ACUTE LOBAR PNEUMONIA IN INFANCY AND CHILDHOOD.

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by

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Pneumonia is, in children as in adults, a very common, and, unfortunately, a very fatal disease. It attacks impartially all classes of children, though, no doubt, it occurs most frequently, and is most fatal, among the poorer classes. This may be, to some extent, explained, as may the greater liability of such children to disease of almost any sort, as the result of their poorer homes, nourishment, and clothing, tending to render them less robust, and, consequently, less able to withstand the onset of illness, than are those in bettef circumstances.
It has been shown, however, that lobar pneumonia is quite as common in previously healthy children as in the delicate; in fact, I have found that, in the great majority of the cases, which I have examined, the patients were quite robust till the onset of the pneumonic attack.
Pneumonia is found to be one of the diseases, for the treat-ment of which, children are most frequently admitted to hospital. This is fully borne out by the statistics of the medical wards of most children's hospitals.
Many, perhaps the majority, of these cases are of the type known as lobular, or broncho-pneumonia, but I propose to confine my attention to the possibly less frequent, and certainly

certainly less fatal, variety, namely acute lobar, or croupous, pneumonia, and to treat of this disease from a purely clinical standpoint.

This necessarily involves a division of pneumonia cases, so far as is possible, into these two great classes. The difficulties of such a division are many, no matter from what standpoint one attempts a classification. The two types have so many characteristics in common, both clinically and pathologically, that some cases seem almost impossible of accurate classification. Still, the great majority of cases display outstanding features sufficiently distinctive, to permit of their being placed without hesitation in one, or the other, class. In arranging such a classification, one must be guided by the clinical appearances, by the course of the disease, and by the previous history of the case.

Some of the chief points of distinction between the two great types of pneumonia may be here mentioned as briefly as possible. Lobar pneumonia is usually primary, and, in most cases, attacks a child in previously good health; while broncho-pneumonia is, in most cases, secondary to some other illness, which is frequently one of the infectious fevers. The onset of lobar pneumonia is almost invariably sudden, while the other type is more or less gradual and insidious in its onset, developing by aggravation of some of the symptoms of the preceding illness.

Again, lobar pneumonia usually runs a definite pyrexial course, terminating by sudden crisis, and is, in almost all uncomplicated cases, followed by a rapid convalescence, relapses being very uncommon. Broncho-pneumonia, in its typical form, runs a more irregular pyrexial course, and the defervescence is brought about gradually by lysis, the succeeding convalescence being very often long, and not infrequently interrupted by relapses. Lobar pneumonia most frequently affects one lung, while both lungs are usually involved in broncho-pneumonia. The definite demarcation of the affected area of lung distinguishes lobar from lobular pneumonia, in which the tendency is for the disease to involve scattered patches, and not a whole lobe, and to be accompanied by more or less general bronchitis. The knowledge that there is a great tendency to involvement of the lung bases in broncho-pneumonia, is sometimes of service in making a distinction. Writing on this subject Holt[1] says;—"If the pneumonia is primary, ~~and~~ and at the apex, it can be pronounced lobar without hesitation". The general appearance of the child often helps to distinguish the one variety from the other, anxiety, distress and cyanosis being much more the features of a catarrhal, than of a croupous, attack.

The importance of recognising the type of pneumonia present is at once apparent, when we consider the question of prognosis, because, while lobar pneumonia usually runs a favourable course, broncho-pneumonia is extremely fatal

fatal, especially in infancy. The above remarks indicate, in a general way, some of the most obvious points of distinction between the opposing types, when looked at clinically, but exceptions are often found. For instance, cases do occur, though rarely, of true lobar pneumonia following an attack of measles, while primary broncho-pneumonia is also a condition of no great rarity. Again ~~in~~ many cases of lobar pneumonia terminate by gradual lysis, while a definite crisis is said to be not unknown in a pure broncho-pneumonia. Mixed cases also occur, and one lung may be affected with lobar, while the other is attacked by broncho-pneumonia; and cases are even recorded of the one type being superadded to the other, in the same lung, or part of a lung. Thus each case has to be carefully examined from many points of view, before being admitted to a place in either group.

The cases which I have analysed, and regarding which I propose to write, are taken, for the most part, from the case-records of the medical wards of Paddington Green Children's Hospital in London. During the period, when I had the privilege of acting as House-Physician to that Hospital, a considerable number of cases of lobar pneu-monia were treated, which I had under constant observation throughout the course of their illness. These I have included in my analysis, together with many others drawn from the records in previous case-books, for permission to use which, I am indebted to the kindness of Drs. Guthrie and Sutherland, the Physicians of the Hospital.

Some other cases I have had under my care in private practice. The cases have been taken in consecutive order, just as they occurred in the books, and, so far as possible, I have eliminated all, in which the diagnosis, regarding the type of pneumonia, seemed in any way doubtful. I had originally noted the course of three hundred cases, but, on a final revision, I decided to omit fourteen of these, as still showing some possibly doubtful features. The following notes and conclusions are thus drawn from my analysis of two hundred and eighty-six cases, which may, I think, be fairly classed as cases of Acute Lobar Pneumonia.
The essential features of the disease closely resemble, in most respects, those seen in the adult type. There are, however, certain differences, and of these I shall speak later.
Regarding diagnosis of the condition in children, there are some points which render this more difficult than in adults. As evidence of this diagnostic difficulty, it is only necessary to mention how many of the cases, which proved to be pneumonia, were sent into hospital for the treatment of some condition quite apart from that actually present. For example, a child may be seized with sudden vomiting, diarrhoea, or convulsion, and it appears as if the seat of disease were the stomach, bowel, or brain, whereas, in reality, such symptom is merely indicative of the onset of an attack of pneumonia, the physical signs of which may not be apparent for some days. Again, in

Again, in pleuro-pneumonia especially, the reference of pain to the abdomen is very common, and frequently a diagnosis of appendicitis or peritonitis has been made in such cases, which, shortly after coming under observation in hospital, have shown signs of pulmonary consolidation. Similarly, it is not uncommon to find, diagnosed as meningitis or gastro-enteritis, cases, which turn out later to be pneumonia, which has set in with cerebral or gastro-intestinal symptoms. That such errors do not infrequently occur is well-known to all in charge of wards in hospitals for children. In many cases they are, no doubt, unavoidable, but, whether or no, their occurrence emphasises the great importance of careful examination of the chest in all cases of sudden fever in children, be the symptoms thoracic, abdominal, or cerebral.

Some of the diagnostic difficulties met with in the examination of children may here be mentioned, as these do not occur in dealing with adult patients. First, there is the obvious disadvantage, in young children, of their inability to speak, and so to explain what is felt amiss. To compensatefor this lack of information, it is important always to get as full and accurate a history, as possible, from the child's mother or guardian, regarding the previous health of the patient, and also regarding the onset of the illness, and the condition of the child since the first symptoms were noticed.

Then, again, the respiration and pulse rates in a child are so easily upset by any emotional disturbance, that it is often difficult to gain any accurate information regarding them, unless the children be seen at rest. Many children resent the mere presence of a stranger, much more being handled by him, and so it is of great advantage, if such children can be observed while asleep, or while their attention is occupied in some direction other than that of the observer. The presence of pain can usually be detected by the child's expression, but often it cannot be localised.

Auscultation is conducted under difficulties in some cases, especially if the breathing be very rapid and shallow. Much depends on the position of the child, and, in a case of suspected pneumonia, it is often very helpful to have the position varied, so as to secure the best possible air-entry to the part of lung under examination.

Percussion, too, is apt to be misleading on account of the very thin and yielding character of the chest-wall; and also, because the dulness of a small area of consolidation may very easily be masked by the resonance of overlying, or surrounding , healthy tissue. In adults the character of the sputum often clinches a diagnosis of pneumonia, but hereagain, in the case of children, we are met by difficulty, being deprived of an opportunity of examining it, as young children almost invariably swallow their expectoration.

Such difficulties can, however, be overcome with practice, and a careful and systematic examination of the whole chest, taken in conjunction with consideration of the history of the case, and the appearance of the child, will in the great majority of cases lead to a correct diagnosis of the nature of the condition to be dealt with.

I now proceed to consider some of the chief features of interest noted in the cases, which I have examined; and first of all, I deal with the question of the age incidence, and then of the sex, of the patients, taking up the various features, and discussing them one by one.

AGE INCIDENCE OF THE DISEASE :-

Regarding the age of children affected, it is often stated that lobar pneumonia is a disease of older children, while the broncho-pneumonic type is held to be the common form in infancy. This doubtless is quite correct, but, at the same time, I think that too much stress has been laid on this point, as, even in infants, I find lobar pneumonia to be of very frequent occurrence. Of the two hundred and eighty-six cases, which I have examined, I find that one hundred and ten, or 38.4 per. cent, were those of infants under two years of age, and of these thirty-four were under one year. Between the ages of two and five years, eighty-four cases were recorded, being equal to 29.3 per. cent of the whole, while from five to twelve years of age there were ninety-two cases, or 32.1 per. cent.

The youngest patient, whose case was noted, was an infant of two months, but cases are on record of lobar pneumonia being found in new-born children; indeed, congenital, or ante-natal, pneumonia has been described, in cases where the mother had contracted the disease just before the child was born. These figures certainly show the majority of cases to be those of older children as compared with infants, under two years, but I think the disproportion is not so great as many writers would lead one to believe. Among the older children affected there were several, who had previously had attacks of pneumonia, many of them while they were under two years of age.

SEX OF CHILDREN AFFECTED:-

Turning now to the question of sex, I find that the proportion of males to females was approximately as three to two. The total number of boys affected was one hundred and seventy-one, and of girls one hundred and fifteen. This is, I think, about the usual proportion and agrees with most published statistics. The proportion of boys, was greaterthan that of girls, attacked during the first year of life, but, after that, the numbers were found to become more nearly equal up to the age of twelve. In later life, after fifteen years, males are more frequent-ly attacked than females. This is due, in great measure, to the different conditions of life and work, but in

/childhood,

childhood, and especially during infancy, the conditions are essentially similar for the sexes, and why males should suffer more frequently than females cannot well be explained.

With regard to infants of both sexes I have seen it stated, that pneumonia is commoner among the bottle-fed than among those fed on the breast. I am not in a position to make any definite statement on this question, as I do not know exactly how many of my cases were breast, and how many bottle, fed. If it be true, however, I think it must be due to the greater predisposition to disease among the bottle-fed infants: That diarrhoea is, especially during hot weather, very much more common amongthe bottle-fed is well-known, and this fact goes a long way, I consider, towards explaining why those infants more frequently contract pneumonia, and other diseases, than do those who are breast-fed; it is the result of the weakening of their powers of resistance.

PREVIOUS HEALTH:-

Investigation into the previous health of all the cases showed that most of the children were in good health till the onset of the attack. Most of them had suffered, at some time, from one or other of the infectious diseases, usually measles, but in no case was any direct connection traceable between such illness and the attack of pneumonia.

Apart from these infectious fevers the children had been strong as a rule. Only seven per. cent. of the cases were noted as being previously delicate or rickety, while a few had suffered from abdominal tuberculosis or congenital syphilis.

While, in the great majority of cases, lobar pneumonia occurs as a primary disease, in a certain number of cases it does undoubtedly come on as a complication, or sequela, of one of the exanthemata.

Dr. Claude B. Ker,[2] in his recently published book, says that lobar pneumonia as a sequela of measles is very rare. He notes that, when it does occur, his observations show, that it is usually in older children, is severe in type, and has a high mortality, being often followed by empyema. The same authority states that lobar pneumonia is a rare complication of whooping-cough;—"In a series of one thousand-sixty-nine consecutive cases it occurred only three times. All the patients made a good recovery, the disease being trivial when compared to broncho-pneumonia". Regarding pneumonia as a complication of cerebro-spinal fever he says:- "The lesions complicating cerebro-spinal infection are more likely to be broncho-pneumonic, though it is well to remember, that cases of pneumonia, affecting a whole lobe, have been reported as due to the diplococcus

diplococcus meningitidis. On the other hand, Dr. Ker says :- "A comparatively common complication of enteric fever is pneumonia - usually lobar".

Influenza too is not infrequently followed by pneumonia. This is most often of the lobular type, but during a recent epidemic of influenza in the North of England, I attended several cases, where succeeding pneumonia appeared of the typical lobar variety. Two children were among those affected in this way, and the pneumonia ran a fairly ordinary course, though the crises were delayed, as a result of the disease being of the "creeping" or "wandering" type. In hospital, I had previously noted several cases as being of this spreading variety, and in some of these there was a history of preceding "feverish cold and cough". After lasting several days, these symptoms had got worse, along with the onset of shortness of breath. This, I consider, was due to the addition of a pneumonic attack to a previously existing attack of influenza. In an article on pneumonia, Sir J. W. Moore of Dublin[3] says :-"The foremost German authorities on the influenza of 1889-1890 laid stress on the erysipelas-like spread of influenza-pneumonia in the lungs, and on the prominent part which the Streptococcus pyogenes seemed to play in its etiology. "The question however", he continues, "in such cases is probably one of a secondary infection, for which the attack of influenza merely laid the foundation".

However this may be, there is undoubtedly, I think, a tendency for post-influenzal pneumonia to assume a migratory character.

PREVIOUS ATTACKS OF PNEUMONIA were recorded in twenty-eight of the two hundred and eighty-six cases. Some of these could be verified by reference to records of their previous attacks, but the majority had not been treated in the same hospital, and so the parents' statements were the only source of information on that point. That two, and even three, distinct attacks may occur in the first few years of life, I have, however, sufficient evidence to prove. Recurrence, quite soon after an attack, was noted in a few cases. One child, a girl of one year and four months, was treated for lobar pneumonia affecting the right apex. She made a good recovery and left hospital apparently quite well. She remained in good health for nearly a month, and was then brought back and re-admitted to the ward with distinct evidence of consolidation, once more of the right upper lobe. After a time the disease spread to the right base as well, and she eventually developed empyema, and died, a day or two after evacuation of the pus by operation. Another child, a girl of eight years, left hospital well, after an attack involving the whole of the left lung. She continued evidently in good health till two months later, when she was again admitted with well-marked consolidation of the left base.

After a typical course of illness, she made an uneventful recovery.

Another similar case was that of a boy, who, at the age of eleven months, suffered from double apical pneumonia. After a short and severe illness he recovered completely, remained quite bright and in good health for four months. Then he suddenly developed a fresh attack in which the left apex alone was involved. Recovery followed a sharp attack as before.

I have recently had the opportunity of observing the course of a few cases of this nature, and am unable to find any evidence to show that the second attack was more serious than the first, in fact, in most cases, the toxaemia seemed less intense. This might be taken as evidence of a certain degree of protection derived from the previous illness; but the very fact, that recurrences are by no means infrequent, seems rather to imply the absence, to any marked extent, of protective immunity conferred, and seems rather to suggest that an increased susceptibility is induced, as a result of a former attack of the disease.

That a special liability to pneumonia should be present in the members of a family does not appear to me altogether improbable. Such susceptibility is seen in connection with some other organismal diseases, such as tuberculosis and influenza, and it may also exist in relation to pneumonia.

Of course mere coincidence cannot be excluded, but the following family record is to me very suggestive of a family susceptibility. A girl, thirteen months old, was admitted to hospital with double pneumonia, with marked cerebral symptoms. Convulsions supervened and she died exhausted on the fourth day of her illness. On inquiry, I found that three other members of the same family had died of pneumonia. The cases all occurred in childhood, though I have no exact record of the ages, and at intervals of many months. The parents were both apparently healthy, and had never suffered from pneumonia. The children, prior to contracting the disease, had all been in good health.

The recurrence of pneumonia in the same house, at even long intervals, has been noted. The explanation of the existence of such "pneumonia-houses", has not been found. It is possible that the family, whose history I have recorded, were the occupants of one of these houses, where the disease recurs repeatedly, and for some unknown reason.

The infectious nature of pneumonia can be assumed from the records of cases, where two or more members of a family or household, have been attacked by the disease, at, or about, the same time. In only one case in my series, did I find evidence of this occurring. A child was sent into hospital by a doctor, who told me that another child, occupying the same room as my patient, had developed lobar

lobar pneumonia some days before. He was nursed at home, and, just about the critical period of his illness, this second child had suddenly become sick and feverish, symptoms which later proved to be due to the onset of a sharp attack of lobar pneumonia.

Sir J. W. Moore[4] quotes the following from the "Lyon Médical",- "A shop-keeper's child was convalescing from pneumonia when a servant-boy developed the disease. He was removed to hospital, another boy taking his place, wearing the same suit of livery, and sleeping in the same bed as his predecessor. Two days afterwards he sickened with pneumonia. A third boy was now engaged. He slept for two nights with the second boy, and thirty hours later fell ill of acute pneumonia".

