

## ACUTE PNEUMONITIS

### A REPORT OF 87 CASES AMONG ADOLESCENTS\*

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In 1934, after two years' experience in caring for a group of male adolescents in a Pennsylvania preparatory school, a report<sup>3</sup> was made of 16 cases of a type of acute pulmonary infection, of unknown etiology, which was not similar to any clinical entity previously reported in the literature. This disease was referred to at that time as "bronchopneumonia," but it was emphasized that it differed from the primary bronchopneumonia of childhood, the secondary bronchopneumonia which follows measles, whooping cough, etc., and from either epidemic hemolytic streptococcal pneumonia or that which complicates surgical procedures or cardiac failure. The opinion was ventured that this type of pulmonary infection is more prevalent than is usually appreciated and that illnesses characterized by cough, malaise, and fever, and diagnosed as "grippe" or "bronchitis" might be in reality this type of pneumonia. Since the appearance of this report in 1934 several other reports<sup>1, 2, 5, 6, 7, 8, 9, 10</sup> of cases of what may be this type of pneumonia have appeared in the literature and it is obvious that the illness which was referred to as "bronchopneumonia in adolescence"<sup>8</sup> is not confined to that age group, although it may be more common in adolescents and young adults. The number of reports coming from college health services, which now offer students careful medical supervision and treatment, makes one suspect that this disease is not a new clinical entity but only one newly recognized because of the liberal use of chest x-rays. The recent roentgenographic exhibit of Ylvisaker and Kirkland<sup>13</sup> leads one to suspect that the illness is more widespread and common than is generally realized. It is not unlikely that the etiological agent of this pulmonary infection also causes an illness in which cough and x-ray evidence of lung involvement are absent, although it is possible that repeated x-rays or films taken in the oblique position would reveal obscure areas of pneumonitis even in these cases.

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Reimann<sup>9</sup> has described an epidemic disease appearing both with and without demonstrable pulmonary involvement; following the clinical data concerning our 87 cases we have added a brief note on a few cases in which we could not find evidence of pneumonitis.

This acute pulmonary disease usually begins with such symptoms as malaise, headache, and a slight cough, no physical signs except fever, little or no leukocytosis, and it develops into an illness in which the findings on x-ray examination of the lungs are much greater than the pulmonary physical signs, discomfort, and appearance of the patient, or the quantity of sputum would lead one to suspect. There seems to be no reasonable doubt that these various reports all refer to the same clinical entity, although the illness has been referred to as "bronchopneumonia of unknown etiology," "atypical bronchopneumonia," "bronchopneumonia of adolescence," "acute pneumonitis," "acute interstitial pneumonitis," "virus pneumonia," and "pneumonitis" by various authors. It would seem reasonable to conclude that this disease is a clinical entity and that to designate it acute pneumonitis, until its etiology is settled, would clarify rather than confuse the situation.

#### CLINICAL DATA

During seven years clinical and laboratory data concerning this disease, occurring in a group of preparatory school boys in Pennsylvania (1932-1934) and in another group in Massachusetts (1935-

TABLE 1  
CASES OF ATYPICAL BRONCHOPNEUMONIA OCCURRING DURING THE SCHOOL YEARS  
1932-40

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total	Approx. school pop.
1932-33	0	1	0	0	1	1	2	1	3	0	9	350
1933-34	0	0	1	0	3	2	1	0	0	0	7	330
1935-36*	0	0	2	1	1	2	0	0	0	0	6	650
1936-37	0	1	6	1	2	3	2	1	0	0	16	650
1937-38	2	1	1	0	0	0	0	0	0	0	4	650
1938-39	1	2	0	0	1	4	0	0	0	0	8	650
1939-40	0	16	15	4	0	1	0	0	0	1	37	650

\* No data were collected in 1934-35 because x-ray facilities were not available at that time.

1940), have been collected. This report of necessity confines itself to adolescents, but the similarity of the data to those obtained for other age groups is evident. In the two boarding-school communi-

ties studied students are hospitalized soon after the onset of any illness and consequently the opportunity of observing incipient illness is good; complete and frequent clinical and laboratory examinations are made possible because of the presence of a full-time medical staff and adequate laboratory facilities.

*Incidence.* It will be seen from Table 1 that isolated cases often occur and that only once during the seven years did the disease reach epidemic proportions; the cases occurring in the fall of 1939 will be reported in detail in a subsequent paper.<sup>4</sup> In general, the illness appears to be more prevalent during the late fall and winter months, and has been very much more common than pneumococcal lobar pneumonia; in the years 1935-40 only six cases of the latter disease occurred in the student body. We have not seen a second attack of this illness develop in any individual.

*Incubation period.* This illness is apparently a communicable one, but only in occasional instances has there been any evidence which would aid in determining the incubation period. In the report referred to we will analyze the 1939 outbreak in detail, but a brief study of certain other cases tends to support the observations of others that the incubation period is relatively long. Tables 2, 2a, and 2b list some cases occurring in three different years and include the student's class, dormitory, and date of admission.

