Mycoplasma pneumoniae pneumonia is a community-acquired infection occurring primarily in children and young adults. Though it has been estimated that only 3 to 10 percent of patients with M pneumoniae respiratory illness develop pneumonia, up to 30 percent of all pneumonias in a general population may be caused by M pneumoniae. In closed populations, up to one-half of all cases of pneumonia may be linked to M pneumoniae. Among family members, the infection rate may be as high as 81 percent in children. The illness usually follows a benign, self-limited course; however, it may be complicated by Swyer-James syndrome, massive pleural effusion, pulmonary fibrosis, bronchiolitis obliterans, and the adult respiratory distress syndrome, some proving fatal. Other organs including those involving neurologic, dermatologic, gastrointestinal, hematologic, cardiovascular, musculoskeletal, and renal systems may be involved.

Most adults experience at least two to four respiratory infections annually, losing over 150 million days from work and school at a cost of nearly $10 billion in medical care. It is also estimated that there are 1.5 episodes of pneumonia per 100 persons per year, with approximately one-half million cases due to Mycoplasma. It is hoped that with a better understanding of respiratory infections and particularly of pneumonia we might learn to prevent some of them or at least shorten their course and lessen the morbidity and mortality.

Our interest in the various community-acquired pneumonias and in the diverse manifestations of M pneumoniae pneumonia prompted a review of the Mayo Clinic experience over a 14-year period with M pneumoniae pneumonia in patients from whom the organism was recovered in the laboratory. In addition, this article includes a review of the natural history, clinical characteristics, radiographic patterns, and laboratory findings of M pneumoniae pneumonia.

There has been a number of reviews of Mycoplasma respiratory infections emphasizing different aspects of the disease, some comparing M pneumoniae with pneumonias of different etiology or presenting extrapulmonary complications of Mycoplasma, including a 587-page review of the entire subject area of mycoplasmas.

M pneumoniae is a member of the class Mollicutes and the family Mycoplasmataceae. Only two of the mycoplasmas are known to cause disease in humans: M pneumoniae and Mycoplasma urealyticum (genital tract). M pneumoniae is about 330 nm in diameter (size range, 100 nm to 850 nm), lacks a cell wall, grows in cell-free media, and thus is the smallest known free-living organism. The incubation period is one to three weeks with infections that can persist for weeks and months.

**Materials and Methods**

**Case Reviews**

We retrospectively reviewed all cases of M pneumoniae pneumonia documented at the Mayo Clinic over a 14-year period. The study group consisted of 145 patients. All patients had clinical findings consistent with pneumonia with chest roentgenographic findings compatible with pneumonitis. In each case there was documentation of infection by isolation of the organism from sputum or throat swabs, and/or by a single complement fixation titer of 1:64 or greater or by a fourfold rise in complement fixation titers to M pneumoniae. Because this was a retrospective study, the true incidence of M pneumoniae pneumonia was greatly underestimated since many patients do not seek treatment or are treated empirically with antimicrobial agents without collecting specimens for culture or for serologic testing.

**Laboratory Methods**

**Culture.** Throat specimens (Culturette) or sputum cultures were inoculated into diphasic broth and incubated at 35°C. Two subcultures from the diphasic broth onto selective agar specific for M pneumoniae were made after four to six days and eight to 12 days of incubation. Plates were observed for at least ten days after the secondary transfer before being discarded as negative. M pneumoniae was identified by typical morphology, hemadsorption, and tetrazolium reduction tests.

**Serology.** The complement fixation test using antigen obtained
from M.A. Bioproducts (Walkersville, MD) was performed by the microtiter modification of the standardized Laboratory Branch complement fixation method.  

### RESULTS

*M. pneumoniae* pneumonia was documented in 148 patients: 75 males, 73 females. The age range of these patients was wide with the youngest patient three months of age and the oldest 77 years. However, most of our patients were older children or young adults with only 14 patients (9.5 percent) older than 40 years of age. Nine (6 percent) were under the age of five years. Thus, nearly 85 percent of the *M. pneumoniae* pneumonias occurred in patients five to 40 years of age. Most were previously healthy, with significant prior or coexisting medical problems present in only 23 patients (15.5 percent).

