Case Records of the Massachusetts General Hospital

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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Case 16-1998

PRESENTATION OF CASE

A 24-year-old man was admitted to the hospital because of the acute respiratory distress syndrome.

The patient had been well until several days earlier, when he began to have nasal congestion with green discharge, myalgia, dry cough, mild dyspnea, and a "sinus headache." A few days before admission, the cough became intermittently productive of rust-colored sputum and was accompanied by right-sided pleuritic pain, fever, chilliness, and diarrhea. On admission to another hospital, the patient's temperature was 38.3°C, and his blood pressure was 145/60 mm Hg. No rash or lymphadenopathy was noted. Consolidation was present over the right upper lobe. While the patient was breathing room air, the oxygen saturation was 92 percent. Radiographs of the chest showed consolidation of the entire right upper lobe, with patchy infiltrates in the lingula and left lower lobe. An electrocardiogram revealed sinus tachycardia. Indomethacin, erythromycin, and ampicillin–sulbactam were given, with 50 percent oxygen administered by face mask. That night the oxygen saturation decreased to 82 percent while the patient was asleep, and he was transferred to an intensive care unit. On the second hospital day, the rectal temperature was 38°C. Ceftriaxone and vancomycin were substituted for ampicillin–sulbactam. The oxygen saturation did not exceed 87 percent, and the oxygen concentration was increased to 100 percent. The temperature rose to 40.3°C at noon, and at 8 p.m. the oxygen saturation dropped to 78 percent. Tracheal intubation was performed, and ventilatory assistance was provided.

On the third day, methylprednisolone (100 mg) was administered intravenously. Bronchoscopic examination revealed normal airways. Microscopical examination of bronchoalveolar washings showed questionable *Pneumocystis carinii*. Gentamicin and trimethoprim–sulfamethoxazole were added to the medications. A chest radiograph (Fig. 1) revealed dense opacities with air bronchograms in the left lower lobe, lingula, and right upper and lower lobes. Arterial-blood gases were measured (Table 1). On the next day, the patient was transferred to this hospital.

The patient lived in New England and installed

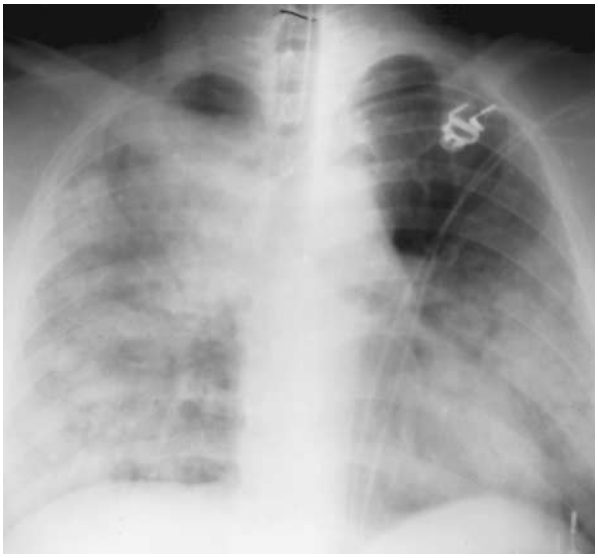

Figure 1. Anteroposterior Radiograph of the Chest Obtained One Day before Admission to This Hospital, with the Patient in a Supine Position.

There is extensive dense multilobar pulmonary opacification with air bronchograms.

TABLE 1. ARTERIAL-BLOOD GASES.*

VARIABLE	AT OTHER HOSPITAL	ON ADMISSION
Partial pressure of oxygen (mm Hg)	60	60
Partial pressure of carbon dioxide (mm Hg)	46	52
pH	7.31	7.3

*Measurements were performed while the patient was undergoing ventilation with 100 percent oxygen.

TABLE 2. HEMATOLOGIC LABORATORY VALUES ON ADMISSION.*

VARIABLE	VALUE
Hematocrit (%)	37.3
Mean corpuscular volume (μm^3)	87
Erythrocyte sedimentation rate (mm/hr)	88
White-cell count (per mm^3)	9,800
Differential count (%)	
Neutrophils	77
Band forms	15
Lymphocytes	3
Monocytes	5
Platelet count (per mm^3)	125,000
D-Dimer test	Positive (78 μg/ml)
Iron (μg/dl)	42
Iron-binding capacity (μg/dl)	186
Ferritin (ng/ml)	841

*To convert the values for iron and iron-binding capacity to micromoles per liter, multiply by 0.1791.