TABLE 2  
1936

<i>Case</i>	<i>Class</i>	<i>Dormitory</i>	<i>Admission date</i>
E. M.	Junior	Rockwell	October 25
C. K.	Junior	Williams	November 2
D. M.	Upper Middler	Blanchard	November 5
J. N.	Junior	Rockwell	November 5
R. R.	Lower Middler	Pemberton	November 7
G. M.	Junior	Rockwell	November 23
R. I.	Upper Middler	Bancroft	November 25
C. S.	Senior	Paul Revere	December 16

Three members of the Junior class, all living in the same dormitory (Rockwell), are found in Table 2, and their contact with others in this group, except C. K., would have been unusual. Eleven days elapsed between the admission of E. M. and J. N. and 18 days between J. N. and G. M. D. M. and R. I. were also classmates, and 20 days elapsed between their admissions. E. M. and J. N., and

J. N. and G. M. were likely contacts; their rooms were on the same floor of a dormitory, close together, and they shared the same bath.

TABLE 2A

1937

<i>Case</i>	<i>Class</i>	<i>Dormitory</i>	<i>Admission date</i>
R. B.	Lower Middler	Tucker	January 8
R. G.	Upper Middler	Taylor	January 10
C. S.	Upper Middler	Taylor	February 2
W. M.	Upper Middler	Taylor	February 17
J. D.	Upper Middler	Bishop	February 28
S. H.	Junior	Rockwell	March 8
W. P.	Lower Middler	Eaton	March 31

In Table 2a there are four classmates, three living in the same dormitory. The interval between the admission of R. G. and C. S. was 23 days, between C. S. and W. M. 15 days, and between W. M. and J. D. 11 days.

TABLE 2B

1939

<i>Case</i>	<i>Class</i>	<i>Dormitory</i>	<i>Admission date</i>
D. V.	Junior	Rockwell	January 14
R. W.	Senior	Day	February 1
F. S.	Upper Middler	Bancroft	February 12
L. B.	Upper Middler	Bancroft	February 19
R. D.	Senior	Day	February 21

Contact between F. S. and L. B. (7 days) is likely; their rooms were near together and they shared the same bath. R. W. and R. D. lived on different floors of the same dormitory (20 days).

From the above tables we have periods between admissions of possible contacts as follows: 7 days, 1; 11 days, 2; 15 days, 1; 18 days, 1; 20 days, 2; 23 days, 1. Incubation periods might be, of course, at least a day or two longer than the interval between the admission of the suspected contacts. Data in Table 6, which concerns a few cases in which no pulmonary lesion could be found, provide further evidence for the determination of the incubation period; five of these cases suggest that the incubation period ranges from 8 to 13 days.

*Age.* The age of individuals in this study ranged from 13 to 19 years. The patients were all males. In the 1939-40 series one

nurse became ill with the disease, but data of her case are not included.

*Previous or accompanying upper respiratory tract infections.* In about half of the cases there was evidence of infection of the nose or throat just previous to the development of cough and malaise, but only in the 7 cases with relatively severe pharyngitis would the patient have paid much attention to this feature of his illness. When one considers the relatively mild nature of the upper respiratory tract infections in these cases and the large number (39) who had no symptoms or obvious signs of infection in the nose and throat, one is inclined to believe that the etiological agent, although it may enter through those channels, prefers to invade the tissues of the lower respiratory tract.

TABLE 3  
SUMMARY OF SYMPTOMS AND SIGNS AT ADMISSION (87 CASES)

<i>Illness before onset</i>	
Without previous "cold" or sore throat .....	39
Preceded by "cold" or sore throat .....	48
<i>Symptoms</i>	
Slight cough .....	45
Moderate to severe cough .....	21
Mild malaise .....	48
Moderate to marked malaise .....	36
Headache .....	68
Chilliness .....	20
Chest pain .....	11
Abdominal pain .....	2
Nausea .....	5
Pharyngitis with dysphagia .....	7
Sputum (on first or second day) .....	14
Nose bleed .....	1
Earache .....	1
Meningismus .....	1
<i>Signs</i>	
Temperature range .....	98.4-103.6
Leukocyte count, range .....	5,200-18,000
Leukocyte count, average .....	9,000
Râles or dulness detected on first or second day .....	26

*Symptoms at onset.* The majority of patients complained of headache, malaise, and cough at the onset of illness, but none exhibited the degree of prostration often seen at the onset of pneumococcal lobar pneumonia, and the majority did not feel or appear

particularly ill. No patient had a chill, but several (20) complained of feeling chilly and of being unable to get warm. Gastro-intestinal symptoms and chest pains were not common. Sputum was infrequently obtained on the first or second day, and was always either frothy or mucopurulent and never of the rusty or "prune juice" type.

*Physical signs at onset.* All patients had fever during the first day of illness, although the temperature at admission was normal in a few instances; the admission temperature averaged about 101° F. Leukocyte counts at admission averaged 9,000; in only 11 cases did the initial leukocyte count exceed 12,000, and in only 3 cases was it less than 6,000. The inability of examiners to elicit adventitious physical signs on examination of the chests of these patients, particularly during the first days of the disease, is a striking feature of this illness; in only 26 cases, despite careful examination, were adventitious signs made out during the first two days of illness and, in most instances, in spite of re-examinations following inspection of the lung x-ray.