Clinical findings of upper and lower respiratory symptoms predominated with cough representing the most common symptom, occurring in 97 percent of the patients (Table 1). A dry, nonproductive cough, though occasionally there was purulent-appearing sputum, was present in patients. All patients presented with fever; 126 (85 percent) had temperatures of ≥37.7°C. Forty-seven (32 percent) patients had chills, but rigors were rarely mentioned in the records. Night sweats occurred in 13 percent. Chest pain (both pleuritic and nonpleuritic) and dyspnea were uncommon findings, occurring in 25 percent and 17 percent of the patients, respectively. No patient had hemoptysis. Physical examination most commonly revealed scattered rales and rhonchi with findings of consolidation present in 39 (26 percent) of the patients.

Upper respiratory tract and otologic signs and symptoms were commonly present. Sore throat was a complaint in 77 (52 percent) patients and evidence of pharyngeal erythema was present in most of these. Rhinorrhea, however, was uncommon and was mentioned by only 33 (22 percent) of the patients. Twenty-nine (20 percent) of the 148 patients were found to have erythematous tympanic membranes, and bullous myringitis was described in 27 (18 percent). A total of 38 patients had adenopathy, presenting as cervical adenopathy in young people.

The extrapulmonary manifestations of *M. pneumoniae* infection were present in 49 patients (33 percent) (Table 2). Twenty-four percent had nonspecific myalgias and arthralgias. There were no cases of frank arthritis.

Gastrointestinal tract involvement, as manifested by nausea, vomiting, anorexia, or diarrhea, was not unusual, with 42 percent of the patients having one or more of these characteristics. Hepatomegaly was noted in one patient along with splenomegaly in an additional patient.

Central nervous system involvement was present in 11 (7 percent) of the patients. Clinical findings in the patients were protean and ranged from ataxia and confusion to syncope and seizures (Table 2). No cerebrospinal fluid examination was done in any patient.

Dermatologic lesions were found in nine of the 148 patients (6 percent). These lesions were usually transient, and rashes varied in form including macular, vesicular, and urticarial types. Erythema multiforme minor and erythema multiforme major (Stevens-Johnson syndrome) are dermatologic manifestations that have been reported to occur with *M. pneumoniae* infections. Neither of these lesions was found in our series.

Cardiovascular involvement is a rare complication of *M. pneumoniae* infection. Our review did not reveal any patient with recognized cardiovascular manifestations. Renal disease with glomerulonephritis has rarely been observed, but again we had no patient with apparent renal involvement.
M pneumoniae pneumonia has been known to occur in the immunocompromised host, and this was the situation in only two of our patients. A 30-year-old white woman with stage IV Hodgkin's disease, mixed cellularity type, was admitted to the hospital with cough and fever to 39°C. She had received prior radiation therapy and was undergoing her third cycle of chemotherapy when her symptoms developed. Upon admission, she was found to have a white blood cell count of 200/cu mm (64 percent neutrophils), bilateral lower lobe infiltrates, and her sputum yielded M pneumoniae. She improved clinically over the next seven days with tetracycline therapy. Her leukocyte count increased to 4,600/cu mm and the chest x-ray film showed resolution.

The second patient was a three-month-old boy with a probable mixed or combined immunodeficiency state who had experienced continuous cough and fever since age two weeks. He died after an open lung biopsy, and cultures subsequently grew M pneumoniae and Nocardia asteroides. The role that M pneumoniae played in this patient with a mixed infection can only be speculative. He was the only patient in our series to die from pneumonia likely due to M pneumoniae.

Complications are rare with M pneumoniae pneumonia. Almost all of our patients had a self-limited course and returned to their previous state of health. Though one-third of the patients in this series were hospitalized, only one patient developed the criteria for the adult respiratory distress syndrome. He recovered uneventfully. In these days of lesser tendency to hospitalize, it is likely that many of those patients formerly hospitalized would now be treated in the outpatient setting.

We encountered no patient with a superinfection or mixed infection except for the three-month-old infant with Nocardia asteroides and M pneumoniae. There was no case of lung abscess or empyema.

