original formation, being only incompletely loosened and persisting in part. Slight indications of such membranes are often enough seen distinctly when making a laryngoscopic examination, a point already well insisted upon by Schrötter; sometimes the anterior commissure of the vocal cords, instead of forming an acute angle, represents a small bow line, sometimes below the commissure a slight fold of membrane extends from one side to the other, and projects more or less far into the character of the larynx."

The case now communicated would seem to lend some support to Roth's views, particularly so because, as in his series of sections, the agglutination was not limited to the vocal cords themselves, but in front extended almost a centimetre into the subglottic cavity. On the other hand it is difficult to explain Chiari's above mentioned case on the strength of Roth's statements.

The only question remaining is that of the treatment to be adopted in such cases. Undoubtedly in lighter cases—that is, such in which no respiratory troubles exist, and in which the voice is moderately or not at all affected, there may be no need to interfere in any way, and in a number of cases reported the policy of abstention has been followed. In cases, however, in which there is either total loss of voice or persistent or paroxysmal dyspnoea of a more serious character, or finally a combination of both aphonia and dyspnoea, surgical interference will be obviously required, and the only question is which treatment seems the most appropriate for these cases. To conclude from my own experience and from a study of the cases recorded in literature, I think that no hard and fast rule can be laid down. Much depends upon the thickness of the diaphragm, upon the patient's age and power of co-operation, and upon the tendency to re-adhesion during the process of removal. Theoretically one might think that thyrotomy, followed by total excision of the obstructing mass, would be both the quickest and the most radical treatment; but, apart from my own case above mentioned, Seifert and Hoffa state that they have had for a long time to carry on mechanical dilatation after the performance of thyrotomy and removal of the web in order to prevent readhesion which was threatening. On the other hand no definite rule can be laid down with regard to intralaryngeal treatment. In Krieg's case¹² mere incisions into the diaphragm produced such an amount of swelling that tracheotomy had to be performed. In Greenfield's¹³ and my own cases attempts at cutting the membrane with ordinary laryngeal knives were unsuccessful; in Seifert's case the knife even broke, as stated above. Bruns, to whom Krieg's patient applied after the performance of tracheotomy, succeeded by very persistent dilatation with special bougies introduced from the tracheal wound through the larynx in effecting complete disappearance of the laryngeal stenosis and restitution of normal voice. The treatment, however, carried on with interruptions, required a year and a half. Morell Mackenzie in his case obtained a good result by intralaryngeal removal of the web by means of cutting forceps. In my own case the combination of this method with the galvano-caustic treatment was equally successful. Should any future case come under my observation, I should make it entirely dependent upon the thickness of the mass which treatment to adopt, but should certainly give a trial to the intralaryngeal one before having recourse to thyrotomy.

NOTES AND REFERENCES.

¹ See programme of that meeting, BRITISH MEDICAL JOURNAL, November 21st, 1885, p. 1001. ² See BRITISH MEDICAL JOURNAL, 1878, vol. ii, p. 834. Meeting of the Royal Medical and Chirurgical Society, Case of Thyrotomy, etc.; and *Monats. f. Ohrenheilk.*, No. 6, 1879, Eine Thyreotomie. ³ *Berl. klin. Woch.*, 1886, No. 10. ⁴ *Archiv für Laryngologie und Rhinologie*, vol. i, Heft 1, 1893. ⁵ *Wiener klin. Woch.*, 1897, No. 25. ⁶ *Annales de la Polyclinique de Toulouse*, No. 5, Mai, 1897. ⁷ *Berl. klin. Woch.*, 1888, No. 10. ⁸ *Ibid.*, 1889, No. 2. ⁹ *Transactions of the International Medical Congress*, London, 1881, vol. iii, p. 316. ¹⁰ *Loc. cit.* ¹¹ *Mittheilungen aus dem embryologischen Institut zu Wien*, 2tes Heft, 1871, p. 155. ¹² *Atlas der Kehlkopfkrankheiten*, 1892, p. 112. ¹³ This case has, so far as I know, never been reported in full. Having seen it at St. Thomas's, I referred to it with Professor Greenfield's permission in my paper on Thyrotomy in the *Monats. f. Ohrenheilk.*, 1879, No. 6.

DONATIONS AND SUBSCRIPTIONS.—An anonymous donor has given £1,000 to endow a bed at St. Thomas's Hospital in memory of the late Charles Kingsley.—The Queen has forwarded her annual subscription of 100 guineas to the Middlesex Hospital.

CLINICAL LECTURE ON BRONCHO-PNEUMONIA, TO SHOW THAT PNEUMOCOCCAL PNEUMONIA IN A CHILD TAKES THE LOBULAR AND NOT THE LOBAR FORM.

Given at St. Bartholomew's Hospital,

By SAMUEL WEST, M.D.,

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I HAVE long been of opinion that the distinctions made between lobular pneumonia of children and the lobar pneumonia of adults do not hold with anything like the preciseness they should if the two conditions are really as distinct from one another as they are usually stated to be.

The question is largely a bacteriological one, and it is only recently that bacteriological investigation has turned in this direction.