This very interesting series of cases affords strong evidence of the infectious nature of the disease. In this instance it was apparently communicated, not only by direct contact from one patient to another, but by the agency of bedding and clothing, as is seen from the infection of the second servant-boy employed, after his predecessor had been removed from the house to hospital. The description of another similar series of cases I have recently read in a French journal. Dr. Vildermann[5] in an article entitled, "Une Epidémie de Pneumonie Lobaire", describes how one member of a family, a girl of six years, took ill suddenly with lobar pneumonia. Eight days later her brother developed the same disease, and finally, after a lapse of two days more, an adult in the same house sickened with it.

That the breath and sputum of pneumonia patients is infectious may be inferred from the fact that cases are recorded though, it must be admitted, very rarely, where patients in hospitals, lying in beds adjacent to those occupied by pneumonia cases, have contracted the disease. That this should be so is not very surprising, when one considers how often the pneumonic sputum is found, on examination, to be full of the characteristic pneumococcus. When patients cough, these organisms must be exhaled in large numbers into the surrounding air, and must in turn be inhaled by any one in the near vicinity. Experimentally it has been shown that the introduction of this sputum into animals, such as rabbits, induces a local inflammatory reaction, followed by a generalised and virulent septicaemia. Similarly, I consider that inhalation of air containing these organisms must be very prone to excite inflammatory reaction in previously weakened pulmonary tissues. This suggests that more care, than is ordinarily exercised, should be taken in regard to the collection and disinfection of the sputum in pneumonia, just as is done in cases of phthisis. In infants, who swallow their sputum, diarrhoea is of very frequent occurrence in the course of a pneumonia, and I think that a definite relation of cause and effect can be traced in such cases.

SEASONAL INCIDENCE:-

Pneumonia, being so often apparently determined in its onset by chill and exposure, might, not unnaturally perhaps, be expected to occur most frequently during the coldest months of the year. That it is of frequent occurrence during the Winter months is certainly true, but, according to most statistical records which I have examined, the greatest number of cases occurs in Spring. The series of cases under review is peculiar and, I think, rather exceptional in this particular. I find that in the Summer months, May, June and July, there occurred the greatest number of cases recorded in any one season of the year, namely ninety-five of the total two hundred and eighty-six cases. The greatest incidence in any month was found to occur in June. In that month were noted forty-one cases, while July came next in order with a total of twenty-eight; April and May following with a record of twenty-six each. On the whole there were more cases in Spring and Summer than in Autumn and Winter. The actual figures were as follows:-

Spring - 79 cases, being equal to 27.6 per. cent of all.
Summer - 95 cases, " " " 33.2 " " " " .
Autumn - 48 cases, " " " 16.7 " " " " .
Winter - 64 cases, " " " 22.3 " " " " .

The lowest monthly record was noted in December, in which month only nineteen cases were recorded.

These statistics are drawn from case-books whose records extend over several years, and why the incidence, as re-

as regards season, should be so exceptional, I am unable to explain. There is one point, however, which I consider worthy of note in this connection. Most of the cases which I had under my own observation, occurred during exceed-ingly hot summer weather, and diarrhoea was a very common symptom for a few days before the actual onset of the pyrex-ial condition. This very exhausting complaint, must, I think, have played no inconsiderable part in lowering the general vitality, and consequently in paving the way for the inroad of the pneumococcus and its toxins. The part play-ed by chill is no doubt similar, in that it weakens the constitution generally, and especially the pulmonary-tissue vitality. Pneumococci have frequently been demonstrated in the secretions present in the throats and mouths of healthy individuals, and it is only when the tissues are depressed, that their powers of resistance can be overcome by the organismal toxins, and that pneumonia results in consequence.

In view of the many published series of statistics regard-ing the seasonal incidence of the disease, and in spite of my own figures showing to the contrary, there seems little doubt that, in general, lobar pneumonia is most common among children in the Spring and Winter months.

In the very cold months of Winter, when the temperature on the whole remains consistently low, there are fewer cases than occur during the Spring months, when, in this country, we are more subject to frequent changes of temperature,

and when conditions are very unsettled, with an atmosphere often exceedingly damp and heavy. We thus see that it is the changes of temperature and moisture of the atmosphere, that appear to act as predisposing causes of pneumonia in those who are exposed to their influence.

Regarding the seasonal mortality, I find, in my series of cases, that the death-rate was highest in Winter, during which season fourteen per cent of the cases ended fatally. The highest mortality was recorded in January. During the Summer months, May, June and July, when the disease was most common, the death-rate was the lowest recorded at any season, and showing a fatality of only 7.3 per. cent. Thus, though this series is unusual in having the greatest number of cases recorded during Summer, the seasonal mortality is more in accord with the usually accepted statements.

MODE OF ONSET:-

The mode of onset of lobar pneumonia is not so characteristic in children as in adults. While, in the latter, an initial rigor is very suggestive of the condition, in children this is not at all a frequent occurrence, and there is a great variety of symptoms ushering in attacks, one or more of which may be present, and predominant, in any given case. Often the initial symptoms are for some days the only well-marked evidence of the presence of any disease; and one must not be led into too hasty a diagnosis of the condition present, but must bear in mind the possibility

of commencing pneumonia. The examination of the chest must be most carefully and systematically undertaken, so as to detect, at the earliest possible moment, any evidence of physical signs, indicative of involvement of the pulmonary system. The results of my investigation into the first symptoms of illness observed in two hundred and eighty-six cases, I now give, the symptoms being arranged in order of frequency of their occurrence:-

1 Vomiting in 135 cases. 7 Delirium in 22 cases.
2 Pain in Chest in 58 cases. 8 Convulsions in 18 cases.
3 Headache in 47 cases. 9 Sweating in 6 cases.
4 Abdominal pain in 33 cases. 10 Epistaxis in 3 cases.
5 Diarrhoea in 25 cases. 11 Sore Throat in 2 cases.
6 Shivering in 23 cases. 12 Faintness in 1 case.

In many cases there were two or more of these symptoms observed almost simultaneously, for example, vomiting and headache. I now proceed to review, in order, these individual initial symptoms.

Vomiting was by far the most frequently noted, occurring, as it did, in nearly half of the cases. In some cases it was merely transient, while, in a considerable number, it was repeated and severe, causing much exhaustion. In other cases there was no actual vomiting, but merely a feeling of nausea. Loss of appetite was in all cases a very noticeable feature from the onset. It appears, like the vomiting, to be due to poisoning of the nerve-centres by the pneumococcal toxin.

Next in frequency came the complaint of pain in the chest, due to pleurisy associated with the developing pneumonia. Headache was often complained of, and with it was sometimes associated earache. The frequency of occurrence of such subjective symptoms could not of course be gauged with any degree of accuracy, because so many of the patients were not of an age to give any intelligible indication of their condition, or of the situation of any pain which was present.

Abdominal Pain was the first indication of illness in forty-three cases. This again is necessarily a minimum, as explained above. The occurrence of the symptom is thus seen to have been of considerable frequency, and, in many of the cases displaying it, there was no evidence of any gastro-intestinal or other abdominal disturbance. It was due, in most cases, to a certain misreference on the part of the brain. While the real seat of its production was in the chest, being due in many cases to diaphragmatic pleurisy, the pain was referred to the terminal branches of the intercostal nerves in the abdomen. Some of the patients did actually suffer from coincident sickness and diarrhoea, and, in these, the pain was no doubt due, in part at least, to some local irritation, which was the exciting cause of one, or both, of these conditions.

Diarrhoea often occurred alone, but was also noted as being a frequent accompaniment of convulsions and vomiting.

It was by far most frequent in infants under two years of age. Only one child over five years was noted as being affected with this initial symptom. The motions were usually green in colour, offensive in odour, and contained much mucus, and, in a few of the more severe cases, blood as well.

Definite Shivering occurred in twenty-three cases. It is not nearly so common in children as in adults, and in no case was it observed in a child under two years of age. Eight of the children showing this symptom were under five years, while fifteen were between the ages of five and twelve. It is thus seen to be very much commoner in older children, though not a frequent symptom at all in childhood. It occurred in four apical and nineteen basic cases, showing a percentage of nearly six apical and thirteen basic.

Delirium appeared in twenty-two cases. The number of cases with reference to age was as follows;- Under two years there were three cases; over two, and under five, years there were seven; while over five, and up to twelve, years twelve cases showed this symptom.

Usually the delirium was transient, and made its appearance at once, along with the first sudden rise of temperature.

It was slightly more frequent, in proportion, in those cases where the lung apex was involved, than in those where the base was the seat of the disease. Generally it showed itself by great restlessness, and talking or screaming during sleep. In a few of the older children it became more active, and they made attempts to get out of bed.

Initial Convulsions were not so frequent as might have been expected. They occurred in only eighteen cases, and were usually accompanied by headache and vomiting, and succeeded by great drowsiness. The actual numbers of apical and basic cases exhibiting this symptom were practically equal, and this shows a greater percentage affected of apical cases, while, in three cases, both upper and lower lobes of one side were simultaneously involved.
Of the eighteen cases one third were under, and two thirds over, the age of two years. Such initial convulsions did not appear to add appreciably to the gravity of the prognosis, though in many cases they caused considerable exhaustion. To compensate for this, the convulsions were, in several instances, followed by many hours of quiet refreshing sleep.

Profuse Sweating occurred at the onset in six cases, all being those of older children. In three, at least, of these cases there was a history of preceding "feverish cold", probably, I consider, influenzal in nature.

Epistaxis was of infrequent occurrence and was apparently due to congestion of the upper respiratory tract.

The other initial symptoms were so very rare as to be almost negligible; they were no doubt due to the toxin affecting organs previously weakened in resisting power.

A frequent development during an attack was a more or less well-marked Herpetic eruption. This was noted in twenty-four cases, being equal, approximately to 8.4 per. cent. I think this is an unusually small percentage of cases, having observed this cutaneous affection in almost half of the cases which I have treated myself. Two of the twenty-four cases showing this symptom, were fatal, both being extensive cases involving both lungs. It usually appeared on the lips or chin, but was sometimes noted on the nose. It may appear in other situations, and even the cornea is sometimes affected by it. Herpes was much more common in older children than in infants, and in only one instance was its presence noted in a child under two years of age. Three children were over two, and under five, years, leaving twenty as the number affected after that age. There is absolutely no connection between the situation of the pulmonary lesion and that of the accompanying herpetic eruption. The appearance of a good eruption of herpes has been described as a favourable prognostic sign, but I do not think it is to be depended on. Of the twenty-four cases showing herpes two ended fatally, a percentage mortality of 8.3, whic is almost as high as that of all the cases examined.

I now proceed to a consideration of the relative

frequency with which individual lungs, or lobes of the lungs, were affected. In tabular form I give, first, the result of my analysis:—

Right Lung - Upper Lobe only, in 58 cases.
- Lower Lobe only, in 56 cases.
- Middle Lobe only, in 4 cases.
- More than one lobe in 20 cases.

Total - 138.

Left Lung - Upper Lobe only, in 16 cases.
- Lower Lobe only, in 82 cases.
-More than one lobe in 11 cases.

Total - 109-

Both Lungs - Upper Lobes only, in 3 cases.
Lower Lobes only, in 24 cases.
Upper and Lower(two lobes or more) in 16 cases.

Total - 43.

Site of lesion not ascertained in 1 case.

From the foregoing table it is evident that the left lower lobe was by far the most frequently affected area, in cases where one lobe alone was involved. Next in frequency came the right lower lobe. Almost equally frequent were cases involving the right upper lobe, and, at a long distance, came the left upper lobe. The least frequently affected of all was the right middle lobe. Statistics are found to differ considerably with regard to this question of relative frequency, but most agree in showing that the right lung is more often implicated than the left.

The percentages found were as follows:

Right Lung alone - 46.5 per. cent.

Left Lung alone - 38.1 per. cent.

Both Lungs - 15.0 per. cent.

Lesion not located .3 per. cent.

It seems impossible to explain why the right lung should be more frequently the seat of the disease than the left. Various explanations have been given, but I have seen none that appears at all satisfactory.

Koplik[6] writes-"According to Jürgensen the greater frequency of pneumonia on the right side may be attributed to the larger size of the right bronchus, and the more direct communication with the lung". I can quite appreciate how the larger bronchus would more readily admit a foreign body of some considerable size, but I cannot see why such a microscopic organism as the pneumococcus should find it easier to traversethe slightly wider tube, when the lumen of either bronchus, and indeed of its small branches, is so enormous in comparison with the size of the organism. Again, considering that the same anatomical arrangement of the bronchi is practically always present, one would expect the proportion of right-sided cases to be much greater than it is, if this structural difference was the real cause, as stated. In the cases I have noted there is only a difference between right and left sided cases of ten per. cent, - not a very striking disproportion.

In cases involving the whole of one lung I found that, here again, the right-sided were in excess of the left-sided.

Regarding those cases classed as double pneumonia, I find that the percentage is rather in excess of most records which I have seen, though Holt gives it as 13 per. cent. of his cases.[7] I observe that Dr. Melville Dunlop, in writing on this subject, states that, of one hundred and forty-seven cases analysed, eight only were double cases.[8] This figure he gives, "with reservation in the absence of confirmation by post-mortem examination", as he evidently thinks it is too high an estimate. He goes on to say, that he believes, that "double pneumonia is oftener diagnosed than is perhaps always justifiable". The difficulty often lies in deciding whether the physical signs, heard over the second lung, are produced there, or are conducted from the other side of the chest. That such well-marked conduction is common is well-known, and this is especially the case in the auscultation of the chests of children. Again, blocking of some small bronchus by mucus may cause temporary collapse of a part of the lung, and such an area of collapse may be mistaken for one of consolidation. The series of cases which I have examined showed a much more frequent occurrence of double pneumonia than does the series commented on by Dr. Melville Dunlop. The respective percentages are 15 in my series and 5.4 in the other. Of course the same objection regarding lack of post-mortem confirmation may be urged here.

Though I am naturally not in a position to offer proof of the correctness of the diagnosis in all these cases, I consider it a fact of no little significance, that post-mortem examinations, held on ten of the fourteen fatal cases, diagnosed as double, resulted on each occasion in confirmation of the accuracy of the diagnosis. In the other four cases running a fatal course, permission for autopsy could, unfortunately, not be obtained.

In one case the lesion could not be definitely localised. Though the child, a boy of five years, had all the appearance, and many symptoms, of an ordinary lobar pneumonia, no physical signs could be made out. Repeated and careful examination of all areas of the chest failed to reveal any evidence of consolidation. The child went through a short course of evidently acute illness with considerable elevation of temperature, rapid pulse, and "inverted" panting breathing, and, after an early and abrupt crisis, made a rapid and uneventful recovery. It is generally admitted that such cases do occur now and then, and that, in spite of most careful examination, no physical signs of pulmonary consolidation can ever be made out. Such a condition, of things must, however, be regarded as quite exceptional, even in connection with the deep-seated, or so-called "central"pneumonias.

The question of the frequency of occurrence of cerebral symptoms, in apical and basic cases respectively, is of some interest, and will be discussed later in dealing with/ner-

nervous manifestations.

The relative mortality with regard to the region involved may suitably be mentioned here. Of the cases in which a single lobe was involved the right apicals showed by far the greatest death-rate, 11.8 per cent. of such cases proving fatal. The right basic cases came next with a mortality of 3.5 per cent. The left basics ended in death in 2.4 per cent. of the cases, while among the left apicals there were no fatalities.

When the whole of one lung was involved the mortality among right-sided cases was 20 per cent; while only 9 per cent. of the left sided cases ran a fatal course. The double apical cases were few in number, and all recovered; while, of the double basic cases, which were eight times as numerous, a quarter of their number, or 25 per cent. succumbed. The highest death-rate of all was noted, as would be expected, among those cases where both lungs were extensively diseased, three, four, and, in some cases, all five lobes being implicated.

Such cases numbered sixteen in all, and of these eight, that is 50 per cent. proved fatal. From these records we see that, not only was right-sided pneumonia of more common occurrence, but it also led much more frequently to a fatal issue, than did diseaseof the left side.

The death-rate in double pneumonia cases was extremely high being equal to 32.5 per cent. of the cases; while among single cases the death-rate was only 6.2 per cent.

LEUCOCYTOSIS:-

The estimation of leucocytosis was recorded in a comparatively small number of cases. The highest estimate I noted was thirty-four thousand per cubic millimetre; in a girl of five years. The right apex alone was affected when I made the estimation, though later the patient succumbed to a general peritonitis complicating the primary pneumonia. The lowest recorded count was eight thousand two hundred, in a boy of six years. His right base was affected and he made a good recovery. I found that, as a rule, in apical cases the leucocyte count was higher than in those, where the lesion was situated at the base. I do not, however, think that this point is of value as an aid to diagnosing the site of disease, in the absence of definite physical signs.

The presence or absence of leucocytosis is of interest from a prognostic point of view. Depending, as it does, on the virulence of the toxaemia, and on the powers of resistance of the tissues, it often gives some indications of value.

In general, the presence of a well-marked leucocytosis in a severe case, is, as in adults, a good sign, while a low count, except in an unusually mild attack, is of bad omen.

The discovery of a high degree of leucocytosis proved to be of assistance in arriving at a diagnosis in one or two cases, where the physical signs of pneumonia were undeveloped, and in which, on account of rather pronounced gastro-intestinal and cerebral symptoms, the patients were being regarded and treated as possible cases of enteric fever.