Roentgenologic Features

Radiologic features were variable, including unilateral "patchy" pneumonitis, mixed interstitial and alveolar patterns, and a streaking pattern outward from the hilum, or so-called "bronchopneumonia." Lower lobe involvement was most common, with 66 percent of the patients having disease in one or both lower lobes. Forty-four percent of the 148 patients had some upper lobe involvement. A diffuse pattern was uncommon with only 14 percent having findings in three or more lobes.

Pleural effusion has been noted to occur in 20 percent of patients with M pneumoniae in a prospective study using lateral decubitus films to find evidence of effusion. Eight of our 148 patients (5.4 percent) had evidence of pleural effusion using standard posterior-anterior and lateral chest radiographs. None of these was documented with lateral decubitus films. All were small, transient, and of no clinical significance. No thoracocenteses were performed.

Laboratory Data

M pneumoniae was isolated from throat (89, 60 percent), sputum (73, 49 percent), or both (14, 10 percent) specimens from 148 patients. In addition, the organism was recovered from a lung biopsy specimen of an infant who died with complications of congenital immune deficiency (mentioned above).

In this retrospective series, complement fixation tests for antibody to M pneumoniae were not obtained as part of the laboratory diagnosis for each patient; however, results from at least one serum specimen were available for 46 individuals. Of these, 15 (33 percent) patients had either a fourfold rise in antibody titer or a single level of ≥1:64. Further, 41 of 77 (53 percent) serum specimens from our patient population had either a fourfold increase or an elevated titer (≥1:64) of cold agglutinins. Only three patients had levels of ≥1:512.

Coombs' test and reticulocyte counts were infrequently performed. An occasional reticulocytosis was noted. Profound hemolytic anemia was recognized in only one patient. An elderly woman had disseminated intravascular coagulation that resolved as her pneumonia was treated. White blood cell counts were performed in 117 patients. Sixty-nine percent had WBC counts <10,000/cu mm, 26 percent had WBC counts of 10,000 to 15,000/cu mm, and 5 percent had >15,000/cu mm.

Elevation of liver enzymes suggestive of hepatitis is a rare complication. Biopsy proven hepatitis did not occur in this series, and liver function studies were obtained infrequently. Eight patients were noted to have transient elevation of either serum transaminases or alkaline phosphatase.

Discussion

M pneumoniae is a community-acquired infection frequently encountered in clinical practice. Untreated, it usually runs its course in less than two weeks, although cough may persist for months. It appears to have less seasonal variation than other community-acquired pneumonias; however, this etiology should be considered first when it occurs in the late summer and fall months. Once thought to cause only benign respiratory tract illness, this review illustrates that extrapulmonary complications and severe illnesses are not uncommon manifestations of M pneumoniae pneumonia. One-third of our 148 patients required hospitalization; this compares with a hospitalization rate of 2 to 90 percent reported by others with an average of about 5-10 percent. The spectrum
ranges from the minimally symptomatic patient who is positive to antibody by the complement fixation test, to one who dies of acute respiratory failure. Of individuals infected with *M. pneumoniae*, probably less than 10 percent seek medical care.1,2

Pneumonia occurs in 3 to 10 percent of infected persons; however, the incidence is probably underestimated since many patients have a mild illness and likely receive empiric antibiotic therapy without laboratory evidence of *M. pneumoniae* infection. Despite this, *M. pneumoniae* is likely responsible for about 20 percent of community-acquired pneumonia and may account for 50 percent in closed populations.1