I shall endeavour to prove that under the one term "broncho-pneumonia" several different conditions are included, and that many of them are pneumococcus inflammation; in other words, that some of the broncho-pneumonias of children are really the same disease as the common pneumonia of the adult, or, to put the proposition in another form, that the only difference between the pneumococcus inflammation of the adult and of the child is that in the one case the inflammatory consolidation which results is lobar or massive, and in the other lobular or patchy.

The evidence which I shall bring forward in proof of this thesis falls into two groups: the first clinical, the second bacteriological.

Of croupous pneumonia I do not intend to say much. The cases, as a whole, present a close family resemblance to one another; so much so that the less obvious, but not, therefore, less important, special features of individual cases are liable to be lost sight of. Yet it is clear on careful observation that there are many varieties of the disease, or many variations in it, and that these stand in close relation with the circumstances under which it has arisen, and with the course it is likely to run.

Bacteriology is gradually, step by step, explaining, or at any rate suggesting explanations of, these variations, and it is to this part of the subject only that I will briefly refer.

There is no doubt that the pathogenic organism with which croupous pneumonia is most commonly associated is the diplococcus pneumoniae or pneumococcus. But this is not the only pathogenic organism found, for the streptococcus, tubercle bacillus, Friedländer's bacillus, the staphylococcus and others have been present in different cases, sometimes alone, sometimes variously combined and associated. Still there is no doubt that the pneumococcus is by far the commonest of them all, for in about half the cases it exists alone, and in another quarter in combination with one or other of the bacilli mentioned. In the remaining cases other organisms are found, sometimes alone, more commonly in combination.

It thus appears:

1. That acute inflammation of the lung is not due to one pathogenic organism only, but to many and various organisms, though some are more likely to produce it than others, either because the lung is especially susceptible to their attack, or because they are more generally prevalent.

2. That the usual organism of croupous pneumonia is the pneumococcus.

3. That the different forms of, or variations in, pneumonia are very probably connected with different kinds of pathogenic organisms.

4. That even where the pneumococcus is the cause of the attack other pathogenic organisms may be associated with it, and thus produce variations in the symptoms; in other words, that the infection is not rarely a mixed one.

5. That secondary and subsequent infection with some other organism may account for a pneumococcus pneumonia ending in a particular way, as, for example, in abscess,

gangrene, or tubercle, though it must be borne in mind that the same organism that can produce these results may also be the cause itself of the original inflammation.

I have referred to these facts in connection with croupous pneumonia because it will become evident that facts of a similar kind are being discovered about the pathology of broncho-pneumonia, to which affection I now turn.

The following is a brief account of the commonly accepted views in respect to broncho-pneumonia at the present time; that it is closely related to capillary bronchitis, from which it can hardly be distinguished clinically; that it is, as a rule, a secondary affection, and met with under the following conditions:

1. As the consequence of bronchitis.
2. As a sequela of the infectious diseases, such as measles, diphtheria, whooping-cough, scarlet fever, etc.
3. As a result of the aspiration of infective particles or foreign substances, the so-called "aspiration or deglutition pneumonia."

In respect of the morbid anatomy the lung is found studded irregularly with small patches of consolidation, the development of which follows the following course: the small air tubes become plugged with secretion, the corresponding alveoli become collapsed and ultimately inflamed, while the surrounding parts pass into a condition of complementary emphysema.

All stages may be found between the portions of the lung which are collapsed and those which are consolidated. In the early stages the collapsed alveoli become filled with secretion which contains a certain number of leucocytes and catarrhal cells. These cells gradually increase in number until they form the mass of the consolidation.

The consolidation of broncho-pneumonia is stated to differ from the lesions of croupous pneumonia in the absence of fibrin network and of alveolar casts, in the preponderance of catarrhal cells, and in the usual absence of blood cells. In addition to this there is generally a considerable infiltration of the bronchial walls and surrounding interstitial tissue. In the aspiration or deglutition pneumonia there is a more dense infiltration of the air cells with leucocytes, producing suppuration or foci of softening, and occasionally gangrene.

Clinically, three classes of cases are usually distinguished:

1. That which corresponds with capillary bronchitis, in which there is little or no consolidation, but the signs of very acute congestion. This is sometimes called "congestive broncho-pneumonia."
2. The disseminated form, which is by far the most common condition, corresponding with that of which the pathological description has just been given.
3. A pseudo-lobar form in which the consolidation is more extensive and not so widely disseminated; but even in this case the consolidation is not massive as it is in croupous pneumonia, so that even when a whole lobe or a considerable part of the lung is involved, there are between the patches of consolidation areas of collapsed or even emphysematous lung.

All these conditions are fairly called broncho-pneumonia, inasmuch as the inflammation either follows directly upon some form of bronchitis or results from some infective substances clearly introduced through the air passages.

This account of the disease is correct so far as it goes, but it is a part of the truth only, and not the whole truth. There are really two clinical groups of broncho-pneumonia, one of which, like that just described, follows bronchitis or stands in direct relation with some affection of the air passages or mouth; while in the other there is no antecedent bronchitis at all or any lesion connected with the air passages or mouth to which it is likely to be secondary. To this group many of the cases placed under the heading of pseudo-lobar broncho-pneumonia belong. We may, if we like, call this latter group "primary" or "idiopathic" broncho-pneumonia, and the former "secondary" broncho-pneumonia. Clinically, the two groups differ in a very pronounced way.