TABLE 3. BLOOD CHEMICAL VALUES ON ADMISSION.*

VARIABLE	VALUE
Protein (g/dl)	5.9
Albumin	2.3
Globulin	3.6
Calcium (mg/dl)	7.7
Phosphorus (mg/dl)	1.2
Glucose (mg/dl)	274
Magnesium (mmol/liter)	1.1
Aspartate aminotransferase (U/liter)	61
Lactate dehydrogenase (U/liter)	783
Creatine kinase (U/liter)	595
Creatine kinase MB fraction	Normal

*To convert the value for calcium to millimoles per liter, multiply by 0.250. To convert the value for phosphorus to millimoles per liter, multiply by 0.3229. To convert the value for glucose to millimoles per liter, multiply by 0.05551. To convert the value for magnesium to milliequivalents per liter, divide by 0.5.

air-conditioning equipment. He owned a ferret and five snakes, to which he fed frozen rabbits and live or frozen rats that he obtained from a pet-supply store. His brother owned a healthy puppy. The patient had returned 27 days earlier from a 10-day trip to Hawaii, where he had cut himself on coral while scuba diving. Several of the hotels that he visited had caged parrots in their lobbies. He did not smoke and reported no sexual activity, use of illicit drugs, or other risk factors for human immunodeficiency virus (HIV) infection, or exposure to ill persons.

The temperature was 37.8°C, and the pulse was 122. The blood pressure was 130/80 mm Hg.

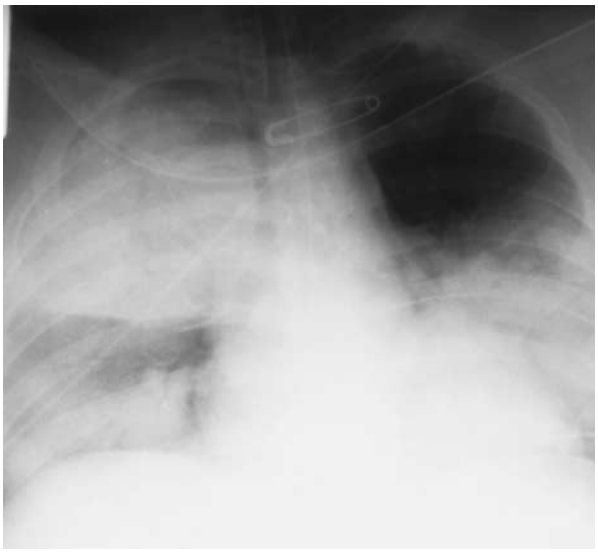

Figure 2. Radiograph of the Chest Obtained on Admission with Portable Equipment, with the Patient in a Supine Position.

Increased consolidation and new air-space opacification are evident within the right lower lobe; consolidation persists in the right upper lobe and left lung, with relative sparing of the left apex. The hilar contours are obscured by the adjacent air-space opacification.

On examination, the patient was intubated and pharmacologically paralyzed. A faint, fine erythematous rash was present over the face, chest, and right thigh; no lymphadenopathy or cutaneous evidence of sepsis was detected. Coarse breath sounds and scattered rhonchi were heard bilaterally. The heart, abdomen, and arms and legs were normal.

A urine specimen obtained from an indwelling catheter was positive (++) for protein; the sediment contained 20 to 50 red cells and 3 to 5 white cells per high-power field, 0 to 5 granular casts per low-power field, and moderate numbers of bacteria. The prothrombin and partial-thromboplastin times were normal. Other hematologic laboratory values are shown in Table 2, and blood chemical values are shown in Table 3. The results of other routine blood chemical and enzyme tests were normal. Arterial-blood gases were measured (Table 1). A radiograph of the chest (Fig. 2) revealed increased consolidation in the right lower lobe, with persistent, dense air-space disease in the right upper lobe and left lung. There was relative sparing of the left apex. No pleural effusion or pneumothorax was seen.