TABLE 4  
CLINICAL DATA DURING COURSE (87 CASES)

Days of malaise	
Range .....	1-14 days
Average .....	5 days
Cough	
Slight .....	27
Moderate or severe .....	50
Sputum, day appeared	
Range .....	1st-8th day
Average .....	4th day
Amount	
Absent .....	40
Slight .....	25
Moderate or copious .....	22
Temperature	
(Maximum), range .....	101-105.2
Duration range .....	2-18 days
Average .....	7 days
Daily swing in temperature	
Present .....	65
Respirations	
(Maximum), range .....	20-38
Pulse	
(Maximum), range .....	90-136

Day râles or dulness detected	
Range .....	1st-12th day
Average .....	3rd day
Adventitious physical signs	
Not elicited .....	15
Relatively obscure .....	36
Obvious .....	46
Sign of consolidation	
Present .....	12
Day appeared, range .....	3rd-10th day
Average .....	5th day
Leukocyte count	
Range .....	6,000-23,400

*Symptoms during course.* All patients experienced some malaise during the course of their illness, but in general their sense of well-being and their general appearance were much better than the extent of their pulmonary infection would lead one to expect. Less than half (36) of the patients appeared to be more than moderately uncomfortable, and 51 did not suffer any significant degree of malaise for longer than three days. More severe forms of this illness were occasionally seen in this series, but cases where malaise persisted for more than a week were exceptional.

Cough was present in every case, but 27 patients had relatively little cough and 40 produced no sputum. Sputum was usually difficult to obtain, did not appear on the average until the fourth day, and was readily obtained from only 22 patients; it was usually mucopurulent, rarely blood-streaked, and never frankly bloody.

*Signs during course.* Maximum temperatures ranged from 101° F. to 105.2° F., and 65 of the cases showed wide daily swings from a normal morning temperature to an evening height of about 103° F. Fever persisted on the average for 7 days, but some cases had elevated temperatures for only two days and others for as long as 18 days. The brevity of the febrile reaction was frequently not an index of the degree of pulmonary infection, but the cases with long febrile periods were those in which a major spread of infection had taken place.

Respiratory rates and pulse rates were accelerated during the acute period of infection, but there were no instances of severe respiratory or cardiac distress.

During the course of the disease adventitious signs on physical examination of the lungs continued to be obscure in many instances; in 15 cases no adventitious signs could ever be elicited, and in 36 others they were made out only after very careful examination. Signs of consolidation (tubular breath sounds, egophony, and pectoriloquy) were discovered in 12 patients between the third and tenth days of illness. At the end of the first week, and at about the time the temperature returned to normal, coarse râles were frequently heard over the infected area.

Leukocyte counts did not exceed 12,000 at any time except in 12 patients, and in 42 patients the leukocyte count never exceeded 9,000.

#### LABORATORY DATA

*Bacteriological.* The difficulty in obtaining sputum early in the disease has contributed to the difficulties experienced by everyone who has attempted to find the etiological agent of this infection. Cultures of such sputum as we have been able to obtain have shown the bacteria commonly found in the mouth flora, *Streptococcus viridans* in large numbers in a few cases, and *H. influenzae* in large numbers in a few others. Beta hemolytic streptococci and tubercle bacilli were not found. A Type XI pneumococcus was isolated from sputum obtained from one case on the seventh day. Recently, Dyer, Topping, and Bengston<sup>2</sup> have reported the isolation of rickettsiae from three cases of pneumonitis and the presence of agglutinins specific for "Q" rickettsiae in several patients. A virus which produced pneumonitis in the mongoose has been isolated by Weir and Horsfall<sup>12</sup> from patients with this disease; Stokes et al.<sup>11</sup> have also isolated a filterable agent.

*Pathological.* There were no deaths in our series; however, fatal cases of this disease have been reported in detail by others.<sup>6, 7</sup>

*Roentgenographic.* We have been fortunate in being able to obtain x-rays of all our cases, and in almost every instance films have been made on the day of admission; in many cases daily x-rays which show the development of the lesion have been taken. No incipient lesions which appeared to originate at the pleura and spread inward have been noted. The majority of the lesions appear to originate at either hilum and then spread outward along a main bronchus fanwise, either laterally toward a base or toward an apex; several lesions appear to originate near either base. In only two cases



were there three lobes involved; in four cases two lobes were involved. In 8 cases the right upper lobe was involved, in 18 the right middle, in 27 the right lower, and in 43 the left lower lobe.

*Cases without pneumonitis*

During the fall of 1939, when this disease was present in epidemic form and 35 cases developed in a student population of 650 within 7 weeks, 11 other patients were admitted with an illness which was not similar to any definite clinical entity. These 11 cases were labeled "pyrexia, etiology unknown," at that time, but in retrospect it seems likely that they were intimately related to the cases of acute pneumonitis.