SECONDARY BRONCHO-PNEUMONIA.

In the ordinary secondary broncho-pneumonia which follows bronchitis the child is generally weakly, often rickety, perhaps tuberculous, liable to attacks of diarrhoea, and

subject to bronchitis, from which it is suffering at the time of onset. The child then becomes more seriously ill; the bronchitis becomes more severe, and the temperature rises to 103° or more. Besides the signs of general bronchitis, there are spots irregularly distributed over the chest where sharp, crackling crepitation is heard, and possibly bronchial breathing, bronchophony, or pectoriloquy. These spots correspond, as is proved by *post-mortem* examination, with patches of consolidation; but the consolidation is rarely sufficient to give rise to dullness, especially as the patches are surrounded with emphysematous lung.

The child is pale, somewhat cyanosed, suffers with a good deal of dyspnoea, and sweats profusely, especially during sleep. There is probably marked inspiratory recession of the lower ribs and intercostal spaces. The temperature is of a hectic or irregularly remittent type, remains high for many days, and terminates by lysis. Recovery is slow and tedious, and there is a great tendency to relapse. The mortality is considerable, especially in very young children. The symptoms are severe, but local rather than general. What general symptoms there are depend upon the cyanosis, which is to a greater or less degree always present. The diagnosis has to be made from capillary bronchitis rather than from anything else. It is in the temperature chart especially that the chief characteristics of the cases are seen.

This is the common form of broncho-pneumonia, upon which the usual clinical and pathological descriptions are based, and of which the 4 cases following are good examples:

CASE I.—T. S., 1 year and 5 months old, was in good health until attacked by measles 5 weeks ago, after which he caught cold and had some diarrhoea. He was admitted with broncho-pneumonia and a temperature of 104.4° . There were the signs of general bronchitis, with a few small patches of dullness, one at the apex and another near the heart on the left side, and others at both bases behind; there was considerable recession of the lower parts of the chest, so that the dullness at the bases was pro-

Chart 1.—Case I.

bably due in great part to collapse. In various parts of the lung there were patches over which small, sharp, crackling crepitations were heard. The child was somewhat cyanosed, and though evidently very ill was at times bright and intelligent. The temperature was of a distinct hectic type, oscillating daily between 103° or 104° and 99° . The chart is characteristic, and shows the main features of the case, which continued without much alteration of physical signs or conditions until death occurred, rather more than a fortnight later, when the patient died somewhat suddenly. There was no *post-mortem* examination.

CASE II.—D. R., aged 1 year and 8 months. The child was a healthy baby; had whooping cough at 12 months of age, from which she completely recovered; and measles seven weeks ago, since which time she had never been quite well. Four weeks before admission, that is, three weeks after the commencement of measles, the child developed bronchitis, and it was for this that she was brought to the hospital, having at the time a temperature of 103.6° . There was impairment of percussion more or less over the whole of the right lung, where the breathing was greatly exaggerated, and in places almost bronchial in character; elsewhere on both sides of the chest the ordinary signs of bronchitis were present. The course of the case need not be minutely described. It was a very long one, and was characterised by a succession of relapses, the temperature rising considerably during each relapse, and the physical signs constantly changing. A patch of dullness, of bronchial breathing, or of crepitation appearing first in one part then in another, the whole case being gradually drawn out for a period of three months. The temperature chart gives a better record of the case than any description would. Ultimately the patient completely recovered.

Chart 2.—Case II.

CASE III.—L. C., 2½ years of age, was well until attacked with whooping cough two months before admission. For the last three weeks the patient had had a good deal of cough and the breathing had been rapid. Two days before admission the patient had become suddenly worse, and was then admitted with a temperature of 103° and all the signs of broncho-pneumonia. The whole of the right side was impaired to percussion, and there were several patches of bronchial breathing, pectoriloquy, and sharp crepitation. In a day or two's time bronchial breathing was to be heard over almost the whole of the right lung, but this rapidly

Chart 3.—Case III.

improved; then a patch was found on the left side below the angle of the scapula. The case was evidently one of broncho-pneumonia with numerous patches of consolidation and collapse in the whole of the right lung and with similar conditions, though not so extensive, in the left. After about a week the patient got better, and then in a few days' time again relapse set in with a good many fresh patches in the left lung. So the case went on, with one relapse following another for a period of three months. The temperature chart really shows the features of the case better than any description. In the end the patient recovered completely.

In the next two cases, although the affection proved ultimately to be broncho-pneumonia, the onset was of a more sudden character; but with this exception they do not differ in their clinical course from those preceding.

CASE IV.—A. D., aged 3, was in good health until October 3rd, when after being at school she became restless and feverish and complained of being giddy; she then got some bronchitis, with very rapid breathing, and on the 6th was admitted with a temperature of 103.6°, pulse 66, respiration 60. The only physical signs were those of bronchitis, and there was no definite consolidation to be found anywhere. The fever was of a markedly hectic character, varying from 103° to 99.5° daily for about a week; after this it became less hectic for a period of fourteen days longer and finally subsided; the patient gradually recovered completely.

