tion, and it is due to the credulity of many of our poorly educated doctors that so much poor therapy is practised, that so many proprietary or semi-proprietary remedies are used, whose extravagant propaganda the credulous, non-thinking type of doctor accepts as gospel truth because he sees it on a printed page. Even with all our science in this modern era, we are not free from fads—there are epidemics of fadism as well as of disease, that sweep over our land, and there is need at present in medicine for much caution in accepting new therapeutic agents especially. The best guard against rashness in this respect is a high standard of education for doctors. Anyone who is continually seeing graduate students, many of whom graduated from poor schools where there were practically no standards for admission, is often struck by the surprising lack of thinking power that some of them show; they do not think logically, they have learned their medicine by rote rather than by acquiring a knowledge of principles and then applying specific facts in accordance with these principles; their formula is that for a certain disease a certain drug is given, they may or may not stop to think why, or just what they expect to accomplish by means of the drug; they practice superficially rather than by trying to dig under the outside crusts of their problems, by going back to principles rather than to rules; they lack a clear vision and a broad viewpoint. A partial remedy for all this is general education, and with it a development of the critical faculty. The vast majority of the medical students of today *are* unusually well educated, thanks to the reforms which have been going on in the last fifteen years, and I doubt if there is a more intelligent, better reasoning class of men anywhere than these same students of the better modern schools. They are being taught what medicine is; that it consists of more than giving a certain drug for a certain disease; by means of the basic medical sciences they are being taught the broad truths upon which medicine rests and the critical faculty, which does not allow them to believe all they see in print, which keeps them away from the irrational and the extreme; as educated men they can appreciate truth and detect error. In short, they are being taught, I hope, something of the philosophy of medicine.

In the words of William Osler, whom one may well call a great medical philosopher, and a tireless seeker after truth:

"The higher the standard of education in a profession, the less marked will be the charlatanism, whereas no greater incentive to its development can be found than by sending out from our colleges men who have not had mental training sufficient to enable them to judge between the excellent and the inferior, the sound and the unsound, the true and the half-true."

Original Articles.

ACUTE RESPIRATORY INFECTIONS AT THE BOSTON CITY HOSPITAL. FROM THE PNEUMONIA SERVICE.*

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ORGANIZATION.

DURING the influenza epidemic of the fall and winter of 1918-1919 the need was felt for more adequate facilities for the diagnosis and treatment of the pulmonary complications arising in the influenza cases. A special fund of \$3,000 was made available for the expense of such a service by His Honor the Mayor, and the service was put in operation February 3, 1919. So far as organization and equipment are concerned, the service was made an independent unit of the hospital with its own bacteriological and clinical laboratories under the Pathological Department, portable x-ray apparatus, special record system, etc.

The advantages of a separate pneumonia service were early apparent. First, all such cases should be segregated to prevent, as far as possible, danger of infection to other patients in the hospital. Second, the special technical study of this class of patients can, as a routine, be carried out as is not possible when patients are scattered throughout the hospital on the four regular medical services. Third, particularly careful observation and nursing are necessary with this group of serious, acute dis-

* Report of the work of the special service given at the hospital clinical meeting, April 25, 1920.

eases which can be provided only when such patients are grouped in a few wards. Fourth, certain forms of treatment, such as the administration of serum, require expert training on the part of the resident physicians giving it. Fifth, the grouping of cases for study must inevitably stimulate those placed in charge of such a group to their best possible effort. Sixth, the assembling of all cases of a given disease in a few wards and on a single service is an immense advantage to all members of the medical staff in that it affords an opportunity for the observation of a relatively large number of cases under most favorable conditions. The same material is also more available for teaching.

It was frequently found impossible in the admitting office to certainly differentiate between the cases of influenza and other acute pulmonary infections, hence practically all cases of pneumonia admitted to the hospital were also sent to the influenza service. The success of the work with the pneumonia cases was so evident that in June, 1919, when the influenza epidemic had died out it was unanimously voted by the medical staff to recommend to the Board of Trustees that the service be continued permanently as a special pneumonia service. As now organized the work is in charge of one of the visiting physicians of the hospital who is chosen by the medical staff each year. One or more of the visiting physicians or first assistant visiting physicians may serve as associate or assistant once each year for a period of not more than three months. The house staff consists of a resident physician and from two to four of the senior medical internes of the hospital. It is provided that each senior medical interne in the hospital is assigned to the pneumonia service for a period of two months.