Specimens of blood, urine, and sputum were obtained. Erythromycin, ceftriaxone, trimethoprim–sulfamethoxazole, gentamicin, and vancomycin were continued, and rifampin and doxycycline were added. A flexible bronchoscopic examination showed

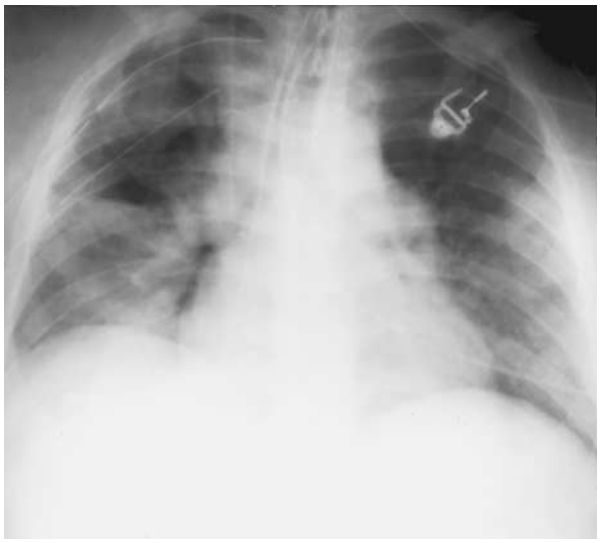

Figure 3. Anteroposterior Radiograph of the Chest Obtained on the Seventh Hospital Day.
There is partial resolution of the consolidation in the right upper lobe and the left lung.

localized bleeding above the carina, which was probably traumatic; generalized mucosal erythema; and scanty thin, pink secretions. No endobronchial lesions were seen. Microscopical examination of bronchoalveolar-lavage specimens showed no fungi, acid-fast bacilli, *P. carinii*, or other microorganisms. Respiratory syncytial virus, influenza A virus, and cytomegalovirus early antigen were not detected. Cytologic examination revealed no malignant-tumor cells. Routine and viral cultures were negative. On the second hospital day, a chest radiograph showed less dense opacification in the right lung and lingula. Blood and sputum cultures obtained at the referring hospital and at this hospital were negative. Serologic tests for tularemia and cryptococcal antigens were also negative, as were tests for antinuclear antibodies, rheumatoid factor, and cold agglutinins. On the following day, evidence of deep venous thrombosis was found in the right leg; heparin was administered. The creatine kinase level was 1246 U per liter, with a normal MB fraction.

On the fourth day, a chest radiograph showed a small right-sided pneumothorax; the left pulmonary opacification was further decreased in density. With heparin temporarily withheld, a tube was inserted into the right side of the chest. A cardiac ultrasonographic examination showed hyperdynamic left ventricular function without abnormalities in wall motion. The right ventricle appeared normal. Doppler examination showed a small anterior pericardial effusion. Tests for anti-HIV antibodies and urinary type 1 legionella antigen were negative. Trimethoprim–sulfamethoxazole and rifampin were discontinued.

The patient's axillary temperature rose daily to 38.1°C; on the seventh day it declined to 37°C for a few hours. Chest radiographs (Fig. 3) showed decreases in the extent and density of the pulmonary opacification and shrinkage of the pneumothorax. The patient continued to require assisted ventilation, with 40 to 60 percent oxygen on most occasions. All culture specimens remained nondiagnostic.

A diagnostic laboratory result was received.

DIFFERENTIAL DIAGNOSIS

DR. PAUL E. SAX*: May we review the radiographic findings?

DR. BEATRICE TROTMAN-DICKENSON: A chest film obtained on the day before the patient's transfer to this hospital (Fig. 1) shows dense multilobar consolidation. The hilar contours are obscured by the adjacent air-space opacification. A film obtained on the following day, on admission to this hospital, shows new opacification in the right lower lobe. On the seventh hospital day, another chest film (Fig. 3) shows shrinkage of the right-sided pneumothorax and partial clearing of the consolidation in the right upper lobe and the left lung.

DR. SAX: This case highlights the important problem of community-acquired pneumonia in adults and the diagnostic challenge of a severe case in which no organisms are identified on routine cultures. An estimated 4 million cases of community-acquired pneumonia occur annually in the United States, at a rate of 12 cases per 1000 adults per year.[1,2] Most patients with community-acquired pneumonia are treated entirely on an outpatient basis, but approximately 20 percent require hospitalization. In the subgroup of patients admitted to the hospital, 20 to 50 percent of those requiring intensive care die of the disease.[3,4]

The causes of community-acquired pneumonia requiring hospitalization vary according to epidemiologic and host factors. The rate of legionellosis, for example, varies widely according to the geographic area.[5] Some centers rarely see confirmed cases of the disease, whereas others report both sporadic and nosocomial cases relatively often.[6]