CASE V.—D. T., 1 year and 5 months of age, was attacked with whooping-cough on January 1st, having been previously in good health. The attack proved to be a severe one, so that she would have attacks every hour or

so. She vomited a good deal, had frequent epistaxis, and rapidly lost flesh and strength. On January 15th breathing became rapid, and she was found to have bronchitis. By the 20th the symptoms were much worse, and there was marked recession of the lower part of the chest. On January 21st she was admitted, with high temperature, respirations 56, pulse 150, temperature 101°. The signs of general bronchitis, with marked

Chart 4.—Case IV.

recession of the lower parts of the chest. The chest was hyper-resonant, except on the right axilla, where there was a considerable patch of dullness, over which the breath sounds were bronchial. Besides this there were signs of general bronchitis over both sides. The next day the temperature rose to 106°, and remained very high for the whole of that day in spite of frequent sponging. Pulse 180, respirations 76. In the course of

Chart 5.—Case V.

the next two days the signs of bronchitis cleared off to a great extent, but the dullness remained the same. The temperature was very high on January 24th; temperature 104°, pulse 200, respirations 80. The condition remained much the same till January 27th, when the temperature went up to 106°, and was reduced by bathing; but it quickly went up again to 104°. That night a crisis occurred, a fall of 10.5° taking place in a few hours; and when the temperature fell to 98°, the pulse was still 148 and the respirations 76. This continued for three or four days, but on January 30th the temperature began again to rise, and continued high until February 14th—that is, eighteen days longer. Signs of bronchitis appeared in the chest again, with some patches of consolidation on the left side as well. The respirations and pulse still remained very rapid, the respirations averaging 40 to 50, and the pulse 160. On February 14th the temperature began to fall, and on the 16th was subnormal, from which time the patient made an uninterrupted recovery, the respirations however remaining rapid for another week, and the pulse also. The first attack appeared to be broncho-pneumonia, but with considerable consolidation on the right side. The second attack presented the ordinary features of broncho-pneumonia.

PRIMARY BRONCHO-PNEUMONIA.

The second form stands in strong contrast in almost every respect to the one just described. The children are often robust and healthy, and well till suddenly attacked with

severe symptoms. The fever rises abruptly, and is often ushered in by convulsions or nerve symptoms. The temperature is less remittent and of a higher average. It is of shorter duration; terminates, as it begins, suddenly, and often by a well-marked crisis; there is no great tendency to relapse; recovery is rapid, the mortality small, and there is no antecedent bronchitis, often no coincident bronchitis, and though in the later days of the disease signs of bronchitis may present themselves, they are evidently secondary. The physical signs are more often local, that is to say, one lung or a part or parts of one lung may be involved only, while the signs of general bronchitis are not so marked. The consolidation may sometimes be sufficient to give signs of percussion dulness, but in the large majority of cases no dulness is present. The general symptoms are often much more severe than the local ones, so that the pulmonary affection may be more or less masked. The patients may be unconscious or delirious, and it is in this group of cases that the diagnosis from meningitis often presents difficulties.

CASE VI.—H. B., aged 9 months, was a weakly child, and had had one or two slight attacks of bronchitis, from which he had completely recovered. He was in his usual health till March 31st, when he woke up one night crying and in a cold sweat. Until his admission on April 5th he had continued very ill, having a good deal of wheezing on the chest, very rapid breathing, and a good deal of fever. On admission the child's temperature was 103°, pulse 200, respirations 70, with a good deal of wheezing over the whole chest, with crepitation in nearly all parts, and extreme recession of the lower part of the neck. The only part where there was any impairment of percussion was at the left base behind, and here the breathing was exaggerated and was almost bronchial. The child was very ill, somewhat cyanosed, and with considerable dyspnoea. The condition remained much the same, without any marked change in the patient till April 6th, when the temperature suddenly fell, just as it does in croupous pneumonia, and in the course of a few hours dropped from 104° to 98°. This was accompanied with great prostration, from which the child did not rally, but died of exhaustion on the following day. From the sudden onset and termination the case presented the clinical features of croupous pneumonia. The physical signs, however, were those of a general bronchitis, with possibly some consolidation at the left base.

On the post-mortem examination the following condition was found: On the right lung there were small patches of consolidation throughout the whole of it, and in the base one or two considerable areas of collapse in addition. The larger bronchial tubes contained but little secretion, but the smaller ones contained some frothy fluid. In the left lung the lower lobe was almost completely collapsed, while the upper lobe, though still crepitant, contained a large number of small patches of consolidation. The posterior surface of the lung was covered with a thick exudation of lymph, a quarter of an inch thick over the lower part, which extended along the diaphragmatic surface and reached above to the middle of the upper lobe. In this lung there was a good deal of muco-purulent secretion in the smaller bronchial tubes throughout. The pathological lesions found were those of ordinary broncho-pneumonia.

Chart 6.—Case VI.

Chart 7.—Case VII.

CASE VII.—D. D., aged 7 months, was a weakly child, but had been in its usual health until February 12th, when it became restless and fretful. It vomited and had some wheezing on the chest, with a good deal of cough. On the 13th it was admitted, and had then a considerable amount of dyspnoea; the temperature was 105°, pulse 50, respirations 60, and there was a good deal of recession of the lower part of the thorax. The physical signs were those of general bronchitis, but in the right middle lobe there was an area of impaired resonance. The child remained in much the same condition until January 25th, when it seemed to be somewhat better, but it died somewhat suddenly that day without any obvious cause. There was no post-mortem examination.

