to fatal doses of a virulent pneumococcus: (3) that the immunity takes place only four days after inoculation, and the blood of rabbits rendered thus immune is not bactericidal to the coccus, rather the latter seems to live longer than in the blood serum of healthy rabbits.

OTHER EPIDEMICS

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Although many epidemics of pneumonia had occurred both at home and abroad before the year 1888, still, much notice of these had not been taken, in this country at least, till Ballard (10) published his classical account of the Middlesborough epidemic, with a report of the bacteriology by Klein. The disease is what would probably have been called "pythogenic pneumonia" by the older writers. Ballard calls it "pleuro-pneumonic fever". He found it was worst, and extended most quickly in the poor and densely populated parts of Middlesborough, especially those in which ventilation and drainage were faulty.

The invasion of the disease was sudden, rigor almost invariable. Pain was complained of on one or other side of the epigastrium. The temperature rose to 104° in a few hours, the pulse was rapid, and there was considerable nervous prostration. Signs of pleuro-pneumonia were generally well marked by the second day of illness, though in some cases not till later, but in many cases the constitutional disturbance was out

of all proportion to the evidence of local pulmonary disease. The crisis occurred usually on the seventh to the tenth day, and in a few cases relapse occurred.

Of sequelae several cases had abscess, and two had empyema.

In the examination of twelve cases post mortem, there was recent pericarditis, in one case recent ulcerative endocarditis, pleurisy in all but one, pneumonia in all. No tubercular lesion was found, and the other organs were generally healthy.

As to nosology. Ballard says: "This particular form is distinctly not a local but a general disease, it is a specific fever, marked, like other specific fevers, by certain definite local characteristics. Like them it would seem to possess the quality of communicability from the sick to the healthy, either immediately through proximity, or mediately through food or otherwise."

The micro-organism found resembled the bacillus coli, and was called the "bacillus of Klein".

A similar epidemic occurred in Middlesborough some years later, and the same bacillus was again found.

Parsons (11) describes an epidemic occurring in

Scotter, Lincolnshire in 1890, and caused, he considers, by faulty drainage.

Here the incubation period was doubtful, varied from a few hours to two days. Onset was sudden, occurring often during the night, with rigor, vomiting, diarrhoea, pain in the chest, headache and prostration. Fever developed rapidly - temperature usually being 104° when first noted. Signs of inflammation of the lungs were present in almost every case, sometimes not till a few days after the invasion. Cough and dyspnoea were not prominent symptoms. The sputum varied, sometimes it was rusty, sometimes there was none.

There were no post mortem examinations, but mice fed with bread soaked in the sputa died, and a bacillus resembling that of Klein was found in cultures from their lungs.

Many of the recorded epidemics occurred in barracks, workhouses and schools.

One of those is recorded by Dr. Russell (8) as "The Outbreak of a Febrile Disease in St. Mary's Roman Catholic Reformatory for Boys, Glasgow 1888".

Out of 66 cases, 17 had signs of a definite lobar pneumonia, and, although authorities differed

as to the nosology of the disease, by some it was regarded as an infectious pneumonia, due to insanitary conditions. No micro-organisms were found, but there was a definite enlargement of the intestinal glands in two cases which came to post mortem examination, and which show a resemblance to the case of James Boyne - the subject of lymphatism, but this may be only a coincidence.

Part of Dr. Russell's description might have referred to the Leith cases, for example:-

"The invasion was sudden, headache and sickness being almost always the first cause of complaint, usually with more or less pain chiefly referred to the right side."

In 1892 an epidemic comprising 31 cases occurred on H.M.S. "Caledonia", an old wooden vessel used as a training ship. Most of the patients had pneumonia, which, in the first half of the series, was considered secondary to influenza, but in the later cases, no causal influenza could be found. In the latter the temperature fell by crisis on the seventh day, and the mortality was only 3.2%.

In the more recently recorded epidemics, one has the advantage of more thorough methods of bacteriological research, as for example, two epidemics of cerebro-

spinal meningitis due to the pneumococcus and reported by Brodie Rogers and Hamilton((14). The second of these occurred among the Kaffirs who had come to a new and well-cared-for compound. They had come from the moist, warm atmosphere of the sea coast, to the cold upland, to work 1,000 feet below the surface, with no protection from the cold.

With many of them nasal catarrh and coughs developed, and even when they were at work, pneumonia was present. Special attention was drawn to the disease by sudden and unexpected deaths unaccounted for by any premonitory constitutional disturbance or signs of sufficient local disease even when pneumonia was present.