TABLE 5  
CASES WITHOUT PNEUMONITIS OCCURRING IN OCTOBER-NOVEMBER 1939

<i>Name</i>	<i>Date adm.</i>	<i>Duration fever</i>	<i>Cough</i>	<i>X-ray</i>	<i>Initial WBC</i>	<i>Symptoms</i>
J. W.	Oct. 10	1	None	Neg.	7,600	Malaise, headache
S. F.	Oct. 17	2	Slight	Neg.	8,000	Malaise, headache
R. B.	Oct. 20	1	Slight	Neg.	12,100	Malaise, headache
J. S.	Oct. 23	4	None	Neg.	13,600	Malaise, headache, abdominal discomfort
J. G. S.	Oct. 24	2	Slight	Neg.	10,900	Malaise, sore throat
J. B.	Oct. 25	1	None	Neg.	9,000	Malaise, chest pain
A. L.	Oct. 31	3	Slight	Neg.	16,100	Malaise, substernal pain
B. S.	Nov. 6	3	None	Neg.	8,600	Malaise, headache
W. B.	Nov. 9	7	Slight	Neg.	6,400	Headache, sore throat
J. F. B.	Nov. 11	1	Slight	Neg.	14,100	Headache
C. B.	Nov. 12	3	None	Neg.	8,300	Malaise, chilliness

In Table 5, data concerning these cases are tabulated: Five of these cases had no cough, while the others had very little; none had leukopenia, and malaise was the chief symptom. These patients were carefully examined but no evidence of infection in the lungs could be found. X-rays were taken of W. B. and C. B. on several occasions, and although it seemed likely that pneumonitis was present none could be demonstrated. The difficulty in being certain that no pulmonary infection is present is well illustrated by case J. V., whose x-ray, taken on the fifth day of his illness, is reproduced (Fig. 4) and shows only a faint shadow in the right upper lobe. These patients did not exhibit the degree of prostration usually associated with

influenza, and the absence of leukopenia further excluded that diagnosis. The most convincing evidence of the relationship between these cases and the 35 pulmonary infections, together with the probability that they had the same etiological agent, comes from the epidemiological data (Table 6).

TABLE 6

<i>Name</i>	<i>Diagnosis</i>	<i>Date admitted</i>	<i>Dormitory</i>	<i>Class</i>	<i>Remarks</i>
T. S.	Pneumonitis	Oct. 14	Taylor	U. M.	Roommate of J. S.
J. S.	Pyrexia, etiology unknown	Oct. 23	Taylor	U. M.	Roommate of T. S.
S. F.	Pyrexia, etiology unknown	Oct. 17	Bartlet	S.	No previous cases in Bartlet
E. M.	Pneumonitis	Oct. 30	Bartlet	S.	
J. W.	Pyrexia, etiology unknown	Oct. 10	Day	S.	No previous case in Day
H. M.	Pneumonitis	Oct. 19	Day	S.	
C. S.	Pneumonitis	Oct. 22	Day	S.	
J. G. S.	Pyrexia, etiology unknown	Oct. 24	Draper	L. M.	No other case
L. W.	Pneumonitis	Nov. 1	Draper	L. M.	in Draper

At the beginning of the epidemic, R. B. and T. S., living in dormitory Taylor, developed pneumonitis; 9 days later J. S., a roommate of T. S., was admitted with the non-pulmonary form of the disease. No cases had appeared from dormitory Bartlet prior to S. F.'s illness, and E. M. was admitted with pneumonitis 13 days later. The source of H. M.'s and C. S.'s pneumonitis is obscure unless it were J. W., admitted from dormitory Day 9 days before H. M. and 12 days before C. S. Only one case of pneumonitis developed in dormitory Draper, but L. W. was admitted 8 days later than J. G. S., who had the non-pulmonary form. If these cases may be used as evidence, the incubation period may be said to range from 8 to 13 days. It should be mentioned that the diagnosis "pyrexia, etiology unknown" has been made on similar cases in years other than 1939. One case, which occurred in November, 1936, had very intimate contact with a case of acute pneumonitis which developed 20 days later.

*Case reports*

Case I. W. S., age 17, felt perfectly well until the day before admission when he noticed a slight cough; there was no sputum, no nasal congestion, no sore throat. On admission a slight non-productive cough was noted, the patient complained of headache, and the physical examination was negative. The leukocyte count was 8,100 and the chest x-ray showed a shadow extending from the left hilum into the left lung field. The illness ran a febrile course of 8 days, occasionally required codeine for a non-productive cough, but the patient never appeared particularly ill or uncomfortable and at no time were adventitious physical signs elicited. His convalescence was uneventful. His x-rays, reproduced in Fig. 1, show the development and subsidence of his lesion.

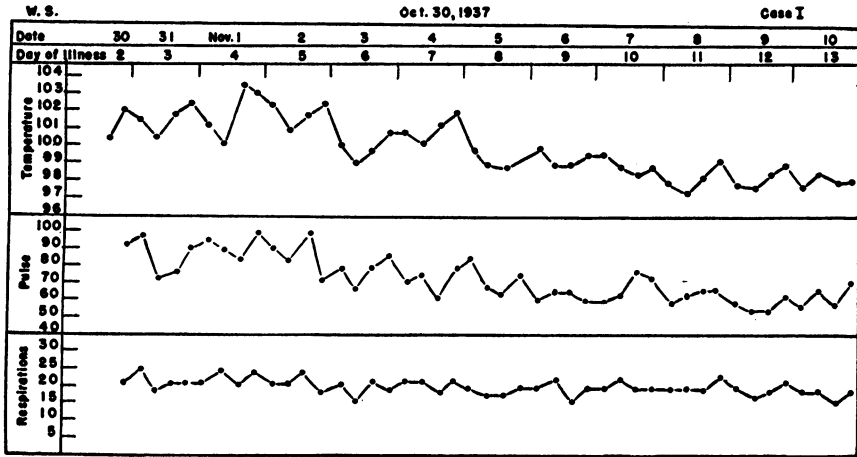


CHART I (Case I). Age 17. Temperature, pulse, and respiration chart during the febrile period.