CASE VIII.—W. T. W., aged 3½ years, has always been a fairly healthy

child, except for two attacks of bronchitis during his second year. He was well till December 25th, 1891, when his digestion was upset by some plum pudding. On December 28th he complained of thirst, lost his appetite, was drowsy, and had some cough. On January 1st he became delirious and had a slight fit. On admission he was found to have the signs of some general bronchitis, which, however, rapidly subsided as the signs of consolidation appeared at the right apex, where there was

Chart 8.—Case VIII.

some impairment of percussion and well-marked bronchial breathing. The pulse was 120, the respirations 64. The temperature averaged about 103°, occasionally reaching 104°; it was hectic in character, but retained high general level. He remained very ill, but gave no special cause for anxiety, and on January 7th appeared to be somewhat better in the morning, but in the middle of the day gave a cough, was seized with dyspnoea, and died in a few minutes. There was no post-mortem examination.

CASE IX.—F. R., aged 4½ years, was in good health till October 12th, when he was suddenly seized with shivering and coughing, and on the 13th he was very feverish, and vomited. The respirations were 40, pulse 150; the temperature was so high that the patient had to be bathed and sponged on several occasions. The physical signs were those of broncho-pneu-

Chart 9.—Case IX.

monia, without any very definite local signs of consolidation. The fever was very high, and the patient very ill, but it was intermittent in character, and it terminated suddenly with a well-marked crisis. At the same time a brother, aged 2, was also in the hospital with broncho-pneumonia, after which an empyema developed, and the child died.

To compare with this last series of cases we may take an other series, in which, on account of the more marked physical signs, the diagnosis of croupous pneumonia was made.

CASE X.—E. K., 1½ year old, a healthy and strong child, was well till January 20th, when he suddenly became very restless, had a kind of fit, vomited several times, and his breathing became short. He was admitted

into the hospital on January 25th—that is to say, on the sixth day of the disease. His pulse was 150, respirations 60, and his temperature very high. The whole of the lower half of the left lung was almost dull, the resonance

Chart 10.—Case X.

greatly impaired, and there was well marked bronchial breathing. There was nothing remarkable about the case, except the severity of the fever. On the tenth day the temperature fell suddenly by a well-marked crisis. Recovery was then rapid, and in five days all physical signs had disappeared.

CASE XI.—G. K., aged 8, was well till October 5th, when he was suddenly attacked with pain in the right side, frontal headache, vomiting, and pain in the chest. Temperature 103.8°, pulse 130, respirations 72. On October 9th the whole right lung was found to be solid from top to bottom, over which bronchial breathing was audible. There was only one part which maintained its resonance, and that was a small portion in the region of the nipple in front; no crepitation was present anywhere. On the left side the breathing was normal, except that it was somewhat exaggerated and puerile. The temperature fell abruptly on October 10th—that is, on the sixth day of the disease, and the patient made a very rapid recovery.

CASE XII.—F. J., aged 5 and fairly robust, was well until January 30th, when he was suddenly seized with sickness and shivering and seemed very ill. On the 31st he was admitted into the hospital with well marked signs of left base pneumonia, the whole lower part being dull and presenting well marked bronchial breathing. The respirations were 160, the pulse 150, the temperature 103.8°. The case presented no particular features, except the extreme rapidity of the pulse, which retained about an average of 160. On February 5th, the seventh day of the disease,

Chart 11.—Case XII.

the temperature fell suddenly, falling 9° in 16 hours. The temperature chart is very characteristic. The fall in the pulse was almost as remarkable as the fall in the temperature, dropping from about 160 to 60. The

Chart 12.—Case XIII.

child made a rapid recovery, except that it was left with some contraction of the affected side.

CASE XIII.—A. C., aged 5½, had been a fairly healthy child, except that it had had two attacks of bronchitis at the ages of 3½ and 4½, but for the last two months it had been a little ailing from some indefinite cause. It was then a little restless at night and was troubled with dyspepsia. A week before admission it suddenly became delirious and vomited, complained of pain which it referred to the abdomen and had several shivering fits. On admission it was found to have a temperature of 104, pulse 160, respirations 56; there were marked physical signs of consolidation at the right apex, but no general bronchitis. The case ran its usual course and terminated by crisis on the tenth day. Recovery was rapid and complete.

The cases that I have quoted prove that there are three clinical varieties of broncho-pneumonia:

1. That in which the disease is of gradual onset, preceded by some affection of the air tubes, the temperature hectic in character, the course prolonged and interrupted by frequent relapses, and the termination by lysis.

2. That in which the history and symptoms are similar, but the disease is of sudden rather than gradual onset.

3. That in which there is no antecedent affection of the air tubes, the affection is of sudden onset and short duration; the temperature persistently high, without any marked tendency to relapse, and the termination is by crisis, the clinical symptoms being those of croupous pneumonia, but the lesions those of broncho-pneumonia.

From the last group, lobar pneumonia differs only in the extent of the consolidation; that is to say, in little more than physical signs.

In other words, the secondary and primary broncho-pneumonias are clinically and pathologically different diseases; and while the secondary stand in close relation with bronchitis and similar affections of the air tubes, the primary stand in close relation with lobar pneumonia.