In studies of the causation of community-acquired pneumonia requiring hospitalization, it is therefore not surprising that the causes vary according to which patients are included and where the study is performed. Certain patterns emerge from these studies, however.[3,4,7-10] The leading identified cause of severe community-acquired pneumonia remains *Streptococ-*

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cus pneumoniae, which is the agent in 5 to 28 percent of cases,[11] and *Haemophilus influenzae, Staphylococcus aureus,* gram-negative bacilli, *Legionella pneumophila,* and *Mycoplasma pneumoniae* also account for substantial but varying proportions of cases. In a total of four series of patients with community-acquired pneumonia who required intensive care, these six agents accounted for 94 percent of cases in which a pathogen was identified.[3,4,9,12] It must be stressed, however, that in virtually every study of community-acquired pneumonia, the responsible pathogen is not identified in up to half the cases, even when extensive cultures and serologic testing are conducted.[13] In the office setting, the proportion of cases with unidentified agents is undoubtedly even higher. If one includes pediatric outpatients, a pathogen is identified in less than 10 percent of all patients seen and treated in an ambulatory setting. As a result, recent guidelines for therapy stress that initial therapy for these pneumonias is necessarily empirical.[11]

Although community-acquired pneumonia may be caused by several viruses, particularly influenza A and B viruses, respiratory syncytial virus, adenovirus, and parainfluenza virus, I shall not consider these pathogens further in this case, because the radiographic pattern of lobar consolidation strongly favors a bacterial pneumonia. Also, there were no host factors and no history of exposure that would have suggested a fungal, parasitic, mycobacterial, or nocardial infection.

The rapid progression of the disease, dense multilobar infiltrates, and multisystem involvement in this case are all compatible with the presence of a severe respiratory tract infection with *S. pneumoniae* or pneumococcus. Failure to isolate this agent from sputum cultures does not rule out the diagnosis, since sputum cultures for this organism are commonly insensitive, and a definitive diagnosis of pneumococcal pneumonia requires a positive blood culture in 20 percent of cases. Since identification of the pneumococcus on sputum culture requires that this agent be differentiated from oral α-hemolytic streptococci in the microbiology laboratory, many authorities believe that pneumococcal pneumonia is greatly underdiagnosed.[14,15] The indolent clinical presentation in this case is not inconsistent with the presence of pneumococcal infection, since many patients with this disease do not have the classic hyperacute syndrome of a single shaking chill followed by a sustained fever.[15] Indolent presentations are particularly common when pneumococcal disease complicates a viral respiratory tract infection.

Despite the frequency of pneumococcal causes of severe community-acquired pneumonia, the diagnosis of pneumococcal pneumonia seems unlikely in this case. This infection accounts for only 20 to 30 percent of cases in immunocompetent young adults, with an estimated rate of 5 cases per 100,000.[16] Pneumococcal pneumonia is commonly found in persons who are very young or very old, persons with alcoholism, and persons with defective opsonization or antibody production, such as that associated with asplenia, sickle cell disease, and HIV infection.

Several features of this case are consistent with so-called atypical pneumonia. The responsible organisms include *M. pneumoniae, Chlamydia pneumoniae, L. pneumophila, Chl. psittaci, Coxiella burnetii,* and *Francisella tularensis.* The onset of the disease is gradual, the cough is dry or produces only scanty mucoid sputum, and extrapulmonary symptoms and signs, such as diarrhea, myalgias, headache, hepatosplenomegaly, and aminotransferase elevations, are prominent. Because the causative agents of atypical pneumonia are not easily identified by Gram's stain or culture of sputum, some clinicians have invoked atypical pneumonia to help narrow the differential diagnosis of community-acquired pneumonia.[17-19] There is considerable overlap between the clinical and radiographic features of atypical and typical pneumonia, however, and no single finding is diagnostic of either disease.[5,20,21]

The two most common causes of atypical pneumonia are *M. pneumoniae* and *Chl. pneumoniae,* together accounting for approximately 25 percent of cases managed in the ambulatory setting.[11] Mycoplasma is generally regarded as a cause of mild pneumonia in young adults, but in rare cases, the infection requires hospitalization and even intensive care.[22] Although all forms of atypical pneumonia may have prominent extrapulmonary manifestations, mycoplasma infection can be associated with many, often serious, nonrespiratory complications, including diverse neurologic conditions, hemolytic anemia, diarrhea, erythema multiforme, erythema nodosum, and myocarditis.[23] These complications may occur with few or no findings on chest radiographs.[24]