A very satisfactory cubicle system is maintained by the use of screens 5½ by 7 feet, made of unbleached cotton stretched over a light wooden frame. This frame is held in place by tape at the head of the bed, thus being easily swung away from the foot to facilitate examination or care of the patient. But one screen is necessary for each bed. The importance of this cubicle arrangement is twofold. First, it has apparently been effective in preventing cross-infections, and second, the critically ill are virtually isolated. This method of isolation has proved so satisfac-

tory that it has only very rarely been necessary to transfer a patient to a single room.

The cases of pneumonia developing empyema or requiring any minor surgical treatment are treated by a surgical service but remain in the wards of the pneumonia service, the patient thus having the advantage of both surgical and medical supervision. By vote of the senior staff all patients entering the hospital with empyema are admitted to the pneumonia service.

From February 3, 1919, to April 30, 1920, a total of 1078 cases were admitted to the service. Of these, 85 were influenza, 188 influenza and pneumonia, 164 bronchopneumonia, 447 lobar pneumonia, 29 empyema (admitted as such), and 165 miscellaneous conditions.

INFLUENZA AND INFLUENZA-PNEUMONIA.

As the service was not organized until February 3, 1919, practically all of the cases of influenza were observed during two limited periods, namely, from February 3 to April 30, 1919, and January 16 to March 16, 1920. The former was following the period of the secondary wave of the great epidemic of 1918, and the second the recurrent epidemic of 1920. For this reason it is evident that the number of cases seen on the pneumonia service is too small to be of value in discussing the incidence and mortality from influenza. We have therefore combined our statistics with those of the other medical services. The two following charts are based on the figures for all cases of influenza entering the hospital during the epidemic periods, or a total of 1,744. They are designed to show by weeks the actual number of patients admitted, the percentage of complicating pneumonias and the mortality among the influenza-pneumonia cases.

Chart 1 covers the period from the beginning of the first epidemic, September 3, to the end of the minor epidemic of the following winter. The heavy solid line representing the number of patients admitted by weeks shows the characteristic abrupt rise to a maximum of 172 in the third week, a slightly less rapid fall during the next four or five weeks, then more slowly approaching zero, the main epidemic covering a period of six to eight weeks. This type of curve is commonly observed in epidemics of this disease.

After a period of approximately six weeks the curve is, to a considerable extent, duplicated. There is the same sharp rise during

CHART I.

ACTUAL NUMBER OF INFLUENZA CASES, PERCENTAGE OF PNEUMONIA AND DEATH-RATE AMONG PNEUMONIAS, SEPTEMBER 3, 1919, TO MARCH 17, 1920. ARRANGED BY WEEKS. 1430 CASES.

Black line=actual number of cases; Broken line=percentage of pneumonias; Light line=death-rate among pneumonias.

the first week, but it is to be noted that the maximum is reached more quickly and is only about one-third as great as the maximum in the main epidemic. The number of new cases does not diminish to any marked extent for the next month, and then descends much more slowly and irregularly.

The facts indicated by the remaining curves are clear, but their interpretation and signifi-

cance very puzzling. It will be seen that the percentage of cases with pneumonia was at first low,—27 per cent.,—but rose rapidly until the ninth week, when it reached 77 per cent., this maximum occurring some weeks after the beginning of the subsidence of the epidemic. The decline was then rapid, but remained above 40 per cent., with the exception of a single week, when it fell to

CHART II.

ACTUAL NUMBER OF OF INFLUENZA CASES, PERCENTAGE OF PNEUMONIA AND DEATH-RATE AMONG PNEUMONIAS, JANUARY 16, TO MARCH 17, 1920. ARRANGED BY WEEKS. 341 CASES.

Black line=actual number of cases; Broken line=percentage of pneumonias; Light line=death-rate among pneumonias.

39 per cent. A very irregular curve, but one of the same general type, is shown during the secondary epidemic of December and January. Here again the percentage of pneumonia was highest some weeks after the decline in the epi-

demic, then fell abruptly, but remained above 40 per cent.

The death rate among the influenza-pneumonias, however, was highest during the first week and from then on the curve is almost exactly the reverse of the curve for the incidence of pneumonia. In other words, with a rapidly rising incidence of pneumonia among influenza cases there was a striking decline in the mortality. The death rate during the first week was 72.7 per cent., but by the eighth week had fallen to 38.5 per cent., and by the thirteenth to 20 per cent., which was the minimum for the entire epidemic period. With the onset of the secondary epidemic in December the death rate among the pneumonias again rose and after the decline in the epidemic in January, reached 66.5 per cent.

The number of deaths in the whole group of influenzas is essentially identical with that in the pneumonias as it seems probable that all fatal cases of the disease have a complicating pneumonia. Only four cases died without a diagnosis of pneumonia. The total death rate for the 740 influenza-pneumonias treated from September 3, 1918, to April 30, 1919, was 54.7 per cent.