Case II. L. B., age 18, seemed perfectly well until the evening before admission when he felt chilly, had a severe headache, and developed a severe non-productive cough. On admission he had the same symptoms and also complained of substernal pain. There was no evidence of infection in the upper respiratory tract, and examination of the chest was negative. There was no sputum. The initial leukocyte count was 6,500; the chest x-ray showed a shadow extending out from the right hilum. The patient ran a febrile course with moderate malaise for 10 days; mucopurulent sputum was obtained in small amount on the seventh day; dulness and fine râles were noted on the fourth day and coarse râles were heard on the eighth day. A reproduction of the x-ray taken on the fifth day is shown in Fig. 2.

Case III. H. M., age 17, developed a common cold on the third day before admission, but experienced neither malaise nor cough until the day of admis-

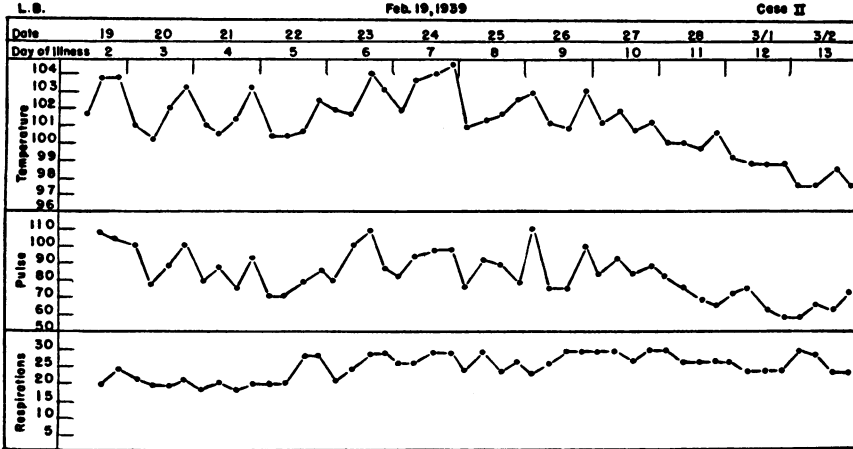


CHART II (Case II). Age 18. Temperature, pulse, and respiration chart during the febrile period.

sion. On admission he complained of severe headache, appeared acutely ill and very uncomfortable, and had a severe cough productive of mucopurulent

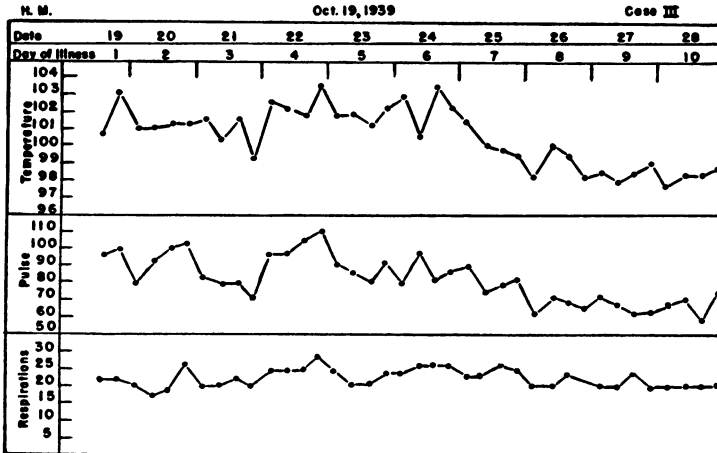


CHART III (Case III). Age 17. Temperature, pulse, and respiration chart during the febrile period.

sputum. On physical examination marked nasal congestion was evident, the pharynx was inflamed, and moderate dulness and many râles were noted

over the left lower lobe posteriorly. Sputum culture showed nothing but the usual mouth flora; the initial leukocyte count was 15,100. The chest x-ray showed a small shadow at the extreme left base which subsequently increased in size (Fig. 3a and 3b) and offers a good example of a lesion developing in that area rather than from the hilum. The patient ran a febrile course for 8 days, during which time his malaise was much more severe than that of most patients, and far out of proportion to the extent of his pulmonary lesion. His leukocyte count remained at about the same level throughout his febrile period. The convalescence was uneventful; there was no evidence of an accompanying sinusitis.