Approximately 50 percent of adults have evidence of previous infection with *Chl. pneumoniae.* This agent is estimated to cause 5 to 15 percent of cases of community-acquired pneumonia,[25] and in most cases, it causes a relatively mild atypical pneumonia, although bacterial superinfection can result in severe disease.[26] The clinical symptoms generally overlap with those of atypical pneumonia of other causes, but severe pharyngitis with prominent hoarseness is reported to be a distinguishing feature. Both mycoplasma pneumonia and chlamydia pneumonia respond to treatment with either a macrolide antibiotic or tetracycline.[27]

Since no features of this patient's clinical presentation are pathognomonic, a useful way to focus the differential diagnosis is to review his environmental exposures. His occupational exposure to air-conditioning equipment could be associated with legion-

naires' disease, because water is the known natural habitat of *L. pneumophila,* and outbreaks have been linked to contaminated cooling towers.[5,28] To isolate the organism from clinical specimens, a special medium (buffered-charcoal yeast-extract agar) must be used.

Risk factors for legionellosis include chronic pulmonary disease, tobacco smoking, alcohol abuse, immunosuppressive medication for organ transplantation, and advanced age. Patients with HIV infection are also at considerably higher risk for legionellosis than noninfected patients.[29] *L. pneumophila* is sufficiently virulent to cause clinically important pulmonary infection even in immunologically normal hosts. Erythromycin is the treatment of choice, but the newer macrolides, azithromycin and clarithromycin, are also effective. Rifampin is sometimes added to treat severe infections, although no data from controlled clinical trials indicate that it results in increased therapeutic efficacy. Tetracyclines and fluoroquinolones also have in vitro and in vivo efficacy, with fluoroquinolones having particularly effective in vitro activity.[30] However, in severe cases, all the available antimicrobial agents may be clinically ineffective.

This patient's exposure to rabbits could have resulted in tularemia. The causative agent, *F. tularensis,* is extremely virulent; as few as 10 organisms inoculated subcutaneously can initiate infection.[31] Tularemia most commonly results from cutaneous contact with infected rabbits or other animals, airborne transmission from such animals, or bites that become contaminated with feces of infected ticks. Both rabbits and ticks can carry the organism for extended periods without adverse effects and hence are the major reservoirs for transmission. Because of the hardiness of *F. tularensis,* some patients have contracted tularemia from inanimate objects, such as hunting knives or coats, that were in contact with infected rabbits weeks or months earlier.[31]

The clinical presentation of tularemia depends on the site of inoculation and host factors. Six clinical forms have been described — ulceroglandular, oculoglandular, oropharyngeal, glandular, typhoidal, and pneumonic — but there is considerable overlap among these forms in many patients.[32] The pneumonic presentation, which predominates in 7 to 20 percent of cases, may result from inhalation of the organism, but tularemia is also one of the few infectious diseases in which pneumonia commonly results from hematogenous seeding of the lung. The manifestations of the illness range from asymptomatic pulmonary infiltrates to progressive multilobar pneumonia and the acute respiratory distress syndrome.

Culture of *F. tularensis* requires special cysteine-containing mediums, but culture is rarely performed, since isolation of the organisms in the laboratory is extremely hazardous. High attack rates have been reported in laboratory personnel when the organism has been cultured without the use of special isolation procedures.[33] The diagnosis is usually made by demonstrating a fourfold rise in serum antibody titers. Patients sometimes have a positive titer on initial presentation, and detectable antibody develops in most patients during the second week of illness. Titers do not usually peak until four to eight weeks after the onset of the illness. The treatment of choice is parenteral streptomycin or gentamicin, with tetracycline used alternatively or for milder cases. The response to therapy is usually prompt.[27]

Another important infection transmitted from animals is Q fever. Caused by the rickettsial organism *Cox. burnetii,* it owes its unusual name to the fact that the cause was initially unknown, with "Q" denoting "query." The organism can survive prolonged periods of desiccation and hence may be transmitted by inhalation of contaminated dust particles from infected cattle, sheep, hides, and milk. Humans also risk exposure when attending the birth of livestock or cats, since high inocula of *Cox. burnetii* are present in the amniotic fluid, placenta, and fetal membranes.[34]

Patients with Q fever have fever, headache, cough, gastrointestinal symptoms, and sometimes hepatosplenomegaly. The cough is dry, and pleuritic pain is unusual.[35] There may or may not be radiographic evidence of pneumonia; such evidence has been reported in 0 to 90 percent of infected persons.[18] There is no pathognomonic radiographic pattern; in one series, the abnormalities cleared slowly, with an average course of 30 days.[36] Unlike other rickettsial infections, Q fever is rarely associated with a rash.