Chart 2 covers the period of the minor epidemic of January and February, 1920. The curve showing the actual number of cases of influenza entering the hospital is an exact miniature of that for the first epidemic. The course of the incidence of pneumonia and the death rate in these cases, however, take an exactly opposite curve, namely, in the first epidemic the percentage of pneumonia increased steadily while the death rate declined, but in this last epidemic the percentage of cases gradually declined while the death rate rose rapidly after the third week. No secondary wave developed this year and after the rapid decline the disease gradually disappeared from the wards. The general mortality for the first week was only 21 per cent., but during the second week rose to 69 per cent. By the third week, however, it fell to 14 per cent. and remained low throughout the remainder of the epidemic. This marked difference in the death rate in the two epidemics is in accordance with clinical observations, the cases in the epidemic of 1920 being much more mild and developing fewer complications. From January 16 to March 11, 1920, a total of 341 cases of influenza were admitted, of whom 137, or 40 per cent., were complicated

with pneumonia. No deaths occurred among the uncomplicated cases. The general death rate for the 137 influenza-pneumonias was 38 per cent.

In every instance among the 273 influenza and influenza-pneumonia cases treated on the pneumonia service where sputum could be obtained the sputum bacteriology was determined. The following table gives the results in the 162 cases in which the sputum was examined. Almost every case yielded two or more organisms.

TABLE I.—SPUTUM BACTERIOLOGY OF 162 INFLUENZA AND INFLUENZA-PNEUMONIA CASES.

ORGANISM	INFLUENZA	INFLUENZA-PNEUMONIA
Pneumococcus, Type I	0	3
Pneumococcus, Type II	0	1
Pneumococcus, Type III	2	16
Pneumococcus, Type IV	21	77
Streptococcus, hemolytic	1	21
Streptococcus, non-hemolytic	0	12
Streptococcus viridans	2	9
Staphylococcus aureus	0	18
Bacillus influenzae	14	73
Micrococcus catarrhalis	1	4

These cases were chiefly from the 1920 epidemic. Among the pneumonias of this group the organisms most commonly associated were pneumococcus type IV and the bacillus influenzae. The next most frequent finding was some combination of pneumococcus type III, staphylococcus aureus and hemolytic streptococcus. The almost entire absence of types I and II is striking.

In several instances what appeared to be a typical lobar pneumonia followed an unmistakable attack of influenza. We have often experienced great difficulty in differentiating a confluent bronchopneumonia occurring with influenza from a true lobar pneumonia. By reason chiefly of the more positive character and severer type of the influenza in the 1918-1919 epidemic less difficulty of this sort was experienced. A considerable series of cases which have been examined in the Pathological Department and the Medical Examiner's Laboratory have grossly and microscopically shown every possible gradation from the incomplete bronchopneumonia to the typical lobar form. If it has so frequently been impossible at the autopsy table to make a positive diagnosis of the variety of pneumonia it is not surprising that we have experienced difficulty at the bedside. In the group of 188 influenza-pneumonias 35.6 per cent. died.

The remarkable results obtained by McGuire and Redden (*Jour. A. M. A.*, 1918, LXXI, 1311; 1919, LXXII, 709) in the fall of 1918 with the use of convalescent human serum in cases of influenza-pneumonia encouraged us to employ the method. Unfortunately the service was not organized until after the epidemic had largely subsided and the number of cases available during the secondary epidemic in the winter and spring of 1919 afforded only a very limited opportunity for testing the value of the serum treatment. In conducting such an experiment we felt that the results could be of no scientific value unless accurately controlled. Cases were therefore paired on the basis of age, sex, length of illness, the character of the signs and severity of the symptoms, one case only of each pair receiving the inoculations. There were in all twenty-two of each group and the total number of deaths in each was ten, or, roughly, 45.4 per cent. Careful observations of the cases and their controls failed entirely to afford any evidence of benefit in the treated cases. The series is obviously too small to warrant any definite conclusions. On the basis of such a limited experience with the convalescent serum treatment we do not feel justified in condemning it as of no value. It is only possible to state that we have failed to obtain any positive results. It was our intention to continue the investigation during the past winter, including careful bacteriological studies of the donors and patients. During the epidemic of 1920 we succeeded in obtaining two liters of serum, but the atypical forms of pneumonia made the diagnosis of influenza-pneumonia very uncertain and this together with the short duration of the epidemic prevented us from securing the necessary clinical material.

BRONCHOPNEUMONIA.