Case IV. J. V., age 16, noticed a slight cough and headache on the day before admission, and when first examined he complained of a moderately severe headache, substernal chest pain, and non-productive cough. The physical examination was negative, the initial leukocyte count 7,500, and the admission chest x-ray was negative. Not until the fifth day did a faint shadow appear in the x-ray, and only then were a few râles heard along the mesial border of the right scapula. The patient ran a febrile course for 12 days, but was not particularly uncomfortable after the fourth day. The physical signs became more evident later in the illness, sputum was always scanty, and the cough moderately severe. The x-rays reproduced in Figs. 4a and 4b show the development of a lesion in an upper lobe.

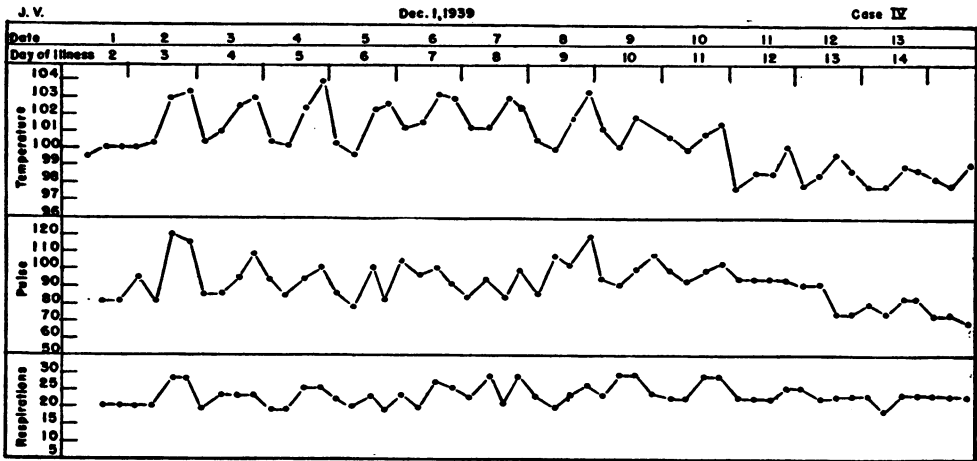


CHART IV (Case IV). Age 16. Temperature, pulse, and respiration chart during the febrile period.

Case V. W. A., age 15, had noticed a slight sore throat and cough for two days prior to admission, but he had not felt particularly ill. During the first hospital day his only complaint was sore throat, and the physical examination

was negative except for a moderate redness of the pharynx. The initial leukocyte count was 8,200, the throat culture showed no beta hemolytic streptococci, and the chest x-ray showed a shadow extending out from the right hilum. The patient's fever subsided on the fourth day, his cough was never severe, and there was no sputum. Adventitious physical signs were elicited after the third day, but were more obscure than the x-ray reproduced in Fig. 5 would lead one to expect.

### Treatment

During the febrile course of this disease the patients' diet was determined by the appetite, the fluid intake was kept between 3,000

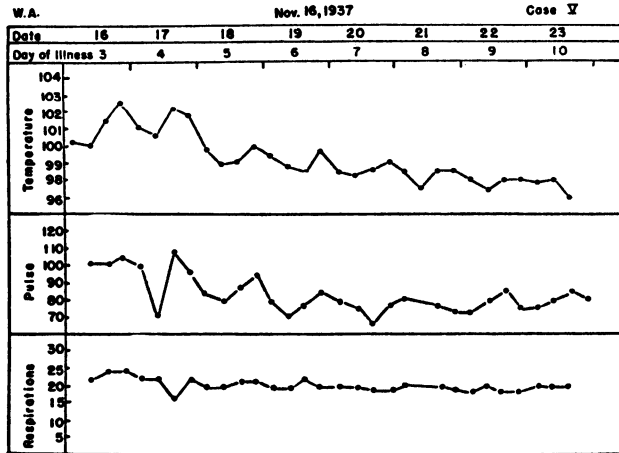


CHART V (Case V). Age 15. Temperature, pulse, and respiration chart during the febrile period.

and 4,000 cc. daily, saline enemas were given when necessary, and codeine was used to control cough. Patients were usually kept in bed one week following the return of temperature to normal and then were allowed up increasingly during the following week, but they did not resume their normal routine until at least two weeks after the subsidence of fever. Three patients who had a relatively severe form of this disease were given sulfapyridine in the manner usually employed for pneumococcal lobar pneumonia; it was without any evident benefit, a fact which further substantiates the belief that these cases are similar to ones reported by others and which also distinguishes them from the primary bronchopneumonia of childhood, pneumococcal lobar pneumonia, and the usual type of secondary bronchopneumonia.

Patients were usually kept in bed one week following the return of temperature to normal and then were allowed up increasingly during the following week, but they did not resume

*Summary*

Clinical and laboratory data have been reported on 87 cases of an acute pulmonary infection which has been observed among groups of adolescents during the past 7 years. The identity of these cases with those reported by others during the past few years is apparent from a comparison of the clinical and laboratory features, and it is suggested that these acute pulmonary infections be referred to as acute pneumonitis to avoid confusion and to distinguish this entity from other clearly recognized forms of pneumonia.

Although this disease may occur in severe and even in fatal form it is to be emphasized that more frequently the illness is characterized by an obscurity of physical signs, a minimum of prostration, and a relatively extensive area of pulmonary infection. In our practice we rarely see patients who exhibit the combination of cough and fever persisting for more than two days without accompanying definite x-ray evidence of infection in the lung parenchyma, but a few cases in which no pulmonary lesion could be demonstrated have been described.