Although Q fever improves in most persons without specific therapy, treatment is recommended to diminish the risk of chronic complications, most notably endocarditis. Since the diagnosis is established by serologic testing, which may be negative on presentation, empirical therapy should be administered when Q fever is suspected on the basis of the clinical presentation and environmental exposure. As with other rickettsial infections, tetracyclines remain the treatment of choice, although in vitro data suggest that quinolones and rifampin may also be effective.[37]

The third important environmental exposure in this case was to parrots, which can cause psittacosis due to *Chl. psittaci*. The name of the disease is derived from the Greek word for parrot, *psittakos*. Since almost any bird may be a vector, some observers have recommended changing the name to ornithosis.[18] The disease is acquired by inhalation of infectious particles, which are spread in the feces, beak secretions, and feather dust of infected birds. Although birds may be asymptomatic when infected, the highest numbers of organisms are spread when the birds are clinically ill, especially with a diarrheal

illness. Cases in the United States have declined with the introduction of tetracycline-laced bird feed and the requirement of a 30-day quarantine period for imported birds. However, smuggling of these pets into this country and the birds' apparent distaste for antibiotic-flavored food limit the effectiveness of these control measures.[38]

Fever, rigors, sweats, and a prominent headache develop abruptly in patients with psittacosis. Pulmonary symptoms may be absent initially, and several days may elapse between the onset of systemic symptoms and the development of a dry cough.[39] Vomiting and diarrhea occur in up to half the patients, and slight elevations in aminotransferase levels are common.[39,40] A pink, blanching maculopapular rash, called Horder's spots, was seen in only 2 of 219 patients in one review.[40] As with other forms of atypical pneumonia, no diagnostic patterns are recognized on chest radiographs, with nodular densities, segmental and lobar consolidation, interstitial abnormalities, and pleural effusions all reported.[11,41,42]

Since culture of *Chl. psittaci* is difficult and hazardous, the key to the diagnosis is an appropriate history of exposure. Exposures have ranged from mouth-to-beak contact to passage through a room where infected birds were present.[38] Up to 25 percent of patients with psittacosis report no exposure to birds. Such patients may in fact not have psittacosis because of serologic cross-reactivity between its agent and the more recently discovered pathogen *Chl. pneumoniae*,[43] which has no particular relation to birds. Tetracyclines are the treatment of choice for psittacosis, and the response to therapy is usually prompt. In one series of 135 patients, 92 percent were afebrile 48 hours after starting treatment.[39]

In this case, it is impossible to diagnose a specific form of atypical pneumonia on clinical grounds. One must therefore rely on a careful investigation of the history of exposure and provide empirical treatment with a macrolide or tetracycline antibiotic while conducting laboratory studies.

Of the three infections for which the patient had a specific history of exposure, legionellosis is the most commonly diagnosed cause of community-acquired pneumonia severe enough to require intensive care. Furthermore, the concomitant diarrhea, aminotransferase elevations, hematuria, hypophosphatemia, and radiographic pattern of a lobar pneumonia spreading quickly to other lobes are well-described characteristics of this disease.[17] However, a negative test for legionella urinary antigen has an important negative predictive value. Seventy to 90 percent of cases of legionellosis are caused by *L. pneumophila* serotype 1, and antigen from this organism persists in urine for weeks after the initiation of antimicrobial therapy.[44] The relatively prompt radiographic response to therapy is also evidence against the diagnosis of legionellosis in this case. In one review of the radiographic features of several types of community-acquired pneumonia, radiographic abnormalities in the patients with legionellosis increased after the initiation of erythromycin therapy and resolved more slowly than in the patients with pneumonia due to other infections.[42]

The history of exposure, clinical course, and response to therapy in this case are compatible with the diagnosis of tularemia pneumonia. The negative results of the initial serologic test argue against this disorder, however, since the patient had been ill for approximately one week at the time of testing. Also, despite widely reported outbreaks in Vermont and on Martha's Vineyard, Massachusetts,[45,46] over 99 percent of cases in the United States occur outside New England, especially in the Southeast and Midwest. Since the patient may have contracted tularemia from one of the rabbits he was feeding to his pet snakes and ferret, I cannot rule out this diagnosis on clinical grounds.