Primary bronchopneumonia in adults was, before the war, very rarely observed in hospital practice, but during the past few years has been seen with surprising frequency, as evidenced by the fact that among 1,078 cases treated on the pneumonia service in fifteen months, 164 were of this type. In the fall of 1917 large numbers of bronchopneumonia cases, for the most part due to the hemolytic streptococcus, and often complicated by a streptococcus empyema, were reported from the southern army cantonments. These early cases usually developed as a complication of measles, though in

some camps there was an epidemic of primary pneumonia of this type. During the spring of 1918 similar cases were observed in large numbers in other army camps scattered all over the country and to a less extent in civil communities as well. With the appearance of the influenza epidemic in the fall of 1918, the disease became widespread and was met with in all civilian hospitals. Throughout the winter of 1919 streptococcus bronchopneumonia was again very prevalent in the civilian population and an unusual opportunity was offered for the study of the disease side by side with lobar pneumonia. Its early recognition is especially important by reason of the frequency of a complicating streptococcus empyema which appears very early in its course, often developing on the second to fourth day of the pneumonia.

Thirty of these cases were studied intensively during December, January and February of the past winter. These were considered examples of primary bronchopneumonia as distinguished from the bronchopneumonia secondary to influenza, a differentiation which is exceedingly difficult and often impossible during a period when influenza is epidemic, as was the case during the past winter. In a majority of this group the history was quite characteristic. The onset was gradual, beginning with a cold or sore throat associated with malaise. The usual story was that the patient continued at work for a few days to a week until the cough, malaise, headache, fever and pain in the chest became so severe that he was obliged to go to bed. In other words, in contrast to lobar pneumonia the infection in the lungs seems to follow an infection of the upper respiratory tract. The prodromal stage is variable, lasting from one to several days or even two weeks. The average in the thirty cases studied was four days. There were five cases which did not conform to this type. In these the onset was abrupt, with a chill, cough, and pain in the chest. The cough appears early, is at first painful and unproductive, but soon is accompanied by a mucoid sputum which is often blood tinged but never conspicuously tenacious as in lobar pneumonia. Pain is a common and often distressing symptom. It is usually localized over the lower half of the chest, rarely under the sternum. Pains in the back and legs are more frequent than in lobar pneumonia but less prominent than in influenza. A pleural rub is occasionally heard. Delirium is much more rare

than in lobar pneumonia. Frequently during the course of the disease chilly sensations are felt and not uncommonly an actual rigor occurring some days after the appearance of the symptoms in the upper respiratory tract seems to mark the onset of the involvement of the lungs. Dyspnoea of some degree is almost always present and frequently very severe. The temperature is elevated but less regular than in ordinary pneumonia and nearly always falls by lysis. The pulse is elevated and respiration much increased, in the cases of severe dyspnoea sometimes reaching sixty or seventy. Prostration is often profound. Cyanosis is occasionally seen. Herpes is rare.

The following table gives the symptoms in their order of frequency in the cases studied:

TABLE II.

Cough	23
Pain in the chest	21
Headache	16
Chill	14
Fever	13
Bloody sputum	12
Pain in limbs	9
Anorexia	8
Dyspnoea	8
Chilliness	5
Vomiting	5
Tiredness	5
Weakness	4
Sore throat	4
Back-ache	4
Eye-ache	4
Sub-sternal pain	1

These symptoms as tabulated do not differ very materially from those of lobar pneumonia, but the mode of onset as emphasized above is as a rule quite distinct.

The sputum bacteriology of the entire group of 164 bronchopneumonias is given in the following table:

TABLE III.—BACTERIOLOGIC EXAMINATION OF THE SPUTUM.

Pneumococcus, Type I	2
Pneumococcus, Type II	4
Pneumococcus, Type III	18
Pneumococcus, Type IV	43
Streptococcus, hemolytic	30
Streptococcus, non-hemolytic	2
Streptococcus viridans	14
Staphylococcus aureus	19
Bacillus influenzae	44
Unclassified and unknown	53

The results are somewhat confusing, as in many cases several organisms were present. Any final grouping of all cases according to the organism found is impossible. The above described variety due to the hemolytic streptococcus gives the most definite clinical picture and seems to represent a distinct group. The

non-hemolytic streptococcus was found in only two cases. It is generally accepted that the streptococcus viridans may be an occasional cause of bronchopneumonia, but its presence in the sputum is not sufficient proof of its etiological importance. In several instances including both fatal and non-fatal cases, we have obtained the organism in anti-mortem lung puncture. The influenza bacillus was the most frequent single organism found, but it has almost invariably been associated with some other pathogenic bacteria. Types III and IV pneumococci were obtained very commonly, as is shown in the above table. The former seems to be the organism present in a majority of the cases of the "migratory" form of bronchopneumonia. One of the most interesting groups is that due to the staphylococcus aureus. They conform very closely to the clinical and pathological type described by Chickering and Park (*Jour. A. M. A.*, 1919, LXXII, 617). Four of this last mentioned group developed empyema, two of whom died. The rarity of types I and II pneumococci in the sputum is very noticeable. It is interesting that thus far we have not seen a single case of bronchopneumonia which has proved pathologically to be due to either of these types of pneumococci.