Whether there is a real specific difference of this kind between the two forms can only be decided by bacteriological investigation. Unfortunately in most of the investigations made so far, the distinction between these two forms has not been made, so that the results obtained, though of interest and importance in a general way, do not throw much light upon the special question at issue.

Before turning to the bacteriological side of the question it will be interesting to refer to some statistics which show first the general frequency of broncho-pneumonia compared with lobar pneumonia, and the relative frequency *inter se* of the primary and secondary forms. On both these points Holt¹ gives some interesting figures:

I.—Frequency of Broncho-Pneumonia compared with Lobar Pneumonia.

	Broncho-Pneumonia.	Lobar Pneumonia.	Proportion of Broncho-Pneumonia to Lobar Pneumonia.
Under six months ...	73	11	6.7 to 1
From six to twelve months...	96	29	3.3 to 1
In second year ...	73	40	1.8 to 1
In third year ...	19	23	0.8 to 1
In fourth year ...	0	6	0.0 to 6
Total ...	261 = 75 %	109 = 25 %	

The last column is especially interesting, as showing the steady and rapid diminution there is in the relative frequency of broncho-pneumonia and lobar pneumonia as children advance in age. Unless a specific difference between lobar and lobular pneumonia be assumed, all that these figures really show is that acute inflammation of the lungs tends to take the lobular form in very young children, but more and more the lobar form as the children grow older. This fact is sometimes stated in another way, namely, that in the first year of life broncho-pneumonia is the usual form, after the third year lobar pneumonia, while during the two intervening years the two forms are often combined.

II.—The Relative Frequency of Primary and Secondary Broncho-Pneumonia.

443 cases	Primary—that is, without previous bronchial affections ... *154		
	Secondary—		
	1. To bronchitis of larger tubes	...	41
	2. To some infectious disease:		
	Measles ...	89	
	Whooping-cough ...	66	
	Diphtheria ...	47	
	Scarlet fever ...	7	238
	Influenza ...	6	
	Varicella ...	2	
	Erysipelas ...	2	
	Acute ileo-colitis ...	19	

* Possibly some of these had their origin in influenza.

Excluding the cases of broncho-pneumonia developing in the course of some infectious disease, the primary bear in this table to the secondary the proportion of 4 to 1. This must be unusual. It is at any rate far above the proportion which my own experience would lead me to regard as correct for this country, and probably the difference is to be explained, as Holt suggests, by the inclusion among the primary cases of a large number of instances in which the broncho-pneumonia had its origin in influenza. I should think that the primary and secondary broncho-pneumonia occur in about equal proportions.

THE BACTERIOLOGY OF BRONCHO-PNEUMONIA.

Speaking generally broncho-pneumonia is shown to be associated with several varieties of pathogenic organisms; for example, the streptococcus, staphylococcus, Friedlaender's bacillus, the tubercle bacillus, and others; but chief among them all is the pneumococcus, which, taking all cases together, is present either alone or in association with some of the others named, at least 50 per cent.

Thus Netter² examined 42 cases, and found

Pneumococcus alone in	...	10	19 = 45 per cent.
With others in	...	9	
Streptococcus alone in	...	8	25 = 60 "
With others in	...	15	
Staphylococcus alone in	...	5	13
With others in	...	3	45 "
Friedlaender's bacillus alone in	...	2	6
With others in	...	4	

Weichselbaum³ in 15 cases found the pneumococcus in 7, streptococcus in 6, Friedlaender's bacillus in 1, and streptococci and staphylococci in 1.

Horton Smith⁴ in 11 cases found the pneumococcus alone in 5, with others in 3—that is, in 8 out of 11, and in only 3 cases was it absent.

There are only two sets of observations known to me in which the primary and secondary broncho-pneumonias have been separated and the results of the bacteriological examination kept distinct.

Mosny⁵ examined 4 cases of primary broncho-pneumonia, and found the pneumococcus in 3 and the staphylococcus in 1. In 13 secondary cases the pneumococcus was present alone in 1, and associated with the streptococcus in 1. The streptococcus was found alone in 5, and associated with other bacilli in 5 more. Friedlaender's bacillus was present in 1, and an unknown bacillus also in 1.

The most complete series is recorded by Holt,⁶ as investigated by Dr. Martha Wollstein, under his direction.

Of primary cases in 17 the pneumococcus was found alone in 9, with streptococcus in 3 and the staphylococcus in 1; in 1 the streptococcus was found alone, in 1 the staphylococcus was found alone. Of 14 secondary cases the pneumococcus was found alone in 2 and with others in 9 = 11; it was absent only in 3.

As far as the evidence goes it seems to show that in secondary broncho-pneumonia the streptococcus is the most frequent organism, and in primary broncho-pneumonia the pneumococcus, and that among the latter the pneumococcus is almost as common as it is in lobar pneumonia of adults.

Thus bacteriology gives confirmation of the conclusion to which clinical investigation has led, namely, that primary broncho-pneumonia is of pneumococcal origin, or, as it may be stated in other words, that the pneumococcus, which in the adult produces lobar consolidation, in the infant and young child produces lobular or disseminated consolidation.

It is now well known that the microscopical distinctions often drawn between the minute lesions of lobar and lobular pneumonia cannot be regarded as absolute, and that for example even the fibrin network which is so common in acute lobar pneumonia is not uncommon in acute broncho-pneumonia, while it may be absent in lobar pneumonia.