I believe that the diagnostic procedure was a serologic test for *Chl. psittaci*. Many of the clinical features of this case have been described in cases of psittacosis,[39,40] and the relatively prompt response to appropriate therapy, with defervescence and improvement of the radiographic abnormalities, is also consistent with this diagnosis. The most commonly used diagnostic method is a test for complement-fixing antibody. For the purpose of surveillance, a confirmed case of psittacosis is defined by the Centers for Disease Control and Prevention as one in which the culture is positive or the antibody levels increase by a factor of four, to a titer of at least 1:32. A single titer of 1:32 can be the basis of a presumptive diagnosis in a patient with an illness compatible with psittacosis. Because of the inherent delay in the diagnosis when serologic testing is performed in the acute and convalescent stages, treatment must be given empirically in suspected cases, as it was in this case. The patient's exposure to the caged parrots was somewhat remote, given the reported average incubation period of 10 days, but he may also have been exposed to infected birds while shopping at the pet-supply store.

CLINICAL DIAGNOSIS

Atypical pneumonia with the acute respiratory distress syndrome.

DR. PAUL E. SAX'S DIAGNOSIS

Psittacosis.

PATHOLOGICAL DISCUSSION

DR. ROBYN S. KLEIN: Several diagnostic tests were necessary. A polymerase-chain-reaction assay for *Chl. pneumoniae* on the bronchoalveolar-lavage specimen was negative. Culture of the specimen yielded a chlamydial species in McCoy's cell line,

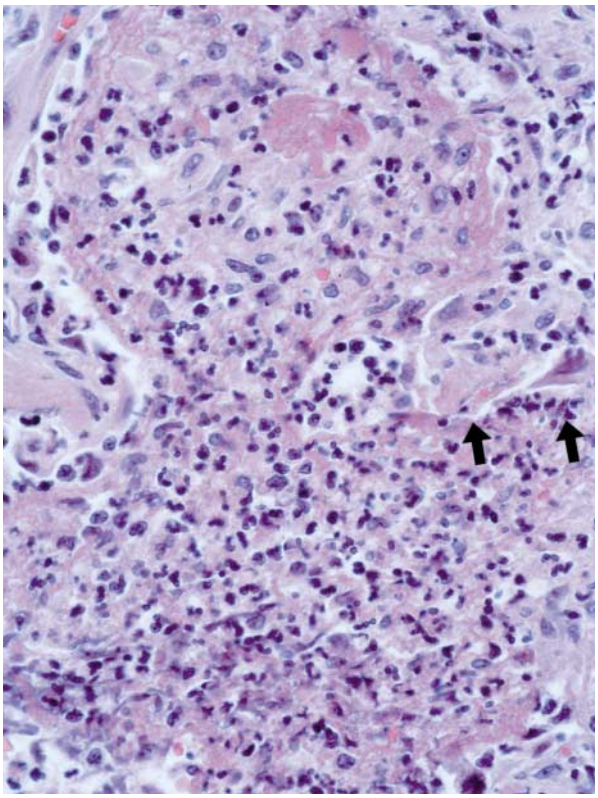

Figure 4. Acute Purulent Bronchiolitis with Epithelial Erosion (Arrows) in a Lung-Biopsy Specimen from Another Patient with Chlamydial Pneumonia (Hematoxylin and Eosin, ×240).
The patient was described in Case 48-1990.[50]