LOBAR PNEUMONIA.

Chart 3 gives the incidence by months, arranged according to sex, of the 447 cases of lobar pneumonia treated from February 3, 1919, to April 30, 1920. It is interesting to note that in both years the marked rise in the number of pneumonia cases was principally due to the increase in the number among males.

CHART III.

INCIDENCE BY MONTHS OF LOBAR PNEUMONIA (447 CASES) FROM FEBRUARY 3, 1919, TO APRIL 30, 1920.

The total case fatality for the 447 cases was 25.5 per cent. The death rate among 574 cases of lobar pneumonia treated in the City Hospital during the year 1916 was 39.4 per cent. and for 774 treated during the year 1917, 36.3 per cent. The well-known variation in the virulence of the infection from year to year and the resulting variation in the death rate may to some extent explain the sharp drop to 25.5 per cent., but is not sufficient to fully account for it. Likewise the reduction in the number of deaths in type I cases treated by antipneumococcus serum to be discussed later is obviously a factor. We believe it not unreasonable to assume that the advantages resulting from the treating of all cases of pneumonia on a single service has contributed in lessening the number of fatal results.

A type pneumococcus was recovered in 335 cases. In Table IV the bacteriologic findings are combined to show the incidence of the various type pneumococci in two sexes.

TABLE IV.—FOUR HUNDRED AND FORTY-SEVEN CASES OF LOBAR PNEUMONIA ARRANGED TO SHOW RELATIVE FREQUENCY OF THE TYPES OF PNEUMOCOCCI ACCORDING TO SEX.

	TYPE PNEUMOCOCCUS				UN-CLASSIFIED	MORTALITY PER CENT.	TOTALS
	I	II	III	IV			
Male	87	62	31	64	73	26.5	317
Female ..	29	9	18	35	39	23.0	130
TOTALS ..	116	71	49	99	112	25.5	447

It will be noted that males suffered relatively more from types I and II, and females relatively more from types III and IV infection. A possible explanation of this interesting difference in the sexes with respect to the type organism found is that types I and II are present only in the mouths of individuals convalescing from such infection or recently in contact with types I and II cases, while types III and IV are very commonly found in the mouths of healthy individuals (Dochez and Avery, *Jour. Exper. Med.*, 1915, XXII, 105; Stillman, *Jour. Exper. Med.*, 1916, XXIV, 651). The women who spend relatively much more time at home do not come in contact with types I and II carriers as do the men, and consequently when pneumonia develops in women the infection is more often due to the common mouth organisms.

During the winter months infection with the various types of pneumococci seem to occur in waves suggesting small epidemics, but no epidemiological investigations were undertaken

and this occurrence may be purely a coincidence.

Among the 353 cases of lobar pneumonia in adults the type pneumococcus was determined in 293. These results are given in Table V.

TABLE V.—LOBAR PNEUMONIA IN ADULTS (293 CASES).

TYPE PNEUMOCOCCUS	No. CASES	PER CENT.	MORTALITY PER CENT.
I	105	36.0	22.8
II	66	22.8	31.8
III	45	15.0	46.2
IV	77	26.2	27.2

The relative frequency of the various types is not unusual and the mortality in the different groups does not show any significant variation from the figures for most other clinics, except for a rather high death rate in type IV cases.

Lobar pneumonia as seen in infants and children was a comparatively mild disease. Considerable difficulty was encountered in obtaining sputum for examination from the younger children, and in consequence only 42 of the total of 94 patients under fifteen years were typed. The results are as follows:

TABLE VI.—LOBAR PNEUMONIA IN CHILDREN (42 CASES).

TYPE PNEUMOCOCCUS	No. CASES	PER CENT.	MORTALITY PER CENT.
I	11	26	9.9
II	5	12	0.0
III	4	10	0.0
IV	22	52	4.9

The most noteworthy feature of these figures is the high percentage of type IV infections. The mortality per cent. is misleading. Only two of the above group died, one with type I and the other with type IV infection. A complicating laryngeal diphtheria in the first and acute nephritis and pleuritis in the second probably accounts for the fatal termination. Only two of the fifty-two cases in which the organism was unknown died. By reason of the extremely low mortality no antipneumococcus serum treatment was attempted in infants under five years. The few cases of older children treated with serum all recovered.