The Temperature, Pulse, and Respiration all show characteristics peculiar to the disease, and opportunities of studying these are valuable, in children especially, because the respective organs and mechanisms concerned, have not suffered, as a rule, from the effects of previous disease. Each of these will be dealt with in turn, the temperature being considered first.

TEMPERATURE:-

The typical temperature curve of lobar pneumonia in children differs little from that seen in adult cases. Its outstanding features distinguish it from that of almost every other disease.

In most of the cases under consideration, the temperature rose suddenly at the very onset, 'by crisis', one might say. A leap up from the normal line to 103 degrees, or even higher in a few hours, was not uncommon. In older children, the temperature, after this sudden rise, usually remained elevated and fairly steady for a varying number of days, when it suddenly fell again by crisis. In infants there was frequently present a more or less marked tendency to remissions of temperature, but on the whole it remained

elevated throughout the course of the disease, until the crisis or lysis set in. In the majority of cases, the maximum temperature was reached between the third and fifth days of the illness.

The accompanying charts show the temperature curves of three fairly typical cases of lobar pneumonia.

Chart 1. shows the sudden rise, and the steadiness, of the temperature once the "fastigium" has been reached. The typical fall by crisis, followed by a post-critical rise, is also seen.

Chart 2. shows a case, where there is a tendency to remission of temperature before the crisis.

Chart 3. shows a more gradual crisis, which is not followed by any post-critical rise:-

Chart 1.

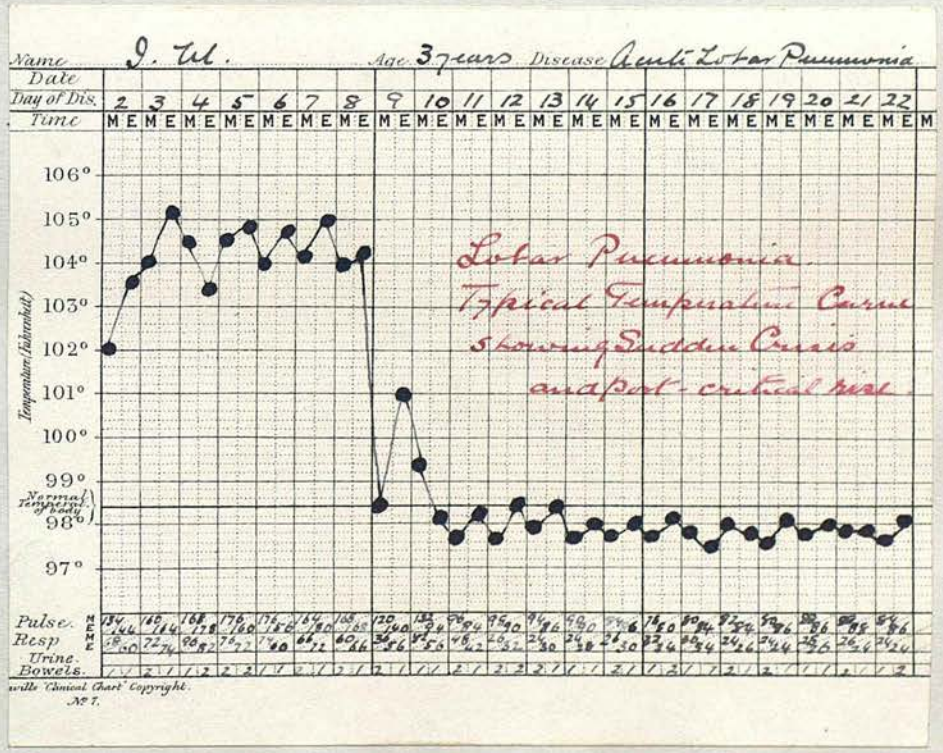


Chart 2.

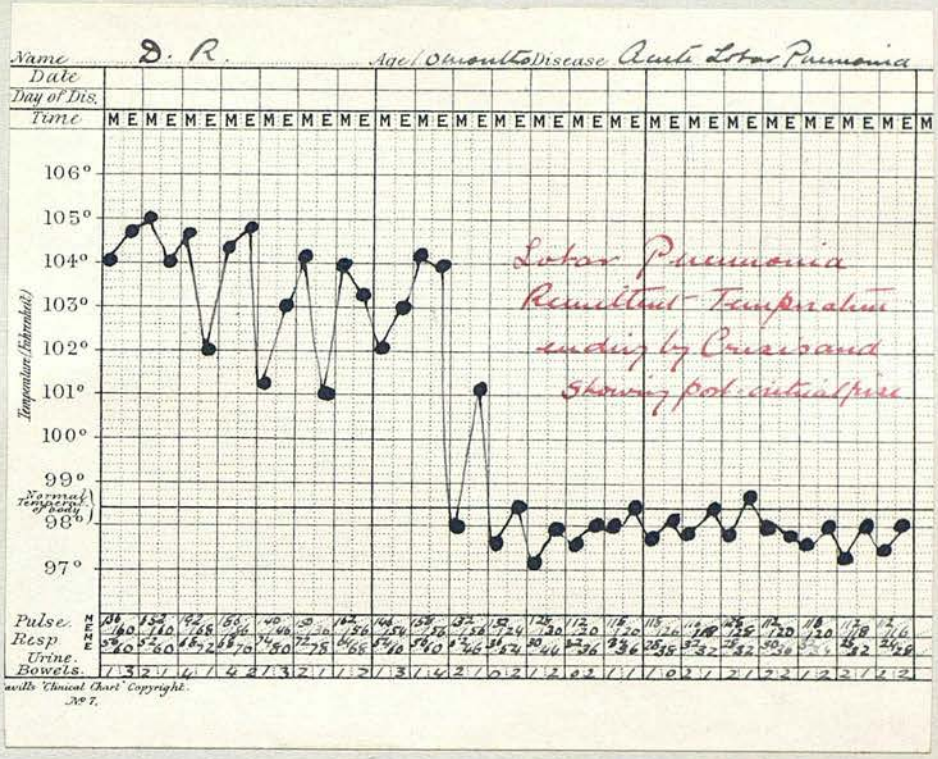
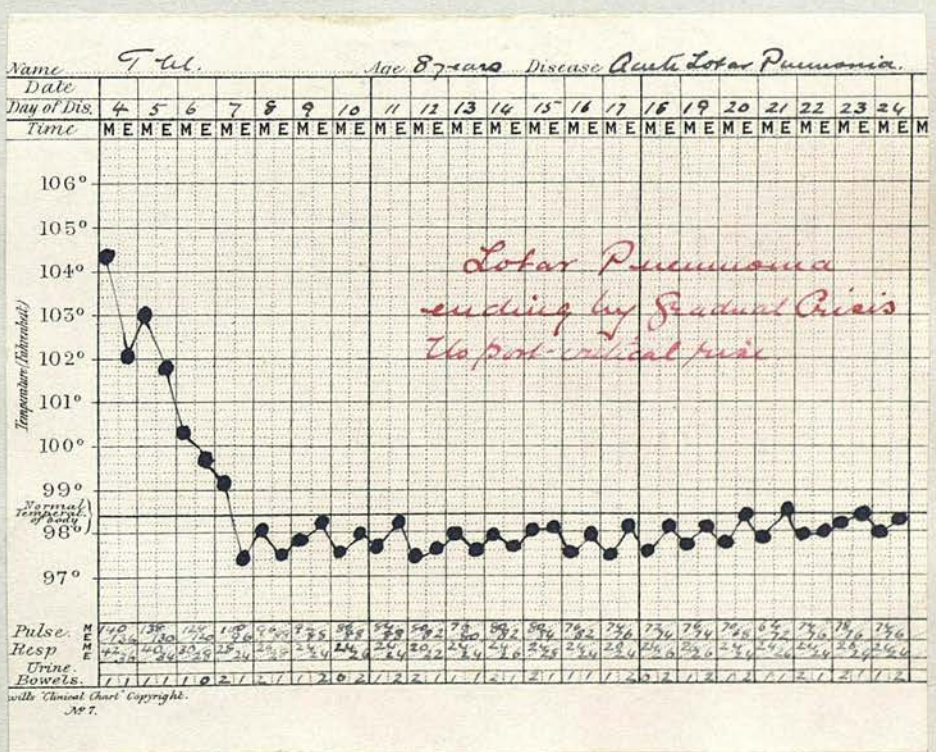


Chart 3.



The occurrence of a well-marked crisis was noted in two hundred and twenty cases, that is in 76.9 per cent of the whole; while in forty-two other cases, or 14.6 per cent. of all, the temperature fell by definite lysis. Nineteen cases were without crisis or lysis, and in these (6.6 per cent.) the temperature remained high till death, or else fell just immediately before the end, as a result of exhaustion and collapse. In five cases, (or 1.7 per cent), the temperature never rose to any marked extent, and in these the occurrence of the crisis or lysis was not appreciable. Three of these five cases were of a very mild type, the physical signs being quite definite, but the patients remaining quite bright and happy throughout. In the other two cases, the intense toxaemia caused collapse very soon after the onset, and, though the patients survived for several days, the temperature never rose to any extent, but remained sub-normal practically all along till death. The following table gives the day of the illness on which the crisis occurred in two hundred and seven cases:-

2nd day of illness - 3 cases.

3rd day of illness - 10 cases.

4th day of illness - 13 cases.

5th day of illness - 15 cases.

6th day of illness - 23 cases.

7th day of illness - 37 cases.

8th day of illness - 48 cases.

9th day of illness - 12 cases.

10th day of illness - 28 cases.

11th day of illness - 4 cases.

12th day of illness - 4 cases.

13th day of illness - 8 cases.

14th day of illness - 2 cases.

16th day of illness - 2 cases.

In the remaining thirteen cases where the disease ended by crisis, the day on which it occurred, was doubtful, as the history of the cases was too indefinite to admit of accurate calculation.

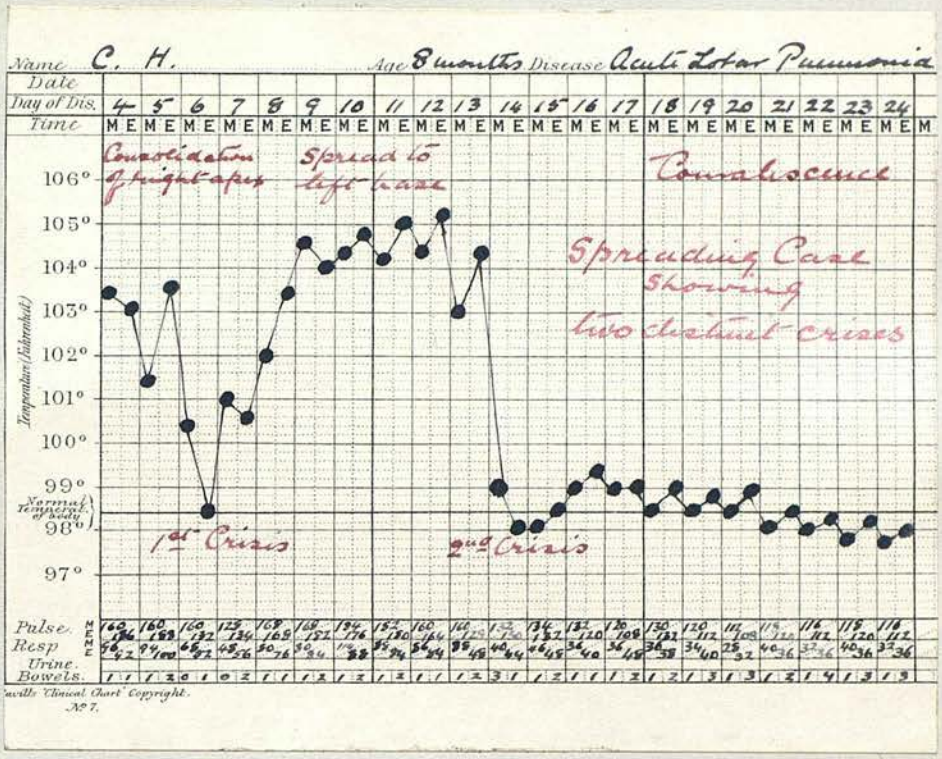
As a rule, the crisis was heralded by some aggravation of the existing symptoms. Delirium was very common for some hours preceding it. Exhaustion and considerable prostration were common symptoms just after the crisis, and, in one case, death followed a few hours later.

In this case the child appeared to have had an ordinary crisis, and was sleeping quietly; but a few hours later it suddenly collapsed and died, presumably as a result of cardiac failure induced by the intensity of the toxaemia.

In thirteen cases the temperature charts showed the occurrence of two distinct crises. These were cases of a spreading type, in which as one lobe was resolving, another became involved. The temperature which had fallen by crisis suddenly shot up again, and, after remaining high for a few days, again dropped down by sudden crisis as before.

Chart 4. shows a temperature curve of this nature. The right apex was first involved, and, while this was undergoing resolution, the left base became affected, and the temperature again rose and finally fell by crisis a second time.

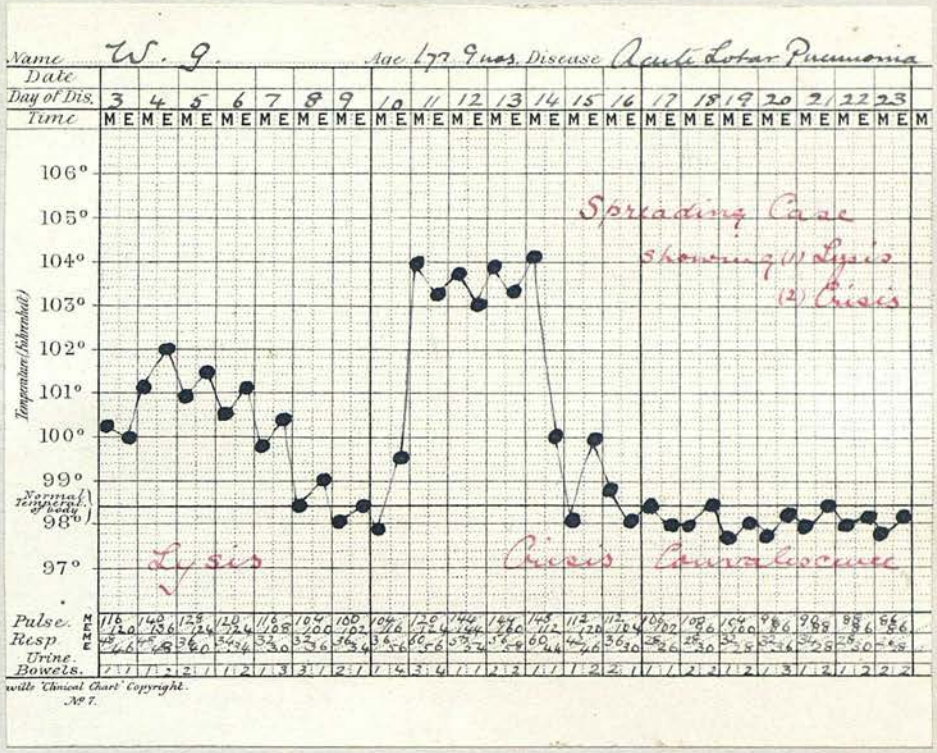
Chart 4.



Another case was peculiar, in that the temperature settled by lysis lasting from the fourth to the ninth day, and then, after it had been normal for two days, ran up again quite suddenly to 104 degrees. It remained high for four days, and then fell by distinct crisis. In the first instance the right apex was involved, and later the disease spread to the lower lobe of the same side.

The temperature of this case is shown in Chart 5.

Chart 5.



A false crisis was frequently observed. This is a fall of temperature occurring usually on the day preceding the true crisis. The temperature falls suddenly to the normal line or near it, and remains down for a few hours.

The symptoms are often less marked during this temporary lull, but soon the temperature rises again with renewed severity of the symptoms. Then, shortly after, the true crisis occurs and the temperature falls as described before, and, except for a slight post-critical rebound, it remains down in uncomplicated cases.

A post-critical rise was noted as occurring in one hundred and seven of the cases, that is in 48.6 per cent.