There are eight series, including ours, in which data were offered to the frequency of clinical manifestations.3,7,8,13,14,18 Murray et al.3 included three other studies in their review for a total of 11 series. The presence of cough in patients with *M. pneumoniae* infection ranged from 75 to 100 percent with an average probably of over 95 percent; the absence of cough probably should suggest that the clinician consider another entity. Cough was nonproductive to mildly productive, consisting of discolored sputum late in the course of the disease. Many polymorphonuclear leukocytes can be observed by Gram stain of sputum from a patient with *M. pneumoniae* infection; the organism is too small to be detected by light microscopy. Dyspnea must be an uncommon complaint, because of the 11 previous reports reviewed here, it is mentioned only by two authors in addition to ourselves. Dyspnea was detected in 22 percent and 17 percent of the patients reviewed by Izumikawa and Hara,7 and by us, respectively. Linz et al.18 described wheezing in 40 percent, and exacerbation of asthma and chronic obstructive lung disease (COPD) has been mentioned by other authors. Since bronchiolitis is a common feature in the few cases in which there are pathologic descriptions of *M. pneumoniae* (see below), it is not at all unexpected there would be dyspnea, especially in those with diffuse pneumonia and in those with underlying obstructive lung disease.

Chills are fairly common in patients with *M. pneumoniae* infection, but shaking rigors are very rare, a feature that may help separate *M. pneumoniae* pneumonia from more usual bacterial pneumonias with the possible exception of Legionella. Malaise is not as common as might be expected considering the patient has pneumonia. Pharyngitis ranges from 6 to 59 percent with an apparent average in several series quoted of about 25 percent. Pharyngitis occurred in 52 percent of our patients. Ear pain ranged from 2 to 35 percent (average 20 percent in our series). Rhinorrhea was mentioned by 22 percent of our patients. In the literature, this ranges from 2 to 40 percent. It is thought that upper respiratory symptoms are more common with Mycoplasma infections than with viral or bacterial pneumonias.

Headache was a complaint in 33 percent of our patients versus 60 percent in Izumikawa and Hara's review,7 and 90 percent in Dean's review.14 It is important to keep in mind that the series reported by Dean and by Izumikawa and Hara relate primarily to hospitalized patients with *M. pneumoniae* infection; thus, they are a more seriously ill population than usual. What role the history of headache played in justifying hospitalization is unknown, but it may have been of enough concern to the admitting physician to rule out meningitis. In the series of Linz et al, headache was present in 24 percent.9 Hemoptysis is rare, occurring in only a low percentage. Chest pain occurred in 2 to 42 percent, with 25 percent in our series. Cervical adenopathy was present in 18 to 40 percent. This probably relates to the range of ages included in the series with cervical adenopathy being more common in children and young adults. Izumikawa and Hara7 do not mention it in their review which included only adults. Findings of consolidation are mentioned in only a few of the reviews cited and the incidence of this problem averaged about 25 to 35 percent.

Respiratory tract illness without pneumonia is the most frequent manifestation of *M. pneumoniae* infection.1 Approximately one-fourth to one-half of patients with Mycoplasma pneumonia will have febrile upper respiratory tract illness with myringitis, bronchitis, or pharyngitis or a combination of these.26,27 Episodes of wheezing in children secondary to *M. pneumoniae* have been reported, as have exacerbations in patients with chronic obstructive pulmonary disease.28,29 Though only several patients in this review had significant COPD, the incidence may have been higher since many patients with chronic lung disease are treated with tetracycline or erythromycin without results of culture or serologic laboratory determinations as stated above. Otologic symptoms occur in up to one-third of the patients with bullous myringitis, otitis externa, and otitis media infections.30 Bullous myringitis was documented in 18 percent of our patients, a higher incidence than has previously been noted.30 Enlargement of hilar lymph nodes has been associated with pneumonia in children due to *M. pneumoniae*.

Physical examination may reveal rhonchi and rales, but signs of consolidation are usually not present. Twenty-six percent of the patients in this review had evidence of consolidation on physical examination.

There have been several attempts to try to describe a characteristic roentgenographic pattern to different pneumonias including *M. pneumoniae*.5,8,13,31-33 All authors agree that there is no characteristic pattern, but some changes may be seen more typically in one type of pneumonia compared to the other. However, it is
not so significant a finding that a clinician may rely upon a specific descriptive abnormality. Some clinicians say in *M. pneumoniae* pneumonia the x-ray film findings look worse than the patient.