From February 3, 1919, to April 30, 1920, a total of 132 pneumonias were proved to be due to type I pneumococcus. With a very few exceptions all cases, including the moribund ones, were treated with the antipneumococcus serum as soon as the laboratory report was received, provided the patient had not had a crisis. The total treated by this method was 75, and the untreated 57. The technique used in the ad-

ministration of the serum is the same as that developed at the hospital of the Rockefeller Institute (Monograph No. 7, Rockefeller Institute for Medical Research, 1917).

The paramount importance of the early administration of the serum is well shown in the following table:

TABLE VII.—DEATH RATE AMONG SERUM TREATED CASES.

	No. CASES	No. DIED	MORTALITY PER CENT.
Treatment started on 2nd day	1	0	0.0
Treatment started on 3rd day	7	0	0.0
Treatment started on 4th day	13	2	15.4
Treatment started on 5th day	13	1	7.7
Treatment started on 6th day	9	2	22.2
Treatment started on 7th day	13	2	15.4
Treatment started on 8th day	8	3	37.5
Treatment started on 9th day	4	1	25.0
Treatment started on 10th day	3	1	33.3
Treatment started on 11th day	1	1	100.0
Day of disease not known	3	0	0.0
TOTALS	75	13	17.3

It seems very significant that among the fifty-six who were treated during the first week of the disease only seven, or 12.5 per cent., died. The death rate for the whole group of seventy-five treated cases was 17.3 per cent. and for the 57 untreated 26.3 per cent. These results, which accord with the experience of others, are strong evidence of the efficacy of serum treatment of type I pneumonia. The fact should be most strongly emphasized that the earlier the treatment is begun the more prompt and favorable are the results. It seems quite questionable if this method is of any value when employed later than the seventh day. Often after a single intravenous injection of 100 c.c. the temperature fell to normal and remained so. In other cases several injections at eight-hour intervals were necessary. The largest amount of serum given was nine doses of 100 c.c. each. The average of serum per patient for the seventy-five treated cases was 197 c.c.

We have noted, as has previously been observed, that those patients who have a marked thermal reaction following the serum injection seem to derive more benefit from the treatment than those who have no reaction. Bull and Bartnal (*Jour. Exp. Med.*, 1920, xxxi, 233) have shown that the inhibitory action of whole blood on the growth of pneumococci is partly dependent on the presence of a sufficient number of leucocytes. These two considerations led us to study the leucocyte reaction following the use of the antipneumococcus serum. Eight cases were carefully studied with reference to

the course of the leucocyte curve immediately following this form of treatment. Seven of the eight patients experienced a prompt thermal reaction after the injection and in five of the seven the reaction was accompanied by a severe leucopenia followed by a leucocytosis. This same course in the leucocyte curve has been observed to occur coincidently with a similar thermal reaction following the injection of other foreign proteins (Gay. Typhoid Fever. The Macmillan Co., N. Y., 1914, p. 168; Scully, *Jour. A. M. A.*, 1917, LXIX, 20). The five cases which reacted in this way showed an immediate striking improvement after one or two doses of serum. In the sixth case the white count was 29,000 per c.mm. before treatment and no essential change occurred in the count after the chill following the serum injection. The temperature fell rapidly, reaching normal in twenty-four hours. A few hours after the temperature reached normal the number of leucocytes diminished. In the seventh case the leucocyte count fell from 23,000 per c.mm. to 13,000 per c.mm. after the first injection and did not increase during the remainder of the treatment. Five doses of serum were given before the temperature reached normal. The single case in which no rigor took place had a white count of 11,000 per c.mm. The count remained low and the patient died after the fifth dose of serum.

Our observations seem to indicate:

1. That patients who have a chill following intravenous serum treatment usually show a few hours later a hyperleucocytosis and these cases react more favorably than do those who have no chill.

2. In cases with a high leucocyte count the maintenance of the leucocytosis or an increase following serum treatment is to be interpreted as a very favorable prognostic sign.

3. Patients whose white count is markedly depressed by the serum or in whom an original leucopenia is not replaced by a leucocytosis after the injection do badly under serum treatment.

We believe it reasonable to conclude that the presence of an increased number of leucocytes is a necessary part of the mechanism of recovery in cases treated with antipneumococcus serum. It seems probable that the cases in whom the administration of the serum fails to produce an increased leucocytosis or is followed

by a depression in the number of white cells suffer from a degree of toxemia too great to permit a reaction to the serum. The value of this foreign protein reaction is an interesting subject for experimental study.