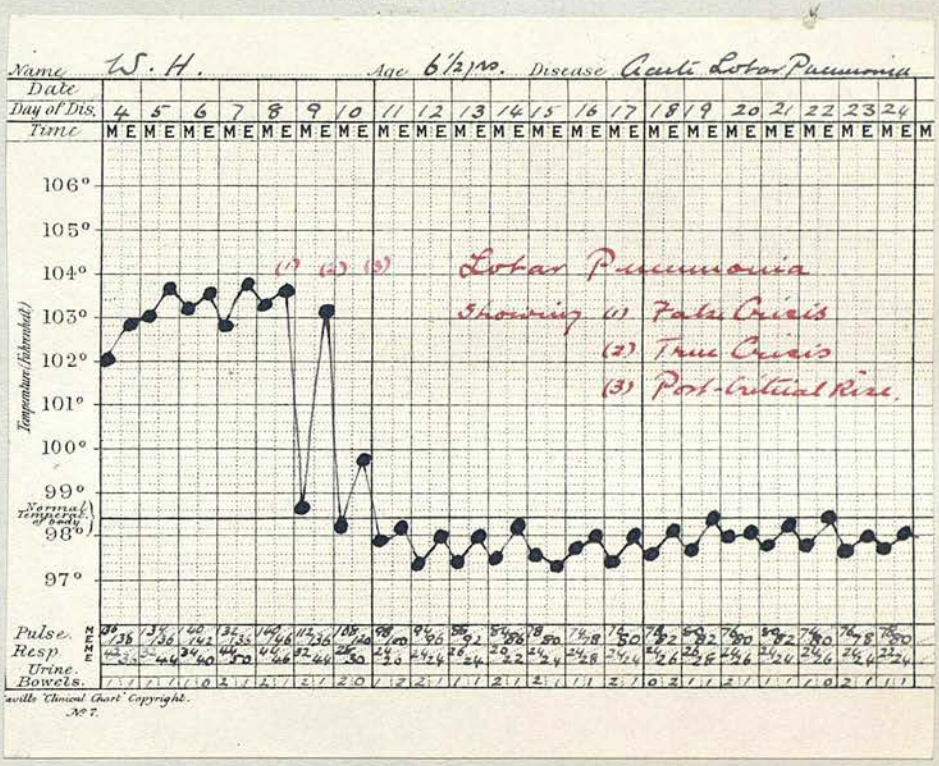
As a rule this lasted for a period of less than twelve hours, and then the temperature quite subsided.

It was more often present in cases which had presented a high

temperature before the crisis, and was absent in nearly all cases where the temperature had remained comparatively low. A continuance of the post-critical rise for more than twenty-four hours, was usually explained by the subsequent development of some complication, such as empyema.

Chart 6. shows the temperature record of a case showing well-marked false crisis, true crisis and post-critical rise.

Chart 6.



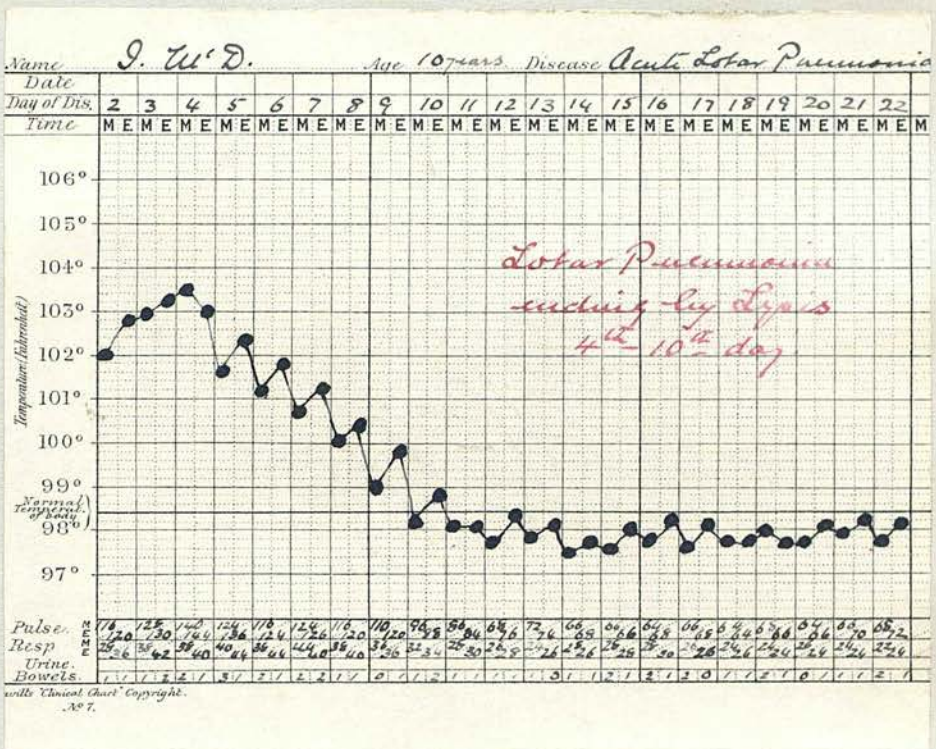
Fall of temperature by lysis, while not the form of defervescence typical of lobar pneumonia, is, nevertheless, not uncommon. As already stated it occurred in 14.6 per cent. of all the cases noted. Holt[9] says,-"This is a mode of termination much more frequent in young children, than in those who are older".

My own observations agree with this, as out of ninety-one cases of infants, lysis occurred in nineteen, and crisis in seventy-two; while, out of one hundred and seventy-one cases of older children, this mode of termination was noted in twenty-four cases only, while crisis occurred in one hundred and forty-seven.

In many cases I found that there was some coincident condition present, which seemed to be, to some extent at least, responsible for the more gradual defervescence. Thus ear discharges were common among these cases, and I also have noted, that a lysis often occurs in cases, where there is much pleurisy present, or any pleural effusion. Lysis was found to last, as a rule, for four to eight days, but in some instances it was more protracted. One case I have noted, where it started about the sixth day of illness, but was so gradual that the temperature was not at the normal level till the eighteenth day. The patient was an infant of nearly two years, who had double basic pneumonia. The temperature reached 105 degrees F. and fell by lysis as described. This is an exceptionally prolonged defervescence in an apparently uncomplicated case. This gradual fall of temperature is less exhausting to the patient than a sudden crisis, with a fall of perhaps six or seven degrees in a few hours. Still, in children, an excessive degree of exhaustion and of post-critical prostration is rare, compared with the frequency of its occurrence in adults. Resolution sets in at the commencement of lysis, and its progress, though rather less rapid than in cases ending by crisis, seems to

be quite as complete and satisfactory. The accompanying chart shews the temperature curve of an uncomplicated case terminating by lysis.

Chart 7.



The maximum temperature most frequently reached was between 104 degrees and 105 degrees F., though this was exceeded in many cases. The following table gives the list of all the recorded maximum temperatures, (excluding the great heights reached in some cases at the time of death).

Temperature	Cases.
97 - 98 degrees(exclusive)	-1.
98 - 99 - -	-0.
99 - 100 - -	-2.
100 - 101 - -	-3.
101 - 102 - -	-13.

Temperature	Cases.
102 - 103 degrees(exclusive)	-25.
103 - 104 - -	-66.
104 - 105 - -	-97.
105 - 106 - -	-69.
106 - 107 - -	-10.

The highest recorded temperature was 106.6 degrees.- This was reached in the case of a girl, nine months old, who developed cerebral symptoms, and eventually died exhausted by repeated and severe convulsions. Ten cases had a tempera-ture over 106 degrees, and of these three proved fatal. Forty-four showed a temperature record between 105 and 106 degrees, while twenty-five reached 105 degrees. Of the former nine died, while of the latter class all recovered except one.

Thus we see that such hyperpyrexia is not always in itself a very dangerous condition, as out of seventy-nine cases, whose temperature reached 105 degrees or higher, only thirteen, or 16.4 per cent, ended fatally, and, in many of these, some other complication was present. In most of the cases, the temperature remained at these high levels, only for a few hours, and in many cases, seemed to do little harm. The great danger is when the hyperpyrexia continues for some days, and that in spite of active measures directed towards reducing it. In several cases the temperature ran up to a great height, 107-108 degrees or even higher, just before the patient's death. This great rise was due, no doubt, to a profound degree of exhaustion of the heat regulating centre in the medulla.

As these temperatures can hardly be said to have occurred in the regular course of the disease, I have omitted them from the table above.

THE PULSE:-

Turning now to the pulse, I first discuss its rate and characters during the disease.

The following table gives a list of maximum pulse-rates recorded, with the number of cases reaching that maximum:-

Pulse-rate	Cases.
100 - 109 per. min.	-3
110 - 119 - -	-5.
120 - 129 - -	-30.
130 - 139 - -	-31.
140 - 149 - -	-81.
150 - 159 - -	-22.
160 - 169 - -	-57.
170 - 179 - -	-19.
180 - 189 - -	-28.
190 - 199 - -	-1.
200 - 209 - -	-7.
Doubtful - -	-2.

From this table we see that the most frequently attained maximum pulse-rate was between 140 and 150 per. minute. This was reached in eighty-one cases, but it was exceeded in a very large number of cases. In thirty-seven cases a rate of over 180 per. minute was noted. As a rule such great rapidity of pulse was of serious import, and of these thirty-seven cases eleven ended fatally. Still even

Still, even very great increase of pulse-rate, while undoubtedly an indication of danger, must not be looked upon as an infallible indication of impending collapse. Several cases, which I have examined, and which eventually recovered completely, had for a short time, at least, a pulse-rate of about 200 per minute. In the early stages the pulse was usually rapid but fairly full and strong. Soon, however, it began to show signs of loss of pressure. Especially in long-continued cases, there was a very distinct fall of pulse-tension: Such lowering of tension, especially when it occurs in association with increasing rapidity, is an important sign of weakening of the left side of the heart.

Irregularity of the pulse was sometimes noted during the pyrexial period of the disease. Unless extreme, this irregularity does not seem of much prognostic importance, as it may often be observed as characterising the pulse of even quite healthy children.

The pulse-pressure, as has been said, tends to fall shortly after the onset of the illness, and the pressure usually remains low till after the crisis. If, soon after that event, the tension does not show signs of increasing, it is an unfavourable element in prognosis. During convalescence the slow rate, and irregularity, of the pulse attracted attention in several cases. In one case a pulse-rate of sixty-four per minute was recorded, about a week after the crisis, an unusually slow rate of pulse to be found in a child of a few years.

Much lower rates have been recorded by other observers, even in quite young children.

The phenomenon appears to be due to the influence of the pneumococcal toxin on the cardiac muscle.

Regarding this subject Henoch[10] says:-"Perhaps the molecular changes in the heart-muscle, which occur in diseases, when the fever is very high, and which are afterwards recovered from, account for this symptom."

Dr. Oliphant Nicholson[11] regards this slow and irregular pulse as "a characteristic post-febrile feature of the pulse in children". He says,- "The pulse in children during convalescence from acute disease generally becomes very slow, and the individual beats are of unequal duration. The peculiar halting character of this slow pulse is strikingly noticeable some days after the crisis of acute pneumonia."

A fatal result from cardiac failure, so common in adult pneumonia, seems very much less frequent in children. This is due, no doubt, as suggested by Hutchison[12], to the presence of the large "reserve power of the child's heart, along with the healthy condition of the kidneys".

Of all the cases I have examined, only one ended fatally from sudden cardiac failure, and this occurred shortly after a crisis, and when the child seemed to be going on well towards recovery.

THE RESPIRATION:-

The respiration in cases of lobar pneumonia presents several interesting and peculiar features. In many cases its rapidity and altered character are among the first symptoms of illness to attract attention. In almost every case there is very great increase in the rapidity of the respirations. In young children this may not at first be very apparent to the eye, because at the same time the breathing may be shallow. It can be more readily appreciated by laying a hand on the child's abdomen.

From my analysis of cases I find that the most frequently attained maximum respiration-rate was between sixty and seventy per minute, this occurring in seventy-four of the cases. In other seventy-two cases, however, the maximum reached was between forty and fifty. In some cases very great acceleration was noted, the highest record being one hundred and thirty-two respirations per minute. This extraordinary rate was reached in the case of a child, one year and four months old, and was associated with disease involving the whole of the right lung, complicated by suppurative pericarditis. This case ended fatally on the eleventh day of illness. In two other cases, the respirations reached the rate of one hundred per minute. One was the case of a boy of seven months, whose whole left lung was consolidated, but who eventually made a good recovery.
The other case, which ended fatally, was that of a girl aged three years, and in this instance there was consolidation of

of both right and left lower lobes. Post-mortem examination showed extensive grey hepatisation on both sides, with marked oedema of the upper lobes as well.

I found practically no difference between the rate of respiration in apical and basic cases, taken as a whole.

A simple, and, at first sight, quite reasonable explanation of the rapidity of respiration, would be, that it is due to the extent of lung tissue involved. In many cases, such as those, particulars of which I have just given, this would appear quite a satisfactory explanation, but with reference to other cases it is found to be untenable. For example, in cases where the right middle lobe alone was diseased, I found the average rate of respiration to be between fifty and sixty per minute. I cannot think that the above explanation can hold good here, where both lobes of the left lung, and the two larger lobes of the right lung, were quite unaffected, and were performing their usual function, while the only part thrown out of action was such a comparatively small area as the right middle lobe. Again, if the rapidity of respiration be due to extensive tissue involvement, why does one find a child breathing very rapidly at the very onset of illness, and before there is any sign of consolidation, or even of excessive congestion, being present? Then, conversely, why does the rate of respiration suddenly become so much slower immediately after the crisis, while the consolidation and congestion clear up much more gradually? To answer these questions the explanations given

above are quite insufficient, and we must look for some explanation apart from that which ascribes the change to mere mechanical obstruction.

To a certain extent this cutting off of available air-space is bound to play its part, but, that all the symptoms are due to that cause, it is difficult to believe. In extensive consolidation, especially in its later stages, the pulmonary obstruction without doubt plays a very considerable part in producing dyspnoea, but at present it is rapid shallow breathing, without actual dyspnoea or distress, which is under discussion.

Having rejected the theory regarding the local pulmonary condition, we must look elsewhere for an explanation of the respiratory phenomena. With this object in view I now turn to look at the other essential factor in the production of respiration, namely the nervous mechanism. It has been proved, by many physiological experiments, that the respiratory mechanism is presided over, and is, to a great extent, controlled, by the respiratory centre in the medulla.

To this centre and its connections we must look for an answer to our questions regarding the respiratory phenomena observed in pneumonia. In this connection I have been largely guided by the teaching of Dr. Sutherland, with whom I have had many opportunities of studying cases, and of discussing the causation of the various symptoms observed in patients, under treatment in the Children's Hospital at Paddington Green.

The explanation which he offers of these phenomena, seems to me to be the most satisfactory in accounting for their occurrence, whether examined from the clinical or the physiological standpoint.

The changes are held to be due to a disturbance of the respiratory centre in the medulla, and this disturbance is excited by the agency of an irritant present in the lungs. The pneumococcal exudate causes stimulation of the terminal pulmonary branches of the vagus nerve. The nerve-impulse thus aroused, is carried to the respiratory centre by afferent branches of the vagus. The result is an increase in the frequency of the respirations, and, at the same time, they are rendered more superficial, results which have been amply demonstrated by experiment on animals. "We can also understand", says Dr. Sutherland,[13] "why it is that the increased frequency of breathing is present from the onset, is quite irrespective of the extent of lung involved, and is out of proportion to the rise in temperature, when compared with other pyrexial affections". This seems to me to be a most convincing and satisfactory theory regarding the causation of these respiratory phenomena from a clinical point of view, and, at the same time, it is quite in accordance with proved physiological facts. Such rapidity of respiration, as is often present in the early stages of pneumonia, might reasonably be expected to be a source of much discomfort and distress to a child. That this is not the case, I have often noticed.

Not infrequently I have seen a child sitting up, or lying in bed, playing with a toy or doll, and with a perfectly contented expression, while, at the same time, its respirations were at least double the rate usually found in a child at that age in health. Such freedom from respiratory distress may continue throughout the whole course of the illness. In this particular, lobar pneumonia presents a marked contrast to broncho-pneumonia, in which the patient usually shows, to a striking degree, the signs of distress, while the face presents an anxious and pained expression. Dr. Hughlings Jackson[14] has described the medullary respiratory centre as controlling involuntary and unconscious breathing, while voluntary and conscious respiration is reg-ulated by the cerebral cortex. Thus a medullary stimulus, such as is present in cases of pneumonia, causes acceleration of the involuntary respiration, and alters its character, and yet the patient is quite unconscious of the change. This explains the absence of distress even when the respiration is very rapid.

Another very interesting feature of the breathing in many cases of lobar pneumonia, is the assumption of what has been called an "inverted rhythm". The normal respiratory cycle consists of inspiration, expiration, pause; but in this "inverted" type of respiration it becomes expiration, inspiration, pause. Various explanations have been offered of the cause of the inverted respiration. Dr. Eustace Smith[15] says,- "This is probably due to an effort to suppress the cough". Others seem to suggest that the inverted type

type is rather an improvement on Nature's method of respiration , affording better chance for the interchange of gases in the lungs. Such explanations do not appear very satisfac-tory. I have seen the inverted type of breathing in cases where there was no cough to be made out; and, as regards the natural type of breathing being improved on, this is, I think, extremely unlikely, to say the least of it.

Here again, a central, and not a local, condition must be admitted as the underlying cause of this very interesting phenomenon, which is not yet fully understood, nor satisfactorily explained. It may be classed along with such cerebro-respiratory peculiarities as uraemic breathing, and Cheyne-Stokes respiration.