Macfarlane et al. compared the chest roentgenograms of patients with *M. pneumoniae* with others consisting of Legionella pneumonitis, bacteremic and nonbacteremic pneumococcal pneumonia, and psittacosis. They recorded their findings only as "mainly homogeneous" or "mainly patchy." They did not describe what each of these means, other than only 50 percent of the patients with *M. pneumoniae* had homogeneous shadowing, in contrast to 70 to 82 percent in the bacterial pneumonias. Forty-eight percent of patients with mycoplasmal pneumonia had disease limited to one lobe versus 35 to 75 percent for the other organisms. They found pleural effusion in 20 percent. In half of these it was a large effusion. Only with *M. pneumoniae* did they notice hilar lymphadenopathy, present in 22 percent. They were surprised to find radiographic deterioration after initiation of treatment in 25 percent of their patients with *M. pneumoniae*, not as high as with the other organisms, but nevertheless higher than expected. They did note much more rapid resolution of the chest roentgenograms than with the other organisms with the majority completely cleared in four weeks and almost all in eight weeks. Ali et al. found that 46 percent were limited to a single lobe. They also noted that either upper lobe was involved in 24 percent (44 percent our series) and one or both lower lobes in 50 percent (66 percent our series). Pleural effusion was present in 8.7 percent of their patients including one with a massive effusion. Four patients (ages 4, 13, 27, and 40 years) had unilateral hilar lymphadenopathy. Ninety-two percent had complete resolution of their chest roentgenogram six to eight weeks after admission.

The chest roentgenographic findings are protean, but there is a predilection for the lower lobes and lobar consolidation is uncommon. Our review demonstrates a higher incidence of upper lobe involvement than has previously been reported, with 44 percent having upper lobe findings.

Small pleural effusions can be demonstrated in 20 percent of patients with *M. pneumoniae* pneumonia using lateral decubitus chest roentgenograms. In our series, though only eight of 148 patients (5.4 percent) had evidence of pleural effusion, a higher incidence may have been found if lateral decubitus films were obtained prospectively. Others have noted the infrequency of effusion with *M. pneumoniae* pneumonia. Nakao et al. studied the fluid in three children with mycoplasmal pneumonia and found a positive culture result in one and rising antibody titers to *M. pneumoniae* in the other two. Empyema is distinctly rare, but the organism has been isolated from pleural fluid. Pneumonia may rarely progress to lung abscess, Swyer-James syndrome, interstitial fibrosis, and the adult respiratory distress syndrome. Koletsky and Weinstein presented a fatal case and reviewed ten others from the literature. Five of the 11 had vascular thrombosis. White et al. have subsequently described a similar patient who died from pulmonary emboli.

There are limited reports in the literature of the lung histology of mycoplasmal pneumonia. Rollins et al. reviewed the findings of six patients; five showed significant bronchiolitis. This might explain the reports of Mycoplasma exacerbating bronchial asthma. The relative absence of *M. pneumoniae* occurring as an opportunistic pathogen or in mixed infection is curious. Infection with *M. pneumoniae* rarely occurs in the AIDS patient.

Extrapulmonary complications may play a significant role in the clinical spectrum of *M. pneumoniae* pneumonia. Central nervous system complications were described in 1938 in the initial report of primary atypical pneumonia. Significant central nervous system (CNS) complications occur in approximately 0.1 percent of all patients with *M. pneumoniae* infections and may be found in up to 7 percent of all patients requiring hospitalization. Seven percent of the patients in our series had CNS involvement. The manifestations are protean and include aseptic meningitis, meningoencephalitis, peripheral neuropathy, transverse myelitis, cranial nerve palsies, and cerebellar ataxia. The cerebrospinal fluid examination in patients with CNS involvement typically shows a pleocytosis, elevated protein, and normal glucose values. *M. pneumoniae* has been isolated from the CSF fluid, but this is a rare finding. In most cases there have been antecedent respiratory symptoms, but in 21 percent of patients with CNS complications, there may be no prior history of respiratory symptoms. The interval between respiratory and neurologic manifestations is approximately ten days. There seems to be no direct correlation between the severity of the *M. pneumoniae* pneumonia and the development or severity of neurologic complications. Treatment with antimicrobial agents appears to have little effect on the CNS manifestations.