BLOOD CULTURES.

In all a total of 302 blood cultures were made with positive results in 21.2 per cent. This small percentage of positive results is largely due to the considerable number of influenza-pneumonia and bronchopneumonia cases included in the series. A summary of the positive findings is given in Table VIII.

TABLE VIII.—POSITIVE BLOOD CULTURES.

	NO. CASES	DEATHS	MORTALITY PER CENT.
Pneumococcus, Type I..	18	10	55.5
Pneumococcus, Type II.	9	7	77.7
Pneumococcus, Type III	12	11	92.4
Pneumococcus, Type IV	10	7	70.0
Streptococcus, hemolytic	6	6	100.0
Streptococcus viridans.	1	1	100.0
Staphylococcus aureus.	8	6	75.0
Bacillus coli communis	1	1	100.0

The rather surprising fact that of eighteen type I pneumococci with positive blood culture only ten died is probably to be explained by the fact that fourteen were treated with anti-pneumococcus serum, seven recovering.

WASSERMANN REACTION.

False positive Wassermann reactions obtained during the febrile period of acute infections have been mentioned (Golden, G. M.; *Hahneman Month.*, Phil., 1918, LIII, 728). We have taken blood for this test in 363 cases. Of these 320 were negative, 33 were persistently positive, four were doubtful, and only six were falsely positive, i.e., positive during the febrile stage and negative during convalescence. That these are actually false positive reactions can be proved only by the absolute exclusion of syphilis. We are not in a position to do this and we have, therefore, no statements to make except that (1) false positive Wassermann reactions during the febrile period of pneumonia are rare; (2) latent or cured syphilis may possibly give a positive reaction only during the febrile period.

LUNG PUNCTURE.

A report of the study of 73 lung punctures performed in lobar pneumonia cases on this service was recently published. (Thomas, H. M., Jr., and Parker, F., Jr., *Arch. Int. Med.*, 1920,

xxvi, 125.) This procedure was done to hasten or confirm the bacteriological diagnosis and proved to be of considerable value clinically. The question has perhaps naturally been raised, Is this method of examination free from dangers to the patient? Theoretically, the infection of the pleura might result or the injury to the lung by the needle possibly lead to local softening and abscess. Empyema developed in only two of the seventy-three cases, or 2.7 per cent., an incidence rate which is less than half of that for the entire group of 447 lobar pneumonias. Lung abscess did not develop in a single instance, neither was any other ill effect ever observed. Furthermore, if carefully done, the introduction of a needle into the lung causes the patient almost no pain. On the basis of this experience we feel justified in concluding that lung puncture is an entirely innocuous procedure.

It was found that the mortality of cases yielding viable organisms by lung punctures after the fifth day of disease was 56 per cent., whereas cases yielding no organisms by lung puncture, irrespective of the day of the disease, with only two exceptions, recovered, or a mortality of 6.5 per cent. Positive lung punctures were obtained, however, just before, during and immediately following crisis in a few cases. These facts seem to indicate that destruction of the organisms is the first step in the process of recovery, but also that crisis may occur before the organisms have been entirely killed, or not until several days after. That definite anti-bacterial properties are developed in the blood has been shown by many investigators but that these properties are in any way important in combating the toxic manifestations of lobar pneumonia has not been claimed.

Our results seem to indicate the existence of both an anti-bacterial and detoxifying mechanism which are active in the process of recovery which act, in a measure, independently. The rate of development of anti-bacterial bodies, on the one hand, and the detoxifying mechanism, on the other, may occur simultaneously or not, according to factors which influence their separate production differently. The work of many investigators suggests that detoxification may occur by a sudden change in the ferment-antiferment balance, but the possibility of a true toxin-anti-toxin reaction has not been definitely ruled out.

EMPHYEMA.

During the period covered by this report a total of sixty-six cases of empyema were treated. Table IX gives the results of bacteriological studies of the exudate, the type of pneumonia and the mortality of this group.

TABLE IX.—SIXTY-SIX CASES OF EMPYEMA GROUPED ACCORDING TO THE TYPE OF PRIMARY PNEUMONIA, SHOWING THE ORGANISM FOUND AND THE MORTALITY IN EACH.