The conclusions to which this evidence points are obviously these:

1. That the primary and secondary broncho-pneumonias have a different bacteriological origin.

2. That secondary broncho-pneumonia is for the most part due to streptococcus infection, derived from some source in connection with the air tubes, throat, or mouth.

3. That primary broncho-pneumonia is of pneumococcal origin.

4. That pneumococcus inflammation occurs with almost equal frequency in the child and the adult.

5. That pneumococcal inflammation takes a different form in each, in the adult producing massive consolidation and in the child disseminated patches of consolidation; in other words, that there are no real pathogenic distinctions between lobar pneumonia of the adult and primary lobular pneumonia of the child.

Now the question may fairly be asked if this be so, why the inflammation of the lung takes a different form in the child from that in the adult. The answer is that it depends in all probability upon the peculiarities of the child's lung.

The respiratory mechanism in children presents many peculiarities. The chest walls are elastic and yielding owing to the incomplete ossification of the ribs and the thorax approaches the cylindrical in form. The type of respiration is diaphragmatic rather than costal and remains so up to about the 6th or 7th year; very slight causes easily produce irregularities of respiration and may even lead to local defects of expansion in different parts of the lung.

In structure also the lungs of children present many notable differences from that in the adult. Thus the trachea and main bronchi in the young child are relatively much larger; the other bronchi are also larger and occupy greater relative space; the air cells are smaller and occupy less relative space; the interstitial tissue of the lung is more abundant; the epithelial lining of the small bronchi and alveoli is relatively larger, the cells are of relatively larger size; they respond more actively to slight irritation under which they proliferate readily and are easily shed, thus giving the catarrhal or epithelial character to the resulting inflammation.

With so many peculiarities in the child's lung and respiratory mechanism it can hardly be matter of surprise that inflammation in the child should present peculiar features.

To sum up the matter, I am of opinion that the term "broncho-pneumonia" would be best reserved for those inflammations of the lungs which follow antecedent affections of the bronchi, and that their exciting cause for the most part will be found to be other organisms than the pneumococcus, while, on the other hand, the primary broncho-pneumonia of children is really croupous pneumonia occurring in a disseminated and patchy form instead of a massive consolidation.

Although it is convenient at the present time to deal with these two forms of broncho-pneumonia under the same heading and in relation to bronchitis, because I do not think we are yet ripe for their clinical separation from one another, still, in my opinion, the proper scientific place for the primary forms of broncho-pneumonia is not with broncho-pneumonia at all as it is commonly understood, but with croupous pneumonia.

It was not until I prepared this paper and was looking up the literature of the subject that I came across an article upon this subject by Holt. It is gratifying to find that his conclusions are practically the same as my own, and arrived at in the same way, namely, by clinical observation, and with this additional advantage, that he is able to support his views by the bacteriological investigations conducted under his own directions, to which I have referred.

The division of broncho pneumonia in the manner which I have suggested certainly removes some of the difficulties which are felt at the bedside and some of the confusion which exists on the subject; and even if it should seem that we may have gone somewhat beyond the facts at present at our disposal in endeavouring to connect these varieties with different bacteria, there is no doubt in my mind of the importance of the clinical distinction between the groups to which I have drawn attention.

If, as I have pointed out, the primary and secondary broncho-pneumonias are distinguished from each other not only in clinical history, course, and results, but also in bac-

	Clinical History.	Bacteriology.	
Broncho-pneumonia, lobular, patchy, disseminated	1. Gradual onset, tendency to relapse. Fever, hectic, markedly remittent, of long duration, with gradual fall. 2. Gradual onset with sudden aggravation, in other respects the same as above. 3. Sudden onset, no tendency to relapse. Fever high, not markedly remittent, of short duration, with sudden fall.	Streptococcus chiefly, and others Streptococcus, etc., associated probably with pneumococcus	Secondary broncho-pneumonia after bronchitis, measles, whooping-cough, diphtheria, etc.
Croupous pneumonia, lobar massive consolidation	Similar in all respects to the last	Pneumococcus Pneumococcus	Primary broncho-pneumonia. — Croupous Pneumonia.

teriology, the case for the recognition of these two forms seems to be clearly made out.

The table here given represents in a diagrammatic form the views I have been expressing.

REFERENCES.

¹ *Diseases of Childhood*, 1897. ² *Arch de Méd. Expér.*, June, 1892. ³ *Med. Jahrb.*, 1886. ⁴ *St. Bart's Hosp. Rep.*, 1897. ⁵ *Etudes sur la Broncho-pneumonie*, 1891. ⁶ *Loc. cit.*

THE USE OF CREOSOTED OIL FOR THE EXPULSION OF TRACHEAL FALSE MEMBRANES AFTER TRACHEOTOMY; AND OF INTRANASAL INJECTIONS OF OIL IN VARIOUS AFFECTIONS.*

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THE time-honoured treatment of croup by emetics, which aims at the removal of the membrane in the earliest stage, and is sometimes successful, deserves to be thought of in all cases seen at the beginning. For the later stages it has been superseded by modern methods of treatment. In all forms of diphtheria the injection of antitoxin should be our first care; and in the naso-pharyngeal cases it often succeeds almost without other aid. In tracheal diphtheria this fortunate result cannot be depended upon. Tracheotomy, which relieves that part of the dyspnoea which is due to superadded spasm, is powerless to clear the membrane away from the trachea and from the bronchial tubes. It is in these cases that the method suggested is of special value.