In association with inverted respiration there is often noticed a peculiar "grunting" or "panting" sound produced during the act of expiration, when this is specially forcible. Various theories have been advanced as to its mode of production. The following passage occurs in the translation of Pfaundler and Schlossman[16]'s book:- "It is probable that the grunting expiration depends chiefly upon an involvement of the pleura. This explains why, in a central pneumonia, (to which many apex pneumonias belong especially), it is so frequently absent". I take this to mean that it is due to pain produced by involvement of the pleura, but that this grunting is due to the presence of pain in the chest, I do not hesitate to deny, because I have myself observed it in several cases where pain was entirely absent. I also dis-

disagree with the second part of the opinion quoted. That this "panting" breathing is sometimes absent in "central" pneumonias may be the case, but, in many cases of this kind, I have noted its presence, when no definite physical signs had as yet appeared, and I consider its presence to be of much value as an aid to diagnosis in those difficult cases where the physical signs are late of developing. The "grunting", I consider, to be due simply to unusually forcible expiration. It occurs only in association with the inverted type of respiration, in which the act of expiration is performed by muscular effort. In this type of breathing, a long breath is taken in, and the air is then held for a time in the lungs, the glottis being closed. Then muscular effort comes into play, and raises the air-pressure, till the vocal cords are driven suddenly apart, and the air is expelled forcibly. The sound is, I think, produced by this sudden separation of the vocal cords, in much the same way as, though in a less violent manner, than, the production of the sound in coughing is brought about. "Cyclic" or "cerebral" breathing is seen in rare cases. This type shows several rapid respirations followed by a pause, after which the rapid breaths are repeated, and so on. This is not unlike the Cheyne-Stokes type, to which it is no doubt related, being due to poisoning of the centre in the medulla by the products of the pneumococcus. The usual type of respiration present in a child in health is almost entirely abdominal, and, in early pneumonia, this is simply

intensified. In the later stages, and especially when there is extensive consolidation, or accompanying bronchitis, the costal type comes into play; the respirations become slower, deeper, and laboured in character, and the extraordinary muscles of respiration are thrown into action to assist each inspiration. This costal type of breathing appears when the ordinary mechanism is thrown out of gear by the prolonged over-stimulation, and consequent exhaustion and paresis, of the medullary centre.

In relation to respiration the action of the alae nasi is of considerable interest. In young children, and even in some adults, a slight degree of inspiratory dilatation may be seen in health. In cases of respiratory obstruction from any cause, this movement is greatly exaggerated. Action of the alae is also common during attacks of pneumonia in children. In the two hundred and eighty six cases I have reviewed, I found this action noted in seventy-one cases. This is, I consider, a small proportion as I have noted it myself in a majority of the cases I have seen. In these notes, too, there was often no mention as to the time of the occurrence of dilatation with regard to the respiratory cycle. I have examined carefully, and have recorded the results of my observation of, twenty-seven cases where this movement was distinct. I have noted seventeen of these as exhibiting the symptom during the act of inspiration, while in the remaining ten cases expansion occurred during, and as a rule towards the end of, expiration.

Dr. Sutherland, in his paper on pneumonia already mentioned, says:- "My own observation has led me to believe that there is no such inspiratory dilatation of the nares in uncomplicated pneumonia, because there is no pulmonary obstruction. Nevertheless there is in pneumonia an exaggerated movement of the alae nasi, but it consists of an expiratory dilatation". The result of my own observations in such cases, is to a certain extent, in agreement with the last part of this opinion quoted, but, in a certain, and by no means inconsiderable, proportion, of cases I found that expansion of the nares distinctly accompanied inspiration. In these cases, too, I had no reason to believe that any morbid condition was present, other than uncomplicated lobar pneumonia. The inspiratory dilatation was present in cases where breathing was of the normal type, as regards rhythm; while expiratory expansion more often characterised the "inverted" type of respiration.

Inspiratory dilatation is due to the excessive action of the "dilatatores nasi" muscles. These, under ordinary conditions, are kept in slight action to antagonise the natural tendency to approximation of the alae. According to Gray's Anatomy :- "Their action in ordinary breathing is, to resist the tendency of the nostrils to close from atmospheric pressure, but in difficult breathing they may be noticed to be in violent action".[17]
When breathing is rendered in any way more difficult than normally, these muscles take their share of the extra work, in common with the sterno-mastoids, scalenes, and other

muscles of extraordinary respiration. Their action may be explained as a natural device directed towards securing the entry of air to the lungs, with the least possible resistance to its passage, and with the minimum of effort on the part of the individual . Such patency of the nasal passages is all the more necessary in children, for, as a result of the high and continued fever, there is a tendency for a certain amount of mechanical obstruction to be produced in them by the collection of crusts of inspissated mucous secretion.

Expiratory dilatation is due to the unusually forcible expiration, which is so often present as an accompaniment of "inverted" breathing. The force of expiration is increased, as a result of the air being expelled by muscular effort, and not, as in physiological expiration, by the elasticity of the lungs only. The sudden increase of pressure caused by this strong forced expiration, drives the alae nasi apart, the mechanism being similar to that seen in the act of sneezing , or of blowing the nose.

Before leaving the subject of respiration, one other point of interest may be considered, namely the pulse-respiration ratio in pneumonia. During the course of the disease the pulse-rate is often found to be exceedingly rapid, and yet even the most rapid pulse is not increased to such an extent, as would be expected, when the rate of respiration is taken into account. Ordinarily in health the speed of respiration stands to the pulse-rate approximately as one to four. In pneumonia there is a very well-marked alteration

of this ratio, there being a much greater increase in the rate of respiration, than there is, in proportion, in the pulse-rate. Often respiration will be quite half as rapid as the pulse; and, in some cases, there is a much nearer approach to equality than even this. In one extreme case I have noted, the pulse-rate was one hundred and ninety-two per minute, while the respirations were one hundred and thirty-two. This is quite exceptional, of course, and occurred in an extremely severe case just shortly before the patient's death. The alteration of Pulse-respiration ratio is due to the same cause as the altered character of the respirations, namely stimulation from the lung carried by the afferent branches of the vagus to the medullary centres, and from there to the various organs concerned. Experiment has shown such stimulation of the vagus to cause increased rapidity of respiration, and, at the same time, decreased rapidity of the heart's action. The observation of this altered ratio is often of much service in the diagnosisof a doubtful case, as in practically no acute condition, except pneumonia , is so marked an alteration found. It is better seen in older children than in mere infants.

CEREBRAL SYMPTOMS:-

The occurrence of cerebral, or nervous, symptoms is very common during the course of lobar pneumonia in children, and I now proceed to discuss these in some detail.

In writing of the various modes of onset of pneumonia, it has already been shown that early cerebral symptoms, of more or less brief duration, are not uncommon.

In some cases these initial symptoms are severe, and may even prove fatal; but, apart from these, the occurrence, later in the course of the disease, of definite signs of cerebral involvement is by no means infrequent.

The most striking manifestations I noted, occasioned by cerebral implication, were convulsions, head-retraction and delirium.

The name "cerebral pneumonia" has been given to this class of case, in which the pulmonary condition is often quite overshadowed by the severity of the nervous symptoms. Severe symptoms of this nature were noted as occurring in forty-five cases, or 15.7 per cent. of the whole. The onset of minor evidences of cerebral disturbance was very much more common, but at present I propose to consider only the graver features of a cerebral nature.

The symptom most frequently noted was Delirium. This was present in twenty-eight cases; next in order of frequency of occurrence was Head-retraction, present in twelve cases; while Convulsions occurred in five cases.

It is often stated that, in children as in adults, cerebral symptoms are more common in association with apical, than with basic, cases. This is only borne out, by the results of my analysis, in those cases, where one lung alone was affected, and even there the difference of the figures is not at all striking. I found marked cerebral symptoms in 17-3 per cent. of all the single apical cases, while in single basic cases there was a percentage of 12.2. Higher

Higher still was the number of cases thus affected, when apex and base of one lung were both involved, namely 32 per cent. On the other hand, while there were in all, three cases where both apices were involved, and in none of these did cerebral symptoms show themselves, there were twenty-four double basic cases, and of these, four, or 16.6 per cent, were more or less severely affected in this way. The accompanying table shows the percentage of cases exhibiting the three most conspicuous nervous phenomena, together with an indication of the seat of the lesion present in the lung:-

Delirium

	"Single" Cases	"Double" Cases.
Apical	8.6 per cent.	0 per cent.
Basic	10.1 - -	8.3 - -
Both	16 - -	12.5 - -

Head-Retraction

	"Single" Cases	"Double" Cases.
Apical	7.2 per cent.	0 per cent.
Basic	2.1 - -	4.1 - -
Both	12 - -	0 - - .

Convulsions

	"Single" Cases	"Double" Cases.
Apical	1.4 per cent.	0 per cent.
Basic	0 - -	4.1 - -
Both	4 - -	12.5 - - .

From these figues it is seen that, while, in single cases, an apical lesion was more frequently associated with cerebral symptoms, in cases of double pneumonia such symptoms were much more frequently produced by a lesion at the base. A great many apical cases, single and double, ran their course without ever showing the least evidence of cerebral disturbance.

From these observations, I concluded, that the site of the pulmonary lesion has little to do with the onset of nervous symptoms, and I hold that these are of most common occurrence when an extensive area of lung tissue is involved. Much too, I think, depends on the temperament of the individual affected, for what would cause wild delirium, or violent convulsions in one child, may, in another, produce no evidence whatever of cerebral involvement.

Another important factor in the production of cerebral symptoms is the height of the temperature, though this alone is seldom, I believe, sufficient to account for them.

I have noted many cases of which hyperpyrexia was a distinct feature, and yet in comparatively few of these cases did pronounced nervous symptoms show themselves.

Constipation, too, plays a part in producing cerebral symptoms , and I think this is often not sufficiently recognised. In a few cases, which I have seen, delirium, supposed to be due to some brain disorder, was quite relieved by the administration of a smart purgative. Writing of the causation of these nervous symptoms, Holt[18] says:-"Extensive disease acts in a twofold way, by the nervous depression which it induces, and by the interference with haematosis,

due to a large part of the lung being crippled, so that blood, deficient in oxygen, and over-charged with effete products, is supplied to the brain and cord."

I found that the average maximum temperature of all the apical cases was 104.8 degrees, while the average of the apical cases showing cerebral symptoms was 105.2 degrees. Similarly the average maximum temperature of all the basic cases was 103.6 degrees, and the average of the basic cases with cerebral symptoms was 104.4 degrees.

This, I think, serves to show that there is some definite relation between the temperature, and the onset of cerebral symptoms, though, in the presence of other contributory factors, it is difficult to prove how much the cerebral upset is to be regarded as dependent on this condition alone.

In this connection I quote the words of Henoch[19], who writes: "I believe that the more typhoid symptoms, ------ are due to the rapid rise and continued elevation of the temperature, and that it is possible, although not proved, that convulsions may arise in this way in children who are predisposed to them".

I now consider in more detail the features of the chief cerebral manifestations.

Convulsions are the most serious and the most fatal of the nervous conditions aroused in the course of a pneumonia. Their occurrence was most commonly noted in previously delicate children, while other nervous symptoms seemed of more frequent occurrence in the robust.

In only one case did I note the presence of both initial and late convulsions. The latter occurred alone in five cases in all, and in four of these the patients were under two years of age. All the cases thus complicated in infancy ran a fatal course, death occurring soon after the convulsions set in. The only child affected beyond the age of infancy, was a boy of five years. In his case an initial convulsion occurred, as well as a more severe one later in the course of his illness. He was reported as being "subject to fits" even when apparently well. In his case, the late convulsion was of the usual type, and affected his body generally, but it was not extremely severe, and was of short duration. He seemed little upset by it, and made a good recovery.

Such convulsions resembled in all particulars those produced by other causes. They were often followed by drowsiness and even stupor, but, in some cases, there was succeeding delirium of an active type. Convulsions, occurring late in the course of pneumonia, are thus seen to be of very grave import, and, in the great majority of cases, their onset is only too sure an indication of an impending fatal issue.

Head-Retraction is next to be considered. This was noted in twelve cases, apart from those in which it accompanied convulsions. Two of the twelve ended fatally. It was much more common in apical, than in basic, cases; but cases, where the pneumonia involved both the upper and lower lobes, showed a still higher percentage incidence of this symptom.

Here again we have evidence that the extent, and not the situation, of the pulmonary lesion is the important factor in determining the onset of nervous phenomena. In both of the fatal cases there was middle-ear involvement, and this I believe to be in many cases an important exciting cause of the symptom under consideration. While otitis media was present, there was no evidence of actual meningeal inflammation found post-mortem in these cases. In many of the non-fatal cases, too, middle-ear infection was noted, and this may have contributed to the production of symptoms, but, on the other hand, many cases had marked pain and middle-ear disturbance, and yet exhibited no trace of head-retraction, or other sign of cerebral upset. That the middle-ear inflammation was the direct cause of nervous symptoms, was shown in a few cases, where these completely disappeared, immediately after the tympanic membrane was punctured, and free escape of discharge allowed. While such local conditions may be responsible for the symptoms in some cases, in many, the general infection of the brain, resulting from the circulation in the blood of pneumococcal toxic products, must be held responsible for their onset. Dr. Still[20] points out, that head-retraction in pneumonia may also be due to an effort to render the breathing easier, quite apart from any cerebral involvement, or other complication. He says:- "Infants, with respiratory difficulty from any cause, not infrequently assume the position of marked head-retraction, apparently in order to assist breathing by the action of the extraordinary muscles of respiration."

Delirium was recorded in twenty eight cases, and of these (again apart from convulsions), two proved fatal.

This symptom was more frequently observed among older children, and, while much more frequent in basic cases, it was, like the other symptoms noted, of most common occurrence, when a large area of lung was diseased. It was most marked at the height of the disease, and usually persisted until the crisis, when it at once disappeared with the fall of temperature, and the onset of resolution. In many cases it was quite mild in type, merely showing itself by some rambling and talking when the child was asleep. A more severe type sometimes was observed, the delirium being more of the typhoid nature, and muttering in character. Again, it was at times of a violent nature, and almost every symptom of actual meningitis was simulated. In a few cases, an alternation of the two types was noted. For a time the child would lie quietly in bed, being very drowsy, and even in a sort of stupor; then the condition would be changed, and a period of great irritability and excitement would follow. This again was followed by a return to a state of great drowsiness as before. Muscular twitchings, trembling of the hands, picking at, or throwing off, the bedclothes were frequently noticed, and in older children, sometimes efforts were made to get out of bed altogether.

Delirium occurred in only six children under the age of five years, and of these three were over the age of three years. The symptoms were almost invariably associated with the presence of high temperature, and often of massive

lung

lung consolidation. From his observations of a large number of cases Holt[21] concludes that, "Delirium and stupor were much more commonly associated with very high temperature than were convulsions". On looking into this subject, I find that in my series of cases also, the temperature records in cases with delirium were higher, than in those cases in which cerebral disturbance was shown by the onset of convulsions.

Of the less serious symptoms, drowsiness and stupor were frequently present, while, in a few cases, temporary strabismus, nystagmus, and pupil irregularity were noted, as evidences of cerebral involvement in different parts. Incontinence of urine, and, in some cases, of faeces, was also observed. Again, headache, and rigidity to the extent even of opisthotonos, occurred, and it was a matter of much difficulty to decide whether the condition present was actual meningitis or merely the much less serious condition known as "meningism". The points of distinction between these two conditions will be discussed later.

Another interesting feature, with regard to nervous symptoms is the condition of the reflexes and especially of the knee-jerk. I found the knee-jerk abolished in nearly half of the cases, which I had under my own observation. As a rule it was found to be absent a few days after the onset of illness, and when the disease was at its height, returning soon after the crisis. Dr. John Thomson[22] quotes the figures of Kephallinos on this subject, as showing the absence of knee-jerk in 41.5 per cent. of his cases.

He adds, "This may be of value in diagnosis, as loss of the knee-jerks is not found in other acute feverish conditions except neuritis and poliomyelitis". Again, Pfaundler[23] says, that he "frequently found this reflex absent or diminished, often even before the onset of pulmonary symptoms, and regards it as of value in diagnosis".

Kernig's sign was elicited in several cases where meningism alone was present.

From the examination of these cases, I conclude that, while the onset of nervous symptoms often gives a case a very alarming appearance, their presence, apart from convulsions, does not add very greatly to the gravity of the prognosis, unless of course there is actual brain disease present as well. Meningitis is, however, a rare complication, and meningism almost invariably passes off at the time of, if not before, the crisis.

In this connection Dr. Eustace Smith[24] writes,- and it must be understood that he is speaking only of cases of pure primary lobar pneumonia,- "The nervous symptoms, however serious they may appear, need cause no alarm, for they subside altogether when consolidation becomes established. So far, indeed, from creating anxiety, such symptoms should be looked upon, as of distinctly favourable import.

The so-called cerebral pneumonia is always a primary disease, and is limited, as a rule, to the more robust subjects. I have never known such a case to end otherwise than favourably".

While my experience has not been so fortunate as this, still, in the cases I have observed, the onset of nervous

symptoms has not, on the whole, been of very serious import.

The conclusions arrived at regarding nervous symptoms may be summarised as follows:-

These are more common in children, than in adults, and are often more intense.

There is no special association of cerebral symptoms with an apical lesion.