	LOBAR PNEUMONIA		BRONCHO-PNEUMONIA		POST-PNEUMONIA		TOTAL	
	No.	Died	No.	Died	No.	Died	No.	Mort.
Pneumococcus, Type I	14	2			6	1	20	15.0
Pneumococcus, Type II	3	2			1	0	3	66.6
Pneumococcus, Type III	1	0			1	0	2	0.0
Pneumococcus, Type IV	5	0			1	1	6	16.6
Pneumococcus unknown					2	0	2	0.0
Streptococcus hemolyticus			10	7	11	0	21	33.3
Streptococcus non-hemolyticus ..			1	0	3	0	4	0.0
Staphylococcus aureus			2	2	2	0	4	50.0
Undetermined					4	0	4	0.0
TOTAL	23	4	13	9	30	2	66	22.7

It will be seen from the above table that all of the empyemas following lobar pneumonia were due to the pneumococcus, while in the case of empyemas occurring with bronchopneumonia none was caused by this organism. Two cases of this second group showed staphylococcus aureus but all the remainder were due to the streptococcus. The first group comprises twenty-three and the second group thirteen cases. The thirty cases grouped in the tables under post-pneumonia were all admitted to the hospital for empyema and too late in the course of the disease to determine the form of the primary pneumonia. So constantly, however, does the pneumococcus empyema complicate lobar pneumonia and the streptococcus empyema a bronchopneumonia that there would seem to be

but little if any doubt that the two cases showing pneumococci in the pleural exudate were secondary to lobar pneumonia and a majority of the remaining twenty which showed streptococci were secondary to a bronchopneumonia. These figures are in accord with the general conception of empyema as conforming to two most common types, namely, (1) pneumococcus empyema following lobar pneumonia, and (2) streptococcus empyema following bronchopneumonia.

Among the total 447 lobar pneumonia cases 5 per cent. developed empyema while the 352 bronchopneumonias (including the 188 influenza-pneumonias) showed only 3.7 per cent. incidence of empyema. The former is within normal limits but the latter seems surprisingly low.

The mortality in the group of thirty-two pneumococcus empyemas was 18.1 per cent. and in the group of twenty-five streptococcus empyemas 28 per cent. The high mortality in the second group is usual and is probably due chiefly to three factors; first, the general virulence of the infection; second, the early recurrence of the empyema which, as a rule, develops while the intrapulmonary process is in an active stage, and third, the frequency of other complications due to the same organism, such as infection of other serous cavities and the mediastinum, abscess of the lung, endocarditis, meningitis, nephritis and septicaemia. If we take the figures for the known group of twenty-three lobar and thirteen bronchopneumonia cases we find a mortality for the empyema of 17 per cent. for the first and 69 per cent. for the second. The mortality for the entire group of sixty-six cases was 22.7 per cent. and for the fifty-five operated cases 20 per cent. There seem good reasons for assuming that the epidemic of influenza and the extraordinary prevalence of broncho-pneumonias in the period to which these figures apply have been factors of considerable importance in maintaining this relatively high death rate in empyema.

In deciding when the patient with empyema should be operated we have been guided by two considerations, (1) the type of infection, and (2) the general condition of the patient, especially with reference to the stage of the pneumonia. As a rule, in the case of pneumococcus empyema, when frank pus is present, an immediate operation has been advised provided the condition of the patient is satisfactory. Unquestionably the patient's chances are much better

if he has reached the point of at least early convalescence from his pneumonia. Fortunately infection of the pleura with the pneumococcus is usually a late complication and empyema does not in consequence develop until the acute stage of the pneumonia has passed. When severe toxic or mechanical symptoms are evidently due to the empyema then drainage of the cavity should be effected without delay.

Empyema due to the streptococcus very frequently develops during the early stages of the bronchopneumonia and the situation is then a serious one. The infection appears suddenly and the effusion often accumulates very rapidly. Early operation in these cases means a very high mortality as the patient is apt to be extremely toxic and in no condition to stand surgical treatment. Aspiration often affords the patient great relief and the toxemia promptly diminishes. By simple aspiration of the chest every one to three days it is usually possible to postpone the operation until the patient's condition is more favorable.

A discussion of the operative technique and the results obtained with the various methods of drainage will be given in a surgical report now in preparation.

INTRACISTERN INJECTIONS OF SALVARSANIZED SERUM IN NEUROSYPHILIS.*

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SINCE the beginning of the use of salvarsan therapy, Butler Hospital has made a special effort to overcome the previous unfavorable results in neurosyphilitic treatment. Intravenous, intraspinal, and intraventricular methods have been used. At first intravenous therapy alone was the rule. Later on the method of Swift-Ellis was adopted. In 1916 a publication was issued from this hospital on this latter method of treatment in general paresis and great results were predicted. A separate publication will show the unfavorable end-results in these cases.

We have also tried intensive intravenous therapy with routine lumbar drainage of the spinal fluid. On several occasions intraventricular therapy has been used.

Every one of these methods offered hope at first but our statistics show that they were dis-

* Real before the Providence Medical Society at a regular monthly meeting.