Tracheotomy itself was formerly too often delayed until the symptoms became urgent, indeed, sometimes to the verge of asphyxia, the disinclination to operate early being perhaps explained by the not infrequent failure of tracheotomy to save life. The author's opinion and practice have long been in favour of early tracheotomy. The scar which is left in the neck is after all a small matter compared with the risk to life involved in delay based upon a doubt as to the diagnosis. Our improved methods are arguments in favour of an early operation. Antitoxin accelerates the detachment of the membrane, and this will be the more readily expectorated if the child has not been exhausted by prolonged dyspnoea; whilst the method now advocated, which has for its chief object to promote the expectoration as well as the detachment of the membrane, cannot conveniently be applied except after a preliminary tracheotomy, but distinctly improves the prospects of that operation.

The present treatment, previously mentioned in a joint communication¹ by Mr. Hubert and the writer is applicable, after tracheotomy, in cases of simple tracheal diphtheria or in those in which the trachea is involved in addition to the pharynx. Its objects are: (1) To promote the expectoration of the membrane; (2) to assist its detachment; (3) to lessen its infectiveness *in situ*; and (4) to stimulate and soothe the ulcerated mucous surface.

The first two indications are the most urgent, and in so far as it has succeeded in fulfilling them, the method has contributed to the saving of life, since death when it occurs is

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due to the direct obstruction set up by the membrane or to its unchecked extension into the small tubes.

In the following cases, as in that previously reported,² the diphtheria was limited to the trachea; and they resembled it also (1) in having been diagnosed at first as simple laryngitis, but when first seen by the writer as latent diphtheria necessitating tracheotomy; (2) in the circumstance that no membrane was seen, even at the time of the operation; and (3) in the fact that the relief afforded by the latter was only temporary and was followed by death from gradual asphyxia in the one case (in which the treatment was not applied and no antitoxin was injected), and in the other by asphyxia and apparent death through impaction of membranes, resuscitation being fortunately obtained by artificial respiration.

The first case illustrates the result of the non expulsion of the tracheal membrane, death occurring within thirty hours after the tracheotomy, and the necropsy showing a thick membrane extending down the trachea from the level of the tracheotomy wound. In this case an opportunity of prescribing the creosoted oil was unfortunately not afforded, and the child remaining without any effectual cough after the tracheotomy, no membrane was expectorated from first to last. Death was due to gradual asphyxia of mechanical origin, not to broncho-pneumonia.

The second case came under treatment on the fourth day, with considerable dyspnoea. Tracheotomy did not show the presence of any membrane, but only some suspicious stringy mucus; but membrane was coughed up on the same evening, and for twenty-one days subsequently, and its diphtheritic nature was shown by cultures both in the early stage and towards the end of the case. Fifteen drops of creosoted oil (1 in 20) were introduced immediately after tracheotomy, and 400 units antitoxin were injected at the same time, and again the next morning. The treatment by creosoted oil was continued throughout the case with an interval of four days, during which simple olive oil was substituted. The slight tingling of the sputum, which had been observed at intervals under the creosote, continued under the influence of the pure olive oil; and further proof that the hæmorrhage was not set up by the creosote was also obtained by raising the strength of the creosote for a while to 1 in 15, and even to 1 in 10: no undue irritation and no hæmoptysis were thereby induced. The original strength (1 in 20) was then resumed, and the treatment continued until membrane ceased to be discharged. Recovery was uninterrupted in spite of the unusually long membranous and pyrexial stage, the signs of broncho-pneumonia at the right base ultimately disappearing. After a rise due to two successive antitoxin rashes, the temperature finally fell, and the tube was removed on April 12th. No paralytic symptoms occurred in the case. The albuminuria, at first considerable, disappeared within the first fortnight. An abundant crop of pustular acne on both legs, which occurred soon after the antitoxin rash, is the only other point deserving notice.

Frequency and Mode of Administration.—Fifteen drops were at first introduced every two hours, but from the third day every four hours. The immediate effect of the creosoted oil was to set up cough, and its influence in aiding the detachment of the membrane was indicated by the ease with which, during the intervals, membrane was expectorated by spontaneous cough. In the cases hitherto treated an ordinary drop bottle has answered every purpose. The oil did not cause the slightest distress to the patients. Indeed, up to the present no practical objection to the method has been noticed; and its safety, which enables it to be carried out by any trained nurse, is a recommendation.

Addendum.—The practical aspects of the question as to early tracheotomy is illustrated by another case of latent diphtheria which was submitted to the same treatment shortly after this paper was read. The case, which appears from the result to have been one of mild laryngeal diphtheria with only slight extension down the trachea, might probably have done well, without operation, under antitoxin alone. But the risk had to be dealt with of the case being perhaps more severe than it appeared, and possibly invaginate with extension of the membrane into the lung. Again, the injection of oil after the tracheotomy and its systematic employment, although the breathing had become free, were part of a precautionary treatment for the tracheal diphtheria which could reasonably be suspected, and were prophylactic measures