Their occurrence is dependent mostly on the extent of lung involved, and on the height, and persistence at a high level, of the temperature.

Convulsions are most common in delicate children, while delirium more frequently affects the robust.

Convulsions are by far more common in infants, than in older children.

Early convulsions do not modify the prognosis to any extent.

Late convulsions are almost invariably fatal.

Head-retraction is often associated with middle-ear suppuration, but its presence does not necessarily imply the existence of meningitis, which is rare.

Delirium is commonest among older children, and is related to hyperpyrexia and extensive pulmonary tissue involvement.

The knee-jerks are often absent before the crisis, and usually return soon after it.

Kernig's sign is present in many cases of meningism, as well as in true meningitis.

COMPLICATIONS:-

I now proceed to discuss some of the more important complications of pneumonia. These are of special interest, as, in most cases, the prognosis depends largely on their presence or absence. Lobar pneumonia, entirely uncomplicated, is seldom fatal in children, and a fatal issue can be traced, in most cases, to some other condition complicating the primary disease.

In treating of the various complications, I propose to illustrate my remarks by means of descriptions of cases, which I have observed, and also to indicate very briefly the essentials of treatment of these conditions.

Perhaps the most common complication is Hyperpyrexia. This was of very frequent occurrence among the cases I have noted, a temperature of over 105 degrees Fahrenheit being recorded in no fewer than fifty-four of the two hundred and eighty-six cases. This complication has already been discussed in its relation to the onset of cerebral symptoms. Frequently it is the result of some other complication, such as middle-ear disease, or gastro-intestinal disturbance. When the ear is affected, puncture of the drum, if not already perforated, and if bulging, is the treatment best calculated to allay the fever.

This should be followed by careful and repeated syringing of the ear while the discharge lasts. When the hyperpyrexia is due to gastro-intestinal trouble, I have found small, and repeated, doses of calomel, or grey powder to be of great value.

In other cases no such exciting cause can be found, - the temperature being greatly elevated as a result of the toxic action on the heat-regulating centre in the medulla. In these cases cool, tepid sponging is of service, and with this may be combined the application of an ice-bag to the head.

Diarrhoea, with, or without, vomiting occurred in several cases, late in the course of the illness. Such symptoms were more common at the onset and were usually of short duration. Still, sometimes very intractable diarrhoea did occur, and proved very exhausting to the patients affected. It is the result of gastro-enteritis, which seems to be due to direct infection of the stomach and intestines. That it should occur is not surprising, when one considers that it is the almost invariable rule for infants to swallow their expectoration, which must, in most cases, be full of pneumococci.

Flatulent distension of the abdomen was sometimes present, and caused interference with the respiration through upward pressure on the diaphragm. In these cases the already low diet must be carefully regulated, so as to prevent fermentation and consequent irritation and distension. Small and repeated doses of grey powder, along with a little salol, have proved very efficacious in these cases.

In extreme cases, blood was noticed to be present in the motions; this usually disappeared soon after the source of irritation was removed, and, in no case, was any active treatment necessary to check the haemorrhage.

The preceding complications were really aggravations of already existing symptoms , but apart from those, definite and more lasting complications were noted in thirty-seven cases.

The various complications noted are given below in order of frequency of occurrence.

Otitis Media -- 18 cases.

Empyema -- 5 - .

Nephritis -- 4 - .

Pericarditis -- 3 - .

Pleural Effusion(serous) 2 cases.

Endocarditis -- 2 - .

Haematuria -- 1 case .

Peritonitis -- 1 - .

Membranous Conjunctivitis 1 - .

Jaundice 1 - .

Empyema and Meningitis 1 - .

Empyema and Pericarditis 1 - .

Empyema, Pericarditis and Lung Abscess 1 cases.

Meningitis and Purulent Encephalitis 1 case.

These complications I will now take up in order, discussing their chief points, and indicating briefly how they are to be met.

Middle-ear Suppuration is a very common accompaniment of febrile disease in children, and, apart from hyperpyrexia, was the complication most frequently met with in the cases I have analysed.

It occurred most often in children under two years of age, and was not infrequently accompanied by marked symptoms of cerebral disturbance; in a few cases there was tenderness over the mastoid region on the affected side, but this was always relieved when discharge from the ear commenced. Puncture of the drum led, in some cases, to an immediate cessation of previously well-marked cerebral symptoms.

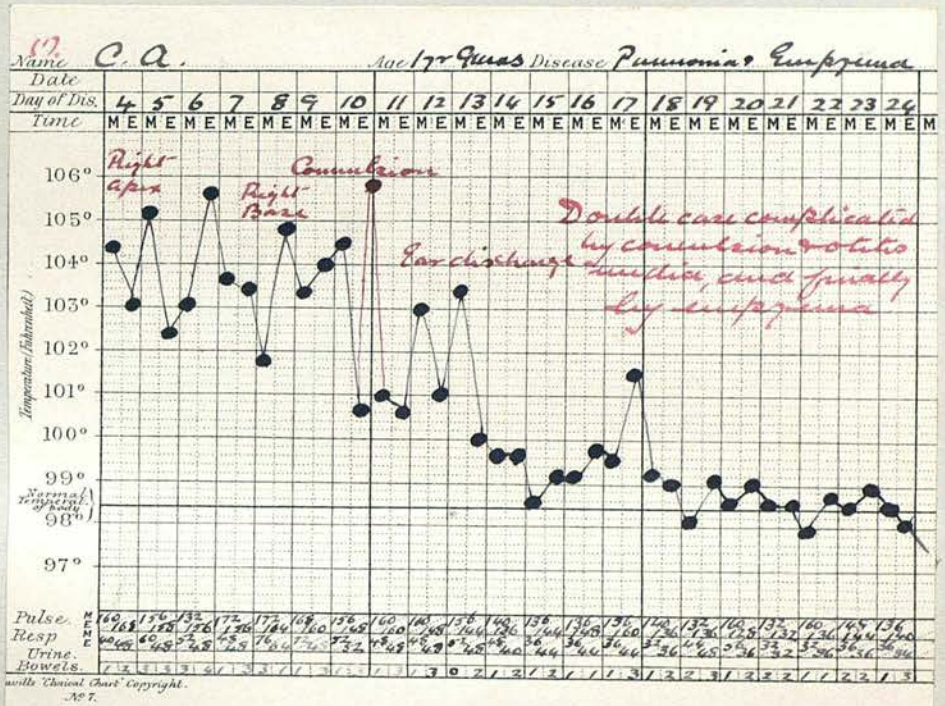
In the pus obtained from many of these cases, the pneumococcus was discovered, showing that the infection was not confined to the lungs. A fatal result ensued in five of these cases, all except one being those of infants under two years of age. In all of them the lung disease was very extensive, and the fatality could not well be ascribed to the presence of ear disease, though this of course always added to the gravity of the case. The best treatment is puncture of the membrane if it be bulging, and then syringing of the ear to keep it clean, and to prevent any infection from without.

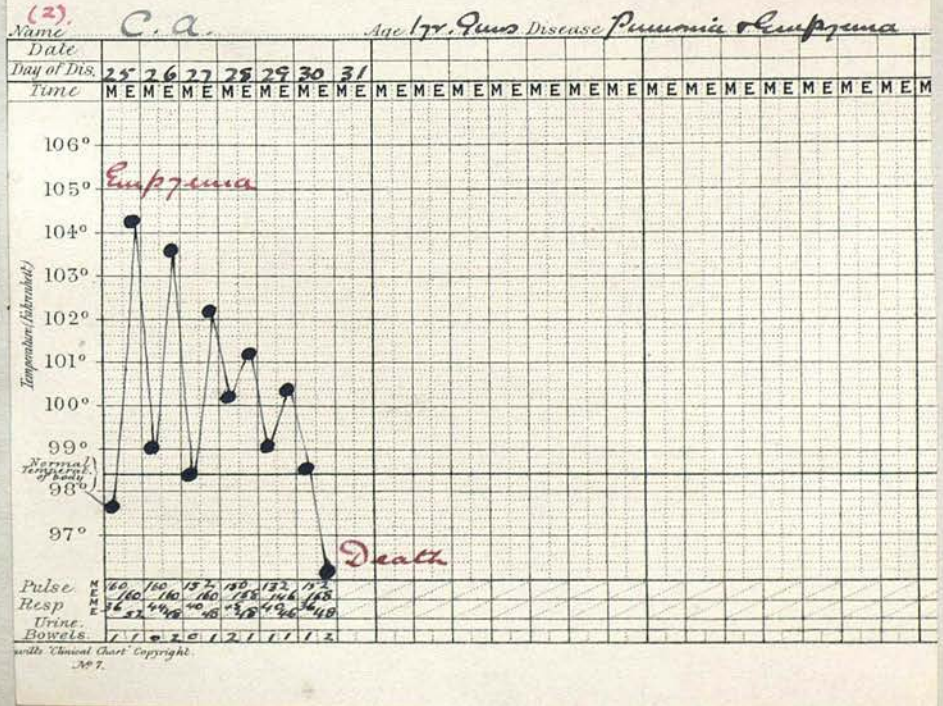
Empyema occurred in five cases, of which two were fatal. All except one of the children affected were infants, and it was among these that both fatal cases occurred. As a rule this complication was observed to come on after the crisis, and just when the pneumonic lung should have been commencing to undergo resolution. Its onset was usually indicated by a rise of temperature soon after the crisis, or by a continuation of the post-critical rise, which was so often present in pure cases of pneumonia.

When this post-critical rise lasted for more than twenty-four hours, the presence of empyema was usually suspected, and, as a rule, soon showed itself. In one case, however, the complication did not arise until a month after the attack of pneumonia. This was in the case of a little girl aged one year and four months, who was treated for pneumonia of the right upper lobe. This apparently underwent satisfactory resolution, and the child left hospital well. She remained, to all appearances, in good health for a month, but, taking ill again, was brought back to hospital. On examination of the chest a very dull area was found at the lower part of the right upper lobe. This area was explored with a needle, and pus was found containing large numbers of pneumococci. This was evacuated by operation, but the child did not long survive. The case was peculiar in having so long an interval between the attack of pneumonia and the subsequent empyema.
In these cases I consider operation to be the only satisfactory method of treatment, and resection of a portion of rib is always advisable, so as to ensure thorough drainage. In one or two cases it was found of some advantage to aspirate, or syphon off, as much pus as possible, previous to more radical measures being undertaken. This procedure has the effect of lessening the shock at the subsequent operation, and, I think, should be adopted in all cases where possible. In one case I tried syphonage alone, and it seemed to be quite satisfactory at the time. After some days, however, pus again collected in the chest.

Aspiration was again tried, but again pus returned, and resection of rib, and drainage, had eventually to be done. The accompanying charts show the record of a case of spreading pneumonia which was complicated by empyema, and which, after a comparatively short course, ended in death.

Chart 8.





Nephritis was noted in four cases, all of which recovered. Here the age of the patients affected was observed to differ from the age of those most commonly affected with empyema, ear-disease and gastro-enteritis. All the children who developed renal disease, were over three years of age. In three of the four cases the presence of the pneumococcus was detected in the urine, a fact which seemed very suggestive that the renal condition, as well as the pulmonary, was due to this organism. The urine was scanty in each case and was found to contain a considerable quantity of albumin, along with blood, and many granular and hyaline tube-casts. All these abnormal constituents disappeared completely during convalescence. Oedema was present in all the cases, which presented all the usual appearances associated with acute nephritis.

In two cases the first symptom noticed was puffiness of the face, and it was on account of this symptom, that these children were brought to hospital. It was only after the lapse of some days, that the physical signs of pulmonary disease became apparent.

In the other two cases, the pneumonia ran an ordinary course, but, after the crisis, the temperature rose again and symptoms of renal involvement developed.

As illustrative of the general features of this interesting complication, I shall describe in some detail one of the cases, which may be considered in most particulars, as representative of all.

The patient, a girl of three years, was brought to hospital on account of swelling of the face and limbs. These symptoms, together with fever, and somewhat rapid breathing, had been first noticed four days previously. She had become dull and drowsy, and had complained of headache. She had refused all food, though she was not actually sick. Very little urine had passed, but her bowels had moved well each day. When examined she was found to be flushed, with rapid, but easy, respiration. Her tongue was furred, and her eyes dull and heavy-looking. The abdomen moved freely in respiration, and costal breathing was absent. Slight dulness was detected all over the left side of the chest behind, and the breath sounds were rather harsh, and vesicular in type, and without accompaniments. No cough was present, and none had been noticed before. The urine was high coloured, of specific gravity 1016, and contained much albumin and blood, as well as many granular and hyaline casts. The case appeared to be one of acute nephritis, and the slight dulness on the left side was the only indication of any other morbid condition. The temperature was 104.6 degrees, and this struck one as being unusually high for a case of nephritis. The child was put to bed and treated as a case of renal disease. On the sixth day of her illness, that is, the day after she came under observation, definite signs of consolidation were found over the left lung, both upper and lower lobes being involved. The temperature fell by crisis on the sixth day from 104.6 to 98 degrees.

It at once rose again to 103 degrees. This rise was found to be occasioned by the spread of consolidation to the right base, over which area pleuritic friction was heard, along with tubular breathing, and increase of vocal resonance. By this time the urine was increasing in amount, but it still contained much albumin, a little blood, and some casts. The temperature remained high till the eleventh day, when it again fell by crisis to 98 degrees. The pneumonic symptoms then rapidly disappeared and convalescence was established. Two slight rises of temperature occurred on the thirteenth and sixteenth days, but these were quite transient, and were due to slight digestive disturbances, having no apparent association with either the pneumonia or the nephritis. By the fifteenth day, four days after the second crisis, the oedema had quite disappeared. The blood and casts had quite gone from the urine, and there remained merely a trace of albumin which rapidly vanished, the urine being clear by the eighteenth day.

I have described this case at some length, as I consider it is particularly interesting in several of its features, viz:-

The first observed symptom was oedema of the face and limbs. When first seen the child presented the appearance of a typical case of acute nephritis, and albumin was abundant in the urine; as were blood and casts.

The temperature seemed higher than nephritis alone would account for, an extensive pneumonia really being present, though, at that time, the physical signs had not developed. There was considerable dyspnoea, and some appearance of distress, but rapid relief followed the crisis.

The temperature curve was typical of lobar pneumonia, and was the more interesting because of the double crisis seen. Convalescence resembled that of an ordinary pneumonia case, much more than that of an acute nephritis.

It is interesting to notice how the progress of the pneumonia seemed little, if at all, affected by the presence of nephritis, and how the renal symptoms speedily disappeared after the crisis, when resolution of the pneumonia set in. The patient made a complete recovery from the complicated condition, and, during convalescence, was able to take food freely without causing any recurrence of the symptoms.

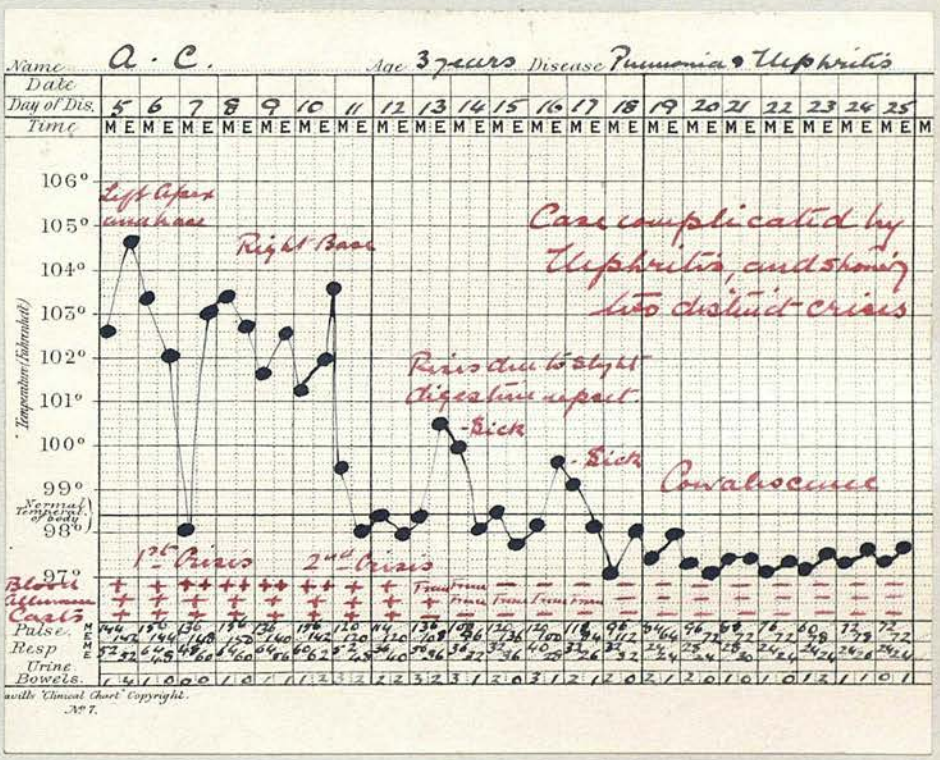
It appears to me from my observation of this case, and of a few others, which I have seen since, that nephritis is not to be regarded, in children at all events, as a very serious complication of lobar pneumonia. It tends to disappear with great rapidity after the crisis, and does so, quite apart from any special treatment directed towards relieving it.