Our attempts to determine the incubation period have been most unsatisfactory, but suggest that a period of from 7 to 20 days is most likely. The symptoms of the illness and its apparently-long incubation period, together with the work of other investigators, indicate that it may be of virus or rickettsial origin.

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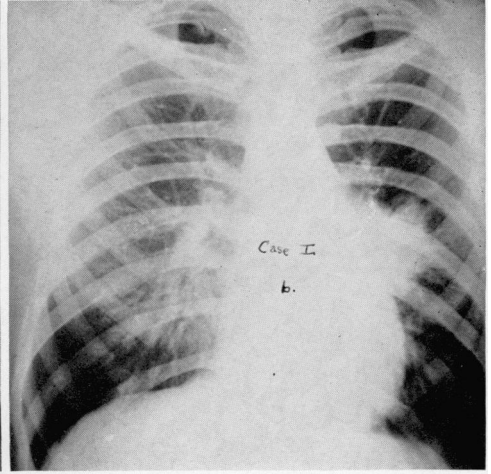
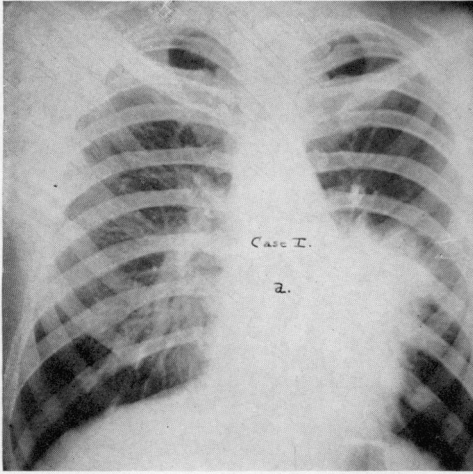
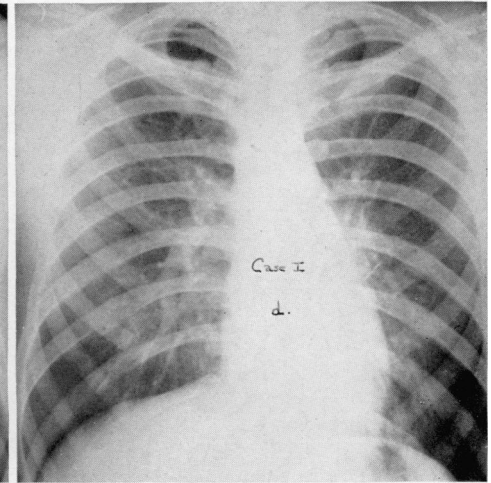
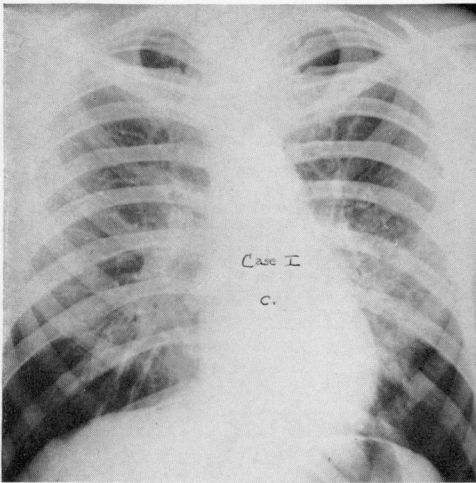


FIG. 1 (Case I). Series of x-rays showing the development and subsidence of the lung shadows in one patient.

a. X-ray taken on the third day of disease, showing a shadow extending from the left hilum.

b. X-ray taken on the fourth day, showing some extension of the area of density.



c. X-ray taken on the thirteenth day, showing a "softening" of the shadow.

d. X-ray taken on the twentieth day, showing a complete disappearance of shadows.

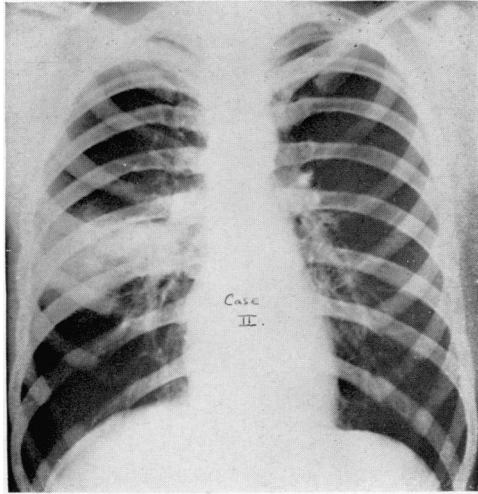


FIG. 2 (Case II). X-ray taken on the fifth day of the disease shows a shadow in the right lung field.