In the second series, there were 26 post mortem examinations. In these the nasal mucous membrane showed every stage of inflammation; the sphenoidal and frontal sinuses were filled with pus.

In one case there was otitis media, rhinitis and meningitis: in two cases there was spinal leptomeningitis: in twelve, meningitis. In the lungs there was generally pneumonia, and always with pleurisy.

In most cases a pure culture of the diplococcus pneumoniae was found, in some mixed with streptococci

and staphylococci: but in preparations from the nasal mucous membrane, the diplococcus was always in excess. Inoculation experiments gave the same result.

A very interesting circumscribed epidemic due to the pneumococcus of Fränkel, is described by Baduel and Gargano (7) in the "Rivista Critica di Clinica Medica", Florence, January 1903.

Six young people of a family of peasants called Corsani, came about the end of January to the Antirabies Institution of Florence, to undergo Pasteur treatment, as they had all been bitten by a hydrophobic dog. They boarded with the family of the Senatori in a suburb of Florence, but the eldest sister and three small brothers slept in the house of the Basis at a little distance.

About the 1st February, Egidio Corsani became ill with severe pain in both ears and deafness. He was removed to Hospital, and had a crisis on the eighth day, with discharge from both ears. After about twenty days, he recovered.

Two days later, the sister, Juilia Corsani, and two little brothers, became ill. The former had a double basal pneumonia with left empyema only cured by surgical treatment. The one brother had a right

basal pneumonia with crisis on the seventh day and no complications or sequelae; the other had only a catarrhal bronchitis, which cleared up in a few days. The two remaining brothers of the Corsani family also became ill with the same symptoms as the others, but in a milder degree. In a short time they were well.

On the 18th February, two of the Senatori boys, twins, aet. 6 years, became ill. One suffered from a pneumonia circumscribed to the base of the right lung, the other, from a catarrhal bronchitis, bilateral blepharo-conjunctivitis, with a small abscess on the right lower palpebral border. which, after treatment, rapidly healed.

On the 24th February, a little girl, aet. 2 years, from the house next the Senatori, was brought to Hospital with gingivitis.

On the 11th March Annina Senatori became ill, suffered from left parotitis, which quickly improved.

The same day a little girl who lived with the Senatori became ill, with catarrhal angina, which passed off in a few days.

Thus there were:-

1 case Double Otitis media

3 cases of Pneumonia in one of whom it was
bilateral and accompanied by empyema

4 cases of Catarrhal Bronchitis, of whom
one had symptoms so slight as scarcely
to justify such a diagnosis, and
another complicated with conjunctivitis

1 case Ulceration of the gums

1 case Parotitis

1 case Catarrhal Angina

The whole eleven cases were studied clinically,
and illustrated by bacteriological research.

There were no other cases in the neighbourhood,
but two other little children of the Senatori family
had some days of illness, with a little fever and
cough.

The family Busi, in whose house the eldest sister
and the three little brothers Corsani slept, remained
immune. There had been much going and coming between
the families.

BACTERIOLOGICAL FINDINGS

In all the cases, except that of the little girl
with gingivitis, a cultural examination of the blood
taken from the veins was made, and in all, cultures
of Fränkel's diplococcus were obtained. The serum al-
so gave positive proof of the agglutination of the
diplococcus. Experiments on animals showed the diplo-
coccus to be a virulent one.

The pus from the case of otitis media showed

mostly diplococci and a few staphylococci - a rabbit inoculated died in 36 hours, and cultures from the rabbit's blood showed the diplococcus most abundantly, and also the staphylococcus.

Cultures from the pus of the empyema showed a pure culture of diplococcus, as did those from the small abscess in the case of conjunctivitis.

In the case of gingivitis, special precautions were necessary, but here also the diplococcus prevailed in numbers over the organisms of the buccal cavity. Thus Baduel and Gargano have no hesitation in admitting that the diplococcus of Fränkel was the common pathogenic agent in this epidemic, and that it was capable, in a short space of time, of manifesting its pathogenic power upon almost all the youths and children of a circumscribed circle of families, living together, and of giving with their diverse localisations, clinical forms, varied in their essence and in their morbid consequences.

Some of those clinical symptoms ordinarily avoid all bacteriological research for the infective agent, through having an importance not superior to that of a common cold. They conclude by saying that diplococcaemia is a very frequent fact, if not constant in the multiform pathology of the diplococcus of

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