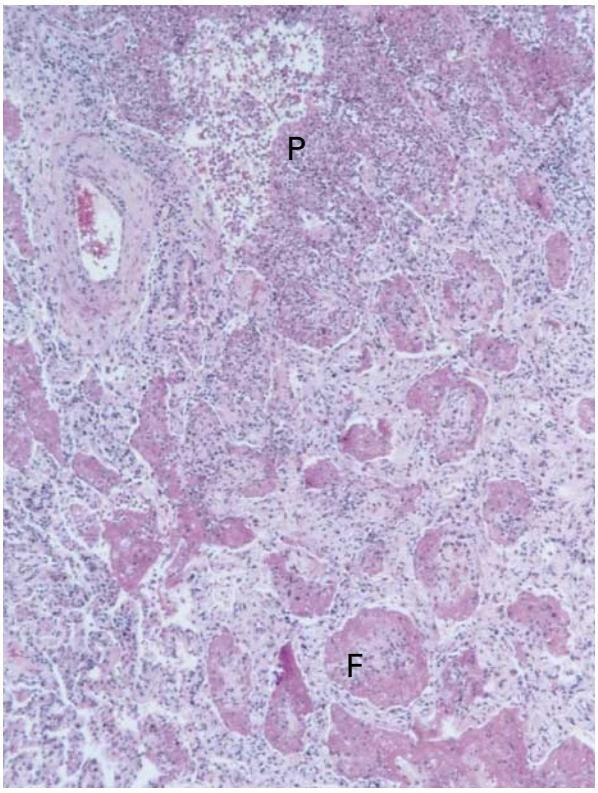

Figure 5. Bronchopneumonia with Fibrinous (F) and Purulent (P) Exudate Filling the Air Spaces of a Lobule from Another Patient with Chlamydial Pneumonia (Hematoxylin and Eosin, ×48).
The patient was described in Case 48-1990.[50]

which supports the growth of *Chl. psittaci* or *Chl. trachomatis*, but not *Chl. pneumoniae*. The organism had a cytopathic effect typical of chlamydia, and antibody staining revealed inclusion bodies of the chlamydial genus, but attempts to identify the organism as *Chl. psittaci* by passage through another cell line failed. Had passage been successful, we would have used antibody staining for trachomatis species. The definitive diagnosis was subsequently made by performing a highly specific immunofluorescence antibody test to measure IgM titers during the acute and convalescent stages of disease. In this case, the IgM titers against *Chl. trachomatis* and *Chl. pneumoniae* were less than 1:16 initially, but the *Chl. psittaci* titer in the specimen obtained during the convalescent stage was greater than 1:64, confirming the diagnosis.

DR. EUGENE J. MARK: Because pneumonia due to *Chl. psittaci* can be treated effectively and is rarely fatal, the description of its pathological features has depended largely on research in animals[47] and specimens obtained at autopsy in the preantibiotic era.[48,49] In both humans and monkeys,[47] the earliest histopathological change is a purulent respiratory bronchiolitis (Fig. 4). In monkeys, the bronchiolitis appears three days after inoculation and spreads into adjacent alveoli six days later. Lesions are first detected radiographically on day 13. The organism can be recovered from lung tissue two days after inoculation and for three weeks thereafter. At the peak of the histopathological reaction, on days 14 to 16, alveoli are filled with an exudate rich in fibrin; this feature is also observed in humans (Fig. 5). Histologic resolution of the pneumonia in monkeys[47] begins on day 26 and is complete by day 37. Resolution in humans leaves an organizing bronchiolitis or an interstitial pneumonitis.[50,51] Fatal cases in humans are characterized by grossly hemorrhagic pneumonic consolidation[48,49] or diffuse alveolar damage.[52] Persons involved in the performance of autopsies must be alerted to the possibility of airborne transmission of the organism.

Chlamydial organisms can be seen as inclusion bodies, less than 1 μm in diameter, in the cytoplasm

of pneumonocytes and inflammatory cells in alveoli from patients with pneumonia as well as in smears of lung tissue and in tissue culture.[49,52,53] The organisms are demonstrated well with a Giemsa stain.

DR. KLEIN: Soon after the diagnosis of psittacosis had been established in this patient, doxycycline and the other antibiotics were discontinued. Approximately two weeks after admission, the patient was extubated. His respiratory status and the infiltrates improved gradually, and supplemental oxygen was discontinued. He was discharged to a rehabilitation facility one month after admission and is now at home.

ANATOMICAL DIAGNOSIS

Psittacosis, causing the acute respiratory distress syndrome.

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35-MILLIMETER SLIDES FOR THE CASE RECORDS

Any reader of the *Journal* who uses the Case Records of the Massachusetts General Hospital as a medical teaching exercise or reference material is eligible to receive 35-mm slides, with identifying legends, of the pertinent x-ray films, electrocardiograms, gross specimens, and photomicrographs of each case. The slides are 2 in. by 2 in., for use with a standard 35-mm projector. These slides, which illustrate the current cases in the *Journal,* are mailed from the Department of Pathology to correspond to the week of publication and may be retained by the subscriber. Each year approximately 250 slides from 40 cases are sent to each subscriber. The cost of the subscription is $450 per year. Application forms for the current subscription year, which began in January, may be obtained from Lantern Slides Service, Department of Pathology, Massachusetts General Hospital, Boston, Massachusetts 02114 (telephone [617] 726-4369).