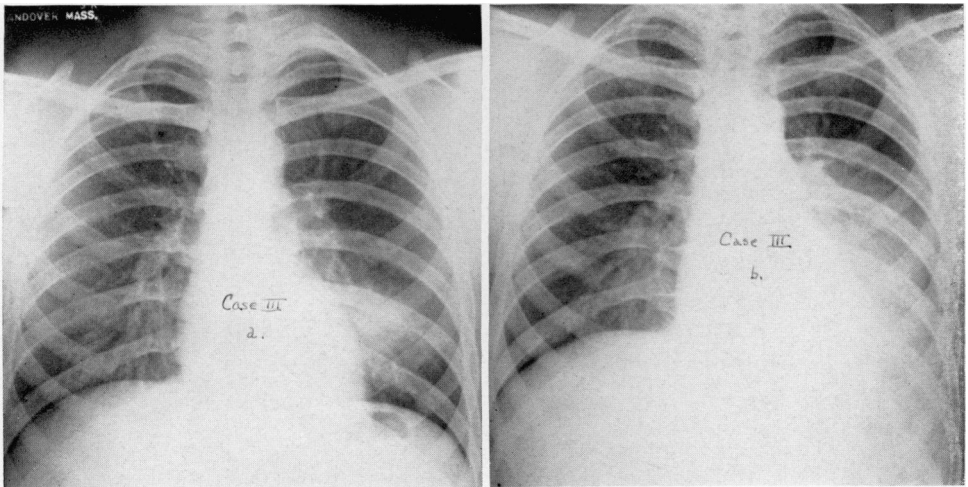


FIG. 3 (Case III). X-rays showing the development of a lesion at the base, rather than from the hilum.  
a. X-ray taken on the third day of the disease.      b. X-ray taken on the eighth day of the disease.

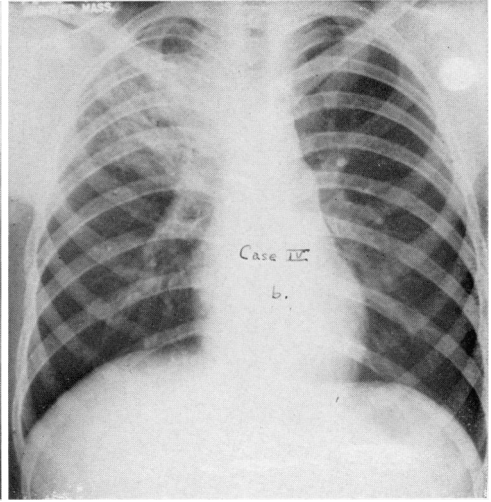
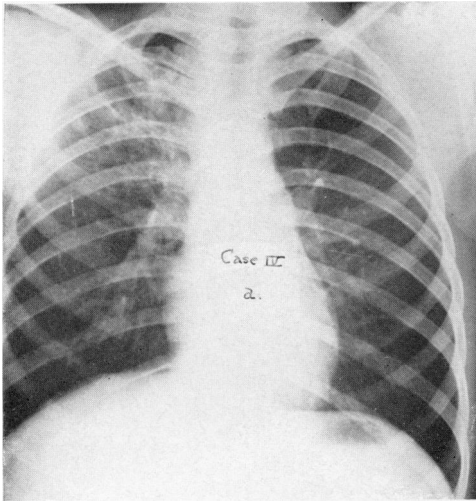
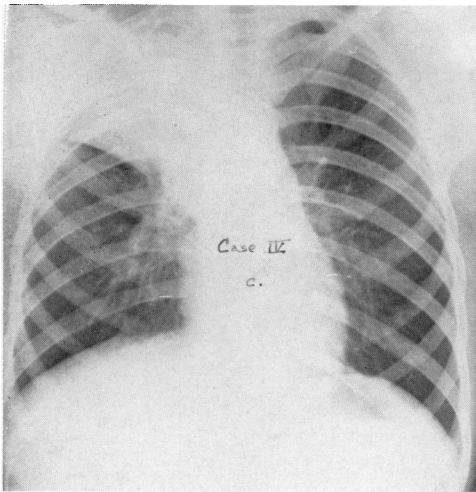


FIG. 4 (Case IV). Series of x-rays showing the development of a lesion at an apex.

a. X-ray, taken on the fifth day, shows only faint shadows at the right apex.

b. X-ray, taken on the seventh day, shows a more dense shadow, at the right apex.



c. X-ray, taken on the ninth day, shows a dense shadow at the right upper lobe.

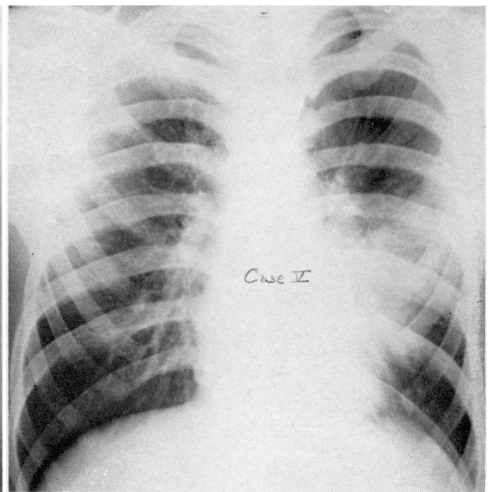


FIG. 5 (Case V). X-ray, taken on the fourth day of the disease, shows a shadow in the left lung field much greater in extent than the patient's clinical course or his chart (Chart V) would lead one to expect.