The temperature and pulse records, with a few notes indicating the progress of the condition, as described in this case, are appended, as I think they are of considerable interest.

In the other cases which I have examined, the pneumonia ran its course without any apparent peculiarity which might be ascribed to the accompanying nephritis.

As regards treatment, I have found that, beyond ordinary care to protect the patient from chill, and the usual very low diet, with perhaps a mild diuretic and diaphoretic mixture, nothing special is called for in these cases.

Chart 9.



Pericarditis occurred alone as a complication in three cases. Two of the patients attacked were infants, and in both the disease proved fatal. The other case was that of a child, four years of age, and this case ended in recovery. This complication has a great tendency to become suppurative, and in the two fatal cases this occurred. The pneumococcus was found in the pus in each case. Pericarditis often results as a direct spread from the affected lung, or from purulent exudate in the pleural cavity. For this reason it is supposed by some to be most common when the lesion is at the base of the left lung. In all the cases I have noted, the pulmonary lesion was on the right side, and, in two of them, it was at the apex. The onset of purulent effusion in the pericardium may be marked by almost no definite signs, but in the two cases noted there was greater dyspnoea, and pulse irregularity than before, and evident signs of cardiac embarrassment. In the non-suppurative case there was well-marked pericardial friction, and along with this was considerable pain. This soon passed off without effusion taking place. No special treatment was necessary in this case beyond the application of hot fomentations as a pain-relieving measure. When suppuration has been diagnosed, the only satisfactory treatment is, as in empyema, to cut down and provide free drainage. Aspiration is not altogether satisfactory, and is by no means free from danger.

In neither of the purulent cases was drainage attempted, the condition of the patients being such, when pus was diagnosed, as to contra-indicate any attempt at operative interference. In each case the physical signs of pericarditis appeared just after the crisis, the temperature suddenly running up to an even greater height than before the event.

In one case empyema and suppurative pericarditis occurred together. Here direct spread was no doubt accountable, as the pus was lying between the diaphragm and the base of the left lung, round the pericardium.

In another case, empyema occurred and was operated on with apparent success, but, a few days later, the patient succumbed to pneumococcal meningitis, the diagnosis being confirmed post-mortem.

In another case both upper, and both lower, lobes were consolidated; empyema followed, and along with it, pericarditis. The child died, and at the autopsy there were found several small abscesses at the base of one lung, in addition to the conditions, which had been diagnosed during life. All those cases occurred in infants, and all proved fatal. We see from the notes of all the preceding complications , how much more serious they are in infancy than in the later years of life.

Pleural Effusion is, compared with empyema, a very rare complication in childhood. It is also much less common in children than in adults. The two cases noted were those of children over two years of age.

Its onset was observed fairly early in the course of pneumonia. Increasing degree of dulness, due to this complication, was found, in one case, on the fourth day of illness; while, in the other case, fluid was found on the sixth day. In neither case was the fluid of any great quantity. Exploration, and the withdrawal of a small quantity for examination, was sufficient to start the process of absorption. Aided by the administration of diuretics and saline laxatives, the process, thus inaugurated, proceeded spontaneously. No special increase of temperature elevation was noticed, but, in each case, the defervescence took place by rather gradual lysis, whose commencement was noted as occurring just after the removal of fluid mentioned. Both cases recovered from this complication, which, except when the fluid is very great in quantity, or very rapid in accumulating, is not to be regarded as serious.

The chief danger lies in the onset of sudden cardiac embarrassment as a result of very rapid pouring out of the exudate. Aspiration of the fluid is seldom necessary in children, and in most cases, as in those described, spontaneous absorption takes place. Painting the chest-wall over the effusion with iodine seems to hasten the absorptive process.

Endocarditis is not a complication of any great frequency, and it can usually be traced to some antecedent illness, such as rheumatism, though it may sometimes be truly secondary to pneumonia. It was noted in only two cases in this series, and, in each instance, there was a history of preced-

preceding cardiac trouble. In the one case this dated quite definitely from an attack of acute rheumatism; while, in the other, it was said to have followed scarlet fever complicated by rheumatic arthritis. The children were nine, and three, years of age respectively. The cardiac condition had become quite quiescent in the interval between the illness causing it, and the onset of pneumonia, and the children had appeared quite well.

In the one case, that of the older child, the heart symptoms had been stirred up at once on the onset of pneumonia, commencing to show themselves at the first rise of temperature. This child had well-marked systolic, and presystolic, mitral murmurs, along with considerable cardiac dilatation and hypertrophy. There was much pain in the left chest, and prostration was intense. The left base was found to be undergoing consolidation. The temperature was 105.2 degrees and respiration 52 per minute. The pulse was running at the rate of one hundred and sixty perminute, and was irregular, both in time and force. Crisis occurred on the fifth day, and the signs of pneumonia soon disappeared.

The other child was brought to hospital because of shortness of breath, supposed to be due to a recurrence of the old cardiac condition. On admission, the temperature was not h high and there was no indication of any definite pulmonary disease. After being for a week under treatment, during which time there was little, or no, improvement in the cardiac condition; the child suddenly became very dyspnoeic, restless and, at night, delirious.

The temperature ran up to 105 degrees, and the respirations and pulse to sixty, and a hundred and sixty, respectively. Examination showed consolidation of the left lower lobe. Five days later the disease spread to the upper lobe as well. The temperature fell by crisis on the eighth day and resolution proceeded rapidly.

I have given details of these cases as showing some points in the effect of endocarditis on the primary pneumonia. In each case the pneumonia ran a perfectly normal course in spite of the presence of endocardial mischief. The second case is, I think, specially worthy of remark, because in it there was a lesion involving the whole of the left lung, and in addition to the endocardial involvement - mitral systolic-diastolic bruits were present - cerebral symptoms and hyperpyrexia were superadded. Yet the case ran a normal course ending in recovery. In these cases there was, no doubt, previous cardiac hypertrophy, and probably some dilatation. The extra strain caused by the onset of pneumonia would tend to cause farther dilatation, and this tendency must have been sufficiently met, by the already existing hypertrophy along with some remaining "reserve power", to prevent the onset of the more severe features of cardiac embarrassment.

In more aggravated cases of endocarditis , when much valve-deformity is present as the result of former disease, most, if not all, of the "reserve power", must be utilised in compensatory action in health, and the added burden of pneumonia would almost certainly prove too heavy, and would bring

about cardiac failure, and, most likely, death.

On the whole, endocarditis, while always a serious complication, whether it is pre-existing, or occurs as a sequela of pneumonia, must not be looked upon as so grave a condition in the child as in the adult.

Cardiac failure is of very infrequent occurrence in childhood, whereas, in the pneumonia of adult life, it is probably far the most common immediate cause of death. In some cases the pneumococcus gives rise to endocarditis of the ulcerative type, and this is an extremely fatal form of complication. This series of cases furnished no example of this form of disease.

Regarding the treatment of endocarditis, this must, in the first instance, be directed towards the removal of the original exciting cause, if there is still evidence of its activity; for example, rheumatism should be treated with salicylates. In the absence of such active evidences, the cardiac action must be kept under control by the use of the ordinary cardiac tonics and stimulants. These must be freely given if any sign of cardiac failure be observed. In cases of dilatation of the right side of the heart, as evidenced by increasing size of the liver, local depletion by means of leeches may be called for. In no case have I had recourse to this remedy, but I have used dry-cupping with evident relief.

Prolonged rest in bed is an essential element in the treatment of endocarditis, and this, aided by cardiac and general

al

tonics will usually lead to satisfactory convalescence.
In the ulcerative type of endocarditis, treatment is seldom of any avail, the disease running a rapid and fatal course.
Haematuria appeared as a complication in one case, the patient being a boy of twelve years. It occurred alone, being unaccompanied by the presence, in the urine, of an excess of albumin, or of tube-casts. There was also an entire absence of the clinical appearances associated with renal disease. It began on the second day of illness, and remained present till the crisis, after which it rapidly and completely disappeared. No treatment was found necessary, the blood disappearing as the pneumonia was recovered from.
The mode of its causation does not seem at all clear, and I was unable to obtain any reliable information as to its previous occurrence. It seemed to me not improbable, that it might be due to some renal thrombosis or embolism caused by the pneumococcus and its products circulating in the blood. On the other hand, cases of so-called "renal epistaxis" are not very uncommon in children, and this may have been a case of this nature, due to some nervous disorder.
Writing of such obscure conditions, as, among others, haematuria from healthy kidneys, Dr. Guthrie[25] says:-
"All may be looked upon as vaso-motor neuroses, though, doubtless, toxaemia of some kind, with lessened viscosity of the blood, may play a part in producing them". Unless very severe, there seems no indication for any special treatment, as the condition soon clears up.

Peritonitis occurred in one case, that of a girl five years of age. She had pneumonia of the right apex, which was ushered in by an attack of sickness and diarrhoea with abdominal pain, and the appearance of blood in the motions. The abdominal symptoms passed off, and the pneumonia ran a normal course. Crisis occurred on the morning of the sixth day, when the temperature fell from 104.6 to 98 degrees. The same evening the temperature ran up suddenly to 104.8 degrees, and there appeared general tenderness and rigidity of the abdomen. Peritonitis was diagnosed and the abdomen was at once opened. General peritonitis was found with much pus present, in which the pneumococcus was found in great abundance. The temperature remained high in spite of free drainage, and the child died on the fifteenth day of illness, being the ninth day after the crisis. Post-mortem examination showed very diffuse peritonitis; and unsatisfactory resolution of the pneumonic lung.

While pneumococcal peritonitis is, perhaps, a less unfavourable variety than that caused by other organisms, it is, I think, in the majority of cases, a fatal complication. The only treatment of any avail is operation immediately the diagnosis is made.

Meningitis was a very rare complication in the cases I examined. One case has already been mentioned, in which it occurred along with empyema. It was recorded in only one other case, and was there associated with purulent encephalitis in an infant one year old.

Meningitis is usually found to be associated with disease of the middle-ear, and this is often pneumococcal in origin. This complication usually develops late in the course of the disease, and as a rule runs a rapid and fatal course. In several cases practically all the symptoms of meningitis were present, but their sudden disappearance after the crisis showed that they were due to meningism and not to true meningeal inflammation. The points of distinction between these two conditions will be considered when the differential diagnosis of pneumonia is discussed. In the case mentioned above, vomiting, headache, delirium, head-retraction and strabismus were present. These led up to convulsions followed by coma. Lumbar puncture relieved the symptoms temporarily, together with the administration of chloral and bromide, but, as is usual in these cases, a fatal issue resulted within a week of the onset of the complication. Post-mortem examination showed not only meningitis, but purulent encephalitis as well.

Membranous Conjunctivitis is a rare complication. I have never had an opportunity of seeing it, but, as it was recorded in one case among those I have examined, I will speak of it shortly. A child of one year was admitted to hospital with pneumonia of the left lower lobe. He had been ill four days, and, just after the onset of illness, the eyes became inflamed and apparently painful. An exudate appeared and soon the tarsal conjunctiva was covered with a tough membrane. Microscopic examination failed to reveal the organism present, but, in the absence of any other

infective condition, it was thought that this was a case of pneumococcal membranous conjunctivitis.

Regarding this form of disease Swanzy and Werner[23] state that :- "Any of the micro-organisms which commonly cause conjunctivitis may give rise to fibrinous exudation and the formation of membranes. Indeed the pneumococcus acting alone can cause severe membranous inflammation with loss of sight". In the case noted, the complication did not prove so serious, and under suitable treatment soon cleared up completely.

Jaundice complicated one case only. It occurred in a male infant of one year, and came on early in the course of the disease. The usual symptoms of mild catarrhal jaundice were present, and soon disappeared, having no apparent effect on the progress of the pneumonia. The cause of such jaundice is doubtful. Gastro-duodenal catarrh would account for it, but this would almost certainly have caused some sickness or diarrhoea as well. Neither was present, nor was there any indication of abdominal pain, and, here again, I think we must look for an explanation of this comparatively harmless complication to the toxic action of the pneumococcus in the blood. No treatment is necessary, as it passes off spontaneously.

Other complications sometimes occur, but I have mentioned the most common ones, all of which, except membranous conjunctivitis and haematuria, I have had an opportunity of examining and treating myself.

I now propose to mention some of the chief features, wherein pneumonia in childhood shows certain differences from the disease as it occurs in adult life.

As regards onset, convulsions, vomiting, diarrhoea, are the most common symptoms, and these replace the characteristic rigor met with inadults.

Sudden delirium at the onset is very common in children, but is exceptional in adults.

Children show initial prostration to a much greater degree than do adults.

The temperature usually runs higher in children, probably as a result of the heat-regulating mechanism being less under control, owing to imperfect development of inhibition.

The temperature, while usually high on the whole, often shows a tendency to remission before the crisis; this is best seen in infancy.

Termination of the disease by lysis is commoner in childhood than in later life.

Apical pneumonia is more frequently noted as occurring in the early years, than in adult life.

Cerebral symptoms more often occur in children, but are not specially associated with apical lesions.

The inverted type of respiration, so characteristic of pneumomia in children, is not so frequently seen among adults.

Cough is often an inconspicuous symptom, and may even be quite absent, in the pneumonia of children.

Sputum is in some cases absent, while its absence in an adult case is exceptional. (Of course most young children

swallow their sputum, but actual absence is here meant).
Abdominal pain is a common complaint among children;
Of the most common complications, pericarditis and empyema are much more frequently seen among children, while pleural effusion of a serious nature is rare.
The rapidity with which physical signs disappear in the cases of children is remarkable.
Lobar pneumonia is much less fatal a disease among children, than among those of more mature years.

Early Diagnosis of Pneumonia:-

The belated appearance of physical signs has already been mentioned as of frequent occurrence in the pneumonia of children. Their absence naturally renders diagnosis a matter of no little difficulty. There are, however, several features, which, in the absence of definite signs, may be of great assistance in coming to a decision as to the absence or presence of pneumonia. Attention, should I think, be specially directed to these points in all cases, before the more systematic examination of the child is undertaken.
First the facies, and general appearance of the child are of importance. In the early stage of a pneumonia, the face often wears quite a placid expression. There is usually some flushing which may involve both cheeks, but is often limited to one side of the face. The skin has a dry, harsh appearance, and a crop of herpes is often seen on the lip or nose. The eyes are bright and in the presence of pain have an anxious look.

When cough is present, the face presents a sort of strained appearance, due to efforts to suppress it.

The action of the alae nasi is often striking.

The attitude, or decubitus, of the patient may be of interest. Older children are usually found to lie in the position which renders breathing most easy, and thus they usually lie on the affected side, so as to give free play to the expansion of the sound lung. The presence of rigidity, head-retraction or delirium, which has come on suddenly in a healthy child, is often suggestive of pneumonia.

The respiratory movements give much information, and should be noted while the child is undisturbed. The presence of the normal abdominal type, or an exaggeration of this, or the addition of costal breathing, are points which should be carefully observed. The rate of respiration is important, also the presence, or absence, of "inversion" and "Grunting". The pulse rate should be carefully noted and compared with the rate of respiration; the character and pressure of the pulse too should not escape attention. Alteration of the pulse-respiration ratio is an important, and often early sign, of pneumonia. The temperature should be taken with a thermometer, but the skin should also be felt with the hand, for certain features can be gathered in this way which the thermometer cannot record, for example, the peculiarly dry, burning feel of the skin, which is so characteristic of pneumonia. An examination of the urine, if this can be obtained, is of use in diagnosis, as the chlorides are diminished early, and later may be absent.

The reflexes, and especially the knee-jerks, should be tested, as these are often lost early, rather a distinctive point in association with sudden fever and prostration, in a previously healthy child.

While all these points cannot in all cases be gone into, more careful attention to some of them, would, I think, be a considerable aid to diagnosis, and would prevent many errors, which are due to want of observation of signs and symptoms, apart from those to be found in the chest and lungs.

After these preliminary, but very valuable, observations have been made, the physical examination of the child should be undertaken in a careful and systematic manner. I do not propose to enter into a description of the commonly observed physical signs, as those are, in almost every particular, the same as the classical signs present in adult pneumonia. A few points, however, may be mentioned, in connection with which I have observed some departure from the ordinary physical signs.

In childhood, the normal breath-sounds are somewhat harsh in quality, and in many cases of pneumonia the early stage is marked by an increase of this harsh vesicular, or puerile, type of sound. In other cases, however, this is not found, but, on the contrary, the breath-sounds become faint and indistinct on the affected side. Later the typical tubular breathing is heard as in the adult. Crepitations are frequently absent in the early stages, and are not heard until late in the course of the disease.

The vocal resonance is sometimes difficult to estimate, and in those cases one gains most information when auscultation is conducted while the child is crying. Increase of vocal resonance may thus be detected early, when the other physical signs are not distinct; indeed, it has been said, that a bronchophonic cry is often the only auscultatory sign that can be obtained.

In the early stage, of engorgement, the percussion note may have a peculiar tympanitic quality - a sort of Skodiac resonance - which soon disappears, giving place to a more definitely dull note, and a feeling of increased resistance. Vocal fremitus cannot be elicited in many cases, and this is apt to be misleading, as suggesting the presence of fluid. It must, however, be remembered that, in the early years of life, the child's voice is unable to produce vibrations of such quality as to be appreciable by the hand placed on the chest-wall. Crying is sometimes productive of this sign, when ordinary speaking is useless.

Apical lesions are most frequently associated with delayed appearance of physical signs, and the axillae and subclavicular regions should always be examined with special care, for, in the child, the first physical signs are often to be found in these areas.

DIFFERENTIAL DIAGNOSIS:-

The predominance, over the pulmonary manifestations, of symptoms suggesting some affection of other organs or systems, is often a cause of much difficulty in the diagnosis of cases of pneumonia. This is well seen in cases where the onset is marked by the appearance of cerebral, or gastro-intestinal symptoms.

Several cases of this nature have come under my notice, and I now mention some points which I have found of assistance in distinguishing cases of early pneumonia from some of the more commonly met diseases.

Sickness and diarrhoea were so common at the onset, that it was often difficult to exclude gastro-enteritis. This was especially the case in hot weather, when that disease was known to be epidemic among young children.

The rapidity of respiration, both absolute, and relative to the pulse-rate, was found of service in diagnosis, being evidence in favour of the presence of pneumonia. The persistence, and increasing severity, of the gastric and intestinal symptoms was strongly in favour of the disease being a true gastro-enteritis.

Appendicitis was often simulated to some extent, when there was severe pain felt in the right side of the abdomen. As a rule, however, this disease could be excluded, for, in pneumonia, the pain, referred to the abdomen, was superficial, and it was found that the abdomen was not specially sensitive to deep pressure, while, in appendicitis or peritonitis

the palpation of the tender area caused great aggravation of the patient's suffering. Rigidity of the abdomen, too, is less marked in pneumonia, the respiratory movements being much more free. Then again, in pneumonia there is the characteristic change in the pulse-respiration ratio.

Scarlet Fever, with its sudden onset and pyrexia, was found, in a few cases, to resemble pneumonia somewhat closely. Here the throat symptoms and the early appearance of the typical rash, soon proved the nature of the case, and, again, the respiration was not so rapid as is usual in pneumonia.

The onset of an acute tonsillitis gave trouble in one or two cases, but the severity of the local symptoms soon revealed the cause of the sudden pyrexia.

Meningitis was the disease, whose presence was found most difficult to exclude. Many children were brought to hospital, with a history of sudden vomiting, headache, delirium or convulsion, or a combination of some of these symptoms, and to come to a decision, as to the nature of the condition present, was often very difficult.

The history in such cases gave very little assistance, the sudden onset being as frequent in the one disease as in the other. The appearance of the child, too, could not be relied on, as practically all the symptoms of meningitis may be aroused by pneumonia alone. Action of the alae nasi, with rapid, and possibly inverted breathing, may be present even early, pointing to a pneumonic condition.

Alteration of the pulse-respiration ratio was of service here too. In meningitis the pulse may be rapid and regular, but in many cases it is distinctly slow and intermittent, and the slowness is sufficient, I think, to deny the presence of pneumonia. Cerebral symptoms ushering in pneumonia were seldom very severe, and they soon subsided, or at least became less acute, after the lapse of twenty-four to forty-eight hours. In meningitis, on the other hand, they were found to increase gradually in intensity as the disease advanced. Holt[27] in a paper mentions this fact as a distinguishing feature. He says - "The cerebral symptoms of pneumonia are rarely so intense, so prolonged, so continuous, or so progressive as those of meningitis, although almost every individual symptom of the one may be present in the other".

Influenza, especially when epidemic, is liable to be confused with pneumonia. Quite recently, in practice, I saw many cases of influenza, some of which were complicated with pneumonia. Among the children affected, some had influenza alone, while two I attended had been exposed to infection, but developed typical lobar pneumonia. I noted one or two points of distinction between the onset of the two conditions. In influenza, while the temperature rose suddenly, it did not so long remain elevated as in pneumonia, and did not reach so high a level. There was also more irregularity and tendency to remission.

In influenza there was more evidence of catarrh of the respiratory passages and the relative rates of the pulse and respiration were not so much altered as in pneumonia. The finding of a well-marked degree of leucocytosis was in favour of the presence of some condition other than influenza. In many cases, however, early diagnosis is almost impossible, and pneumonia can only be distinguished from influenza by the continued absence of physical signs in the lungs and by the nature of the course of the disease. The main features distinguishing lobar pneumonia from disease of the broncho-pneumonic type have already, here, been discussed.

Pleuritic Effusion is less common in children than in adults, but it is also less easy to detect, when present. The percussion note obtained over fluid, though certainly dull, often fails to show the "flat" quality usually associated with the presence of fluid, and the breathsounds, and vocal resonance, may, in some cases, be little altered by the fluid. This renders it hard to distinguish the condition from one of pneumonic consolidation. In cases of effusion, however, there is usually more definite limitation of movement of the affected side. The dulness due to fluid increases gradually, while in pneumonia it is often found present over a whole lobe simultaneously. Again, in pleurisy with effusion, the dulness does not as a rule coincide with the area of a single lobe of the lung, but it is limited only by the wider boundaries of the pleural sac.

Vocal fremitus cannot be relied on as a distinguishing feature, for, as has already been explained, this is often much diminished, and may be even entirely absent in cases of pneumonia, and indeed in healthy chests as well. Displacement of the heart is an important sign of the presence of fluid, together with the absence of râles and friction sounds.

The temperature in pleurisy is not so high as in pneumonia, nor is the pulse-respiration ratio altered in the same way. Early prostration, so marked a feature of pneumonia, is not seen in the same degree in pleurisy with effusion. As a means of diagnosis, when other means have failed, the use of the exploring needle is of great assistance. Many other points of distinction might be mentioned as aiding the diagnosis of pneumonia from cases of the foregoing, and other diseases, but these above I have given, as being some of the more important features which I have observed myself in the clinical examination of patients. Before leaving the subject of diagnosis, another point may be mentioned, namely the means of distinguishing, whether the onset of cerebral symptoms in pneumonia is due to the presence of meningitis, or of "meningism". It is naturally of great importance to be able to distinguish between those conditions, as the prognosis must be so very different according as the symptoms are due to the one or the other.

Cerebral symptoms due to meningism cause little, or no apprehension, while the same symptoms arising from the presence of meningitis point to a grave and usually fatal prognosis.

Pneumonia with a temperature of 105 degrees or over, is in itself quite sufficient to cause marked cerebral symptoms, as the result of fever and toxaemia, and a case may appear to be one of severe meningitis, and yet all the cerebral symptoms will disappear at once after the crisis, if indeed they have persisted so long. The presence of nervous symptoms from the onset of pneumonia is usually a favourable feature, for complicating meningitis is almost always characterised by the onset of its symptoms, late in the course of the primary disease. The condition of the fontanelle is a useful guide in infants, and the persistence of normal tension is a point of evidence against the presence of actual cerebral disease. Dr. John Thomson[28] notes the value of this sign in cases of cerebral pneumonia as distinguishing cases of meningism from those complicated by meningitis. "Generally speaking", he says, "it may be said, that in feverish cases in young babies, cerebral symptoms do not indicate the presence of intra-cranial disease, unless they are accompanied by a bulging fontanelle".

The value of Kernig's sign is, I consider, small in these cases, as I have several times found it well displayed in cases of simple meningism. Lumbar puncture is a useful operation for diagnostic purposes, and the examination of the fluid withdrawn is often the means of settling the

question of causation of cerebral symptoms.

As I am here recording the result of clinical observations, I do not propose to discuss the morbid anatomy of the disease, which is essentially similar to that of lobar pneumonia as seen in adult life; but I now pass to the consideration of prognosis in pneumomia, and then will indicate briefly some of the general principles of treatment, which have been found most successful in practice.

PROGNOSIS AND MORTALITY:-

The prognosis in cases of lobar pneumonia of children is, on the whole, very favourable. Much depends on the age and previous health of the patient, and, above all, on the presence or absence of complications.

A fatal result in a case of uncomplicated lobar pneumonia, in a previously healthy child, is rare. The presence of a history of previously enfeebled health makes the outlook less hopeful; and the addition of complications makes the prognosis a matter of very greatly increased gravity, especially if the complication in question be one of the more severe, such as meningitis or peritonitis.

The disease is very much more fatal in infancy, than in the later years of childhood. The total number of deaths that occurred in this series of two hundred and eighty-six cases was twenty-nine. This shows a death-rate among all cases, at all ages of childhood, of 10.1 per cent.

The total number of cases of infants, that is children under two years of age, was one hundred and ten, and of

these twenty-three proved fatal, a death-rate equal to 20.9 per cent. Of children over two years of age, one hundred and seventy-six were treated, and of these only six died, a mortality of 3.4 per cent.

These figures serve to show how much more fatal the disease is among infants; and they indicate that, in the case of very young children, the prognosis must always be grave, while among older children it is, on the whole, exceedingly favourable.

Most of the children affected recovered completely, and it is rather exceptional for the disease to leave any permanent signs of enfeeblement behind it.

Tuberculosis, and similar diseases may ensue in a certain number of cases, but this must, I think, occur only in children who were previously delicate and predisposed to those diseases.

TREATMENT:-

The subject of treatment of cases of lobar pneumonia in childhood is a very wide one. The literature of the subject, like that of pneumonia in general, is enormous in amount, and is ever-increasing in its extent. Claims are constantly being advanced as to the special value of some more or less new therapeutic agent, which has been used with extraordinary success in a series of cases.

I do not intend to enter on a discussion of the various lines of treatment, but will here mention some of the/gener

general principles which I have myself observed to be most successful in combating the disease.

The treatment of pneumonia is essentially symptomatic in its nature. There is no line of treatment, which I have seen, or heard of, which may be reasonably credited with the power of cutting short the course of the disease. Certain methods of treatment have comparatively recently been introduced to try to abort the disease by the use of serums or vaccines. I have never used these myself, but have had the opportunity of watching the progress of a few cases, in which they were employed. In no case was I able to detect any improvement, which could be attributed to their use.

Fortunately pneumonia is a very self-limited disease, and runs a definite course, terminating naturally, and without any therapeutic interference. This natural tendency to cure must always be taken into account, before bestowing the credit of a cure on any special line of treatment. While I believe that no known treatment is of much avail against the disease itself, much may be done to relieve the patient of the inconvenience and distress caused by troublesome symptoms, and the onset of complications may be, to some extent, anticipated and prevented.

I will merely mention some of the most common and important symptoms, which may give rise to trouble, and will also indicate the means of treatment which may be expected to prove most beneficial when these conditions are met with.

Before proceeding to discuss those symptoms, however, I will very briefly outline some features of importance in connection with the nursing and dieting of pneumonia patients.

The surroundings of the child should be arranged with careful attention to hygienic principles.

The patient should always be confined to bed, and must not be allowed to sit up. The bed should be placed in as airy, and well-ventilated, a room as possible.

Abundance of fresh air should be admitted to the room, but care must be taken to protect the patient from draughts. A fire in the room is an advantage, but the bed should not be placed near it; hot bottles may be put in the bed, if necessary to keep the extremities warm. The patient should be warmly clothed, but the bed-clothes must be light and not sufficient to induce perspiration. A jacket of cotton-wool or gamgee tissue is useful, especially in cases where the child is delirious and inclined to throw off the bed-clothes. The diet should be very light and of a fluid nature entirely; indeed, a child with pneumonia suffers almost invariably from complete loss of appetite for solid food, but is always thirsty.

Milk with barley water, the dilution being regulated according to the age of the patient, is perhaps the best form of food in those cases.

Chicken and mutton soups are also permissible at first, and later, if there is no digestive upset, beef-tea may be given, being a valuable stimulant as well as a nourishing food. It should always be remembered that the danger is greater from over-feeding, than from the giving of too little food.

Thirst is often excessive and may be relieved by giving cold water as frequently as desired. This should be given in small quantities however. Excessive dryness of the tongue can sometimes be relieved by painting it with an ointment, a useful combination being one made of boracic acid, peppermint and vaseline.

The use of drugs plays a small part in the treatment of pneumonia, and, in many cases, practically none is required beyond a mild diaphoretic mixture such, for example, as one containing citrate of potash, or the solution of acetate of ammonia. The use of powerful drugs, whose action is directed towards the reduction of temperature, is harmful in most cases, and these should not be employed, other and better means of reducing temperature being available. Careful nursing is perhaps the most important feature of the treatment, and efforts must be made to spare the patient any avoidable exertion, so as to conserve his strength.

The most common symptoms calling for treatment may now be referred to, also the appropriate means of relieving them.

Pain in the chest is very common as a result of pleurisy, which is an almost inevitable accompaniment of pneumonia. This is best met by the application, to the painful area, of a light linseed, or linseed and mustard, poultice.

Hot fomentations too are often of use in this connection. Should the pain persevere in spite of these, two or three leeches applied over the part, will almost certainly give speedy, and usually permanent, relief.

A dose of Dover's Powder too may prove useful, but all opium should be avoided in the treatment of pneumonia, unless it is absolutely necessary, because of its very marked action in depressing the already poisoned respiratory centre in the medulla.

Cough may be a troublesome symptom, and may cause the patient much distress, especially in the presence of pleurisy. It is usually observed to be worst when a large area of lung is involved. Relief is often obtained by the application of hot fomentations; and steam-inhalations at intervals may do good especially if there is any associated bronchitis. Small doses of paregoric may be given, if the cough is very severe, and preventing sleep. In a few cases where secretion was abundant, and the cough causing distress, I found the administration of half to one minim of the 'liquor atropinae' give great relief. Being a respiratory stimulant, this drug can be given with safety.

Sleeplessness is a very exhausting symptom, being in many cases the precursor of delirium. It is often due to some condition outside the lung, such as ear disease, and the treatment must be directed to removing the exciting cause. When delirium is present or when sleeplessness is prolonged and causing signs of exhaustion, the use of bromides is indicated, and the application of ice to the head is also useful in some instances.

Another cause of sleeplessness is hyperpyrexia. In pneumonia, unless the fever runs exceptionally high, or remains for long at a more moderate, though considerable, elevation, say between 104 and 105 degrees, no active treatment is called for. Should it be excessive and causing restlessness and sleeplessness, something must be done to reduce it, and so to prevent exhaustion.

Constipation alone may be a cause of hyperpyrexia , and and this must be remedied before the temperature will fall. If no definite cause can be found for the high temperature, tepid or cold sponging, or bathing, is most useful and usually is successful in reducing the temperature by several degrees. The application of an ice-bag to the head is also of use, and a dose of calomel, or grey powder, helps these other remedies.

With the approach of the crisis there is often distinct aggravation of the symptoms, and, should any evidence of cardiac failure or exhaustion appear, active treatment and stimulation is urgently called for.

In cases where the right side of the heart shows signs of failure - and this can be gauged by increase of the size of the liver - the pressure may be relieved by means of causing more free discharge of fluid from the bowels and kidneys. Calomel, followed by a saline purge, is useful for this purpose, and in mild cases may be sufficient. In severe cases I have found considerable relief to be given by the use of dry-cupping over the lung-bases. Leeches may also be used over the praecordia or over the liver, and may cause marked improvement in the condition, but of their use, in this connection, I have no experience. The administration of cardiac and respiratory tonics is often necessary, and strychnine may be given by the mouth, or hypodermically. Alcohol in the form of whisky, brandy, or champagne, often produces good results, and its use, along with strychnine, must be pushed until some definite sign of improvement takes place.

Failure of the left side of the heart, with dilatation, is shown by the outward displacement of the apex-beat, and and by the weakening of the first sound. This must be combated by means of tonics and stimulants as before.

In cases where cyanosis is marked, considerable benefit often results from the inhalation of oxygen.

After the crisis, the patient must be carefully watched, and the onset of complications looked for and guarded against.

While these are a few general notes on the methods of treatment which I have found most useful in dealing with

cases of pneumonia, no definite rules can be laid down, and, in the treatment of each case, one must be guided by the result of careful observation, not only of the physical signs and symptoms of the disease, but of the general appearance and temperament of the individual.

After the crisis, the appetite usually returns with wonderful rapidity, and, as soon as the temperature falls, in the absence of complications, the diet may be considerably increased, until soon the child is again taking the ordinary dietary of health. Usually children recover very rapidly after an attack of pneumonia, and they need not be long confined to bed, but may be allowed to get up when the physical signs show resolution to be satisfactorily effected. They must however be protected from all possibility of chill, and must not be allowed to exert themselves for sometime, as the heart must be given time to recover from the depressing effects of the toxaemia, to which it has been subjected.

Convalescence may be hastened by the administration of tonics such as cod liver oil and malt, or hypophosphites, along with as nourishing a diet as the child is able to digest. A change of air too, from town to the country or sea-side, is in fine weather, of great benefit to the convalescent patient.

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