Hematologic manifestations with *M. pneumoniae* pneumonia are not uncommon. IgM autoantibodies that agglutinate human erythrocytes at 4°C (cold agglutinins) can be found in 33 to 76 percent of patients. Frequent occurrences of subclinical hemolytic anemia are suggested by the fact that 83 percent of patients with *M. pneumoniae* pneumonia have a positive Coombs' test and reticulocytosis is found in 64 percent. These tests were infrequently performed in our group of patients. Though clinically hemolytic
anemia is usually associated with cold agglutinin titers of $>1.512$, it has been reported with titers as low as 1:64. As previously stated, we had only one recognized case of profound hemolytic anemia. Fifty-three percent of our patients had either a titer of $\geq 1:64$ or a fourfold increase in titer; however, less than one-half of our patients had serologic tests performed. Cold hemagglutination is not specific for *M. pneumoniae* infections and may occur in hemolytic anemias, liver disease, peripheral vascular disease, and viral infections. Major complications, though rare, include paroxysmal cold hemoglobinuria, Raynaud's disease, disseminated intravascular coagulation, thrombocytopenia, and renal failure.\(^3,53\) The white blood cell count is normal in 75 to 90 percent of cases of *M. pneumoniae* infection, with the WBC exceeding 10,000/cu mm in approximately 20 percent of the cases.\(^3\) We found a WBC count of $\geq 10,000$ in 31 percent of the patients. The WBC exceeded 15,000/cu mm, however, in only 5 percent.

Gastrointestinal symptoms have been reported in 12 to 44 percent of patients with *M. pneumoniae* pneumonia and consist primarily of anorexia, nausea, vomiting, and diarrhea.\(^3\) These symptoms usually occur early in the course of the illness. Elevated serum transaminase levels suggestive of acute hepatitis concomitant with *M. pneumoniae* pneumonia can occur.\(^3,40\)

The association of *M. pneumoniae* infection with cardiovascular disease was first reported by Finkelstein and Klainer\(^81\) in 1944 when they described pericarditis associated with primary atypical pneumonia. Since then, there have been reports of myopericarditis, hemopericardium, congestive heart failure, complete heart block, and endocarditis.\(^51,52,62,63\) Cardiac involvement may be present in as many as 5.4 percent of patients with *M. pneumoniae* infection.\(^28\) *M. pneumoniae* has been isolated from pericardial fluid.\(^64\) Patients may endure a prolonged illness and death has been reported.\(^17\) Of our 148 patients, there were no cases of apparent cardiac involvement.

Though skin lesions have been noted in one-fourth of cases in several series, we found only 6 percent with any dermatologic manifestations.\(^3,35,66\) There were no cases of erythema multiforme and four of the patients had skin lesions that occurred after antibiotics were started. A variety of dermatologic lesions have been reported including petechial, macular, morbilliform, and vesicular eruptions. Erythema, pityriasis rosea, erythema nodosum, and urticaria have all been noted. These lesions are usually benign and of little consequence to the patient. Stevens-Johnson syndrome and erythema multiforme minor are rare, but have been documented.\(^68\)

Musculoskeletal manifestations consisting of nonspecific arthralgias and myalgias may be seen in 15 to 45 percent of patients with *M. pneumoniae* infections.\(^52,66\) Frank arthritis, though rare, has been noted and is usually migratory and polyarticular involving the larger joints. Two of the three reported, documented by positive fluid cultures, have been in patients with hypogammaglobulinemia.\(^66\)

Some investigators have speculated that *M. pneumoniae* can cause a chronic arthritis similar to rheumatoid arthritis. Though a significant number (24 percent) of the patients in this series had myalgias, we had no case of clinically apparent arthritis. Other complications reported include acute glomerulonephritis\(^28\) and osteomyelitis.\(^87\)

*M. pneumoniae* is a slow-growing fastidious bacterium that can be cultivated in the laboratory by initial amplification in diphasic broth followed by at least two subcultures onto a complex selective agar medium. *M. pneumoniae* was recovered from all the patients in our series; however, the organism required 8 to 25 days of incubation for detection.\(^69\) In addition, the organism was recovered only sporadically in our community in the past. For example, of 104 throat and 95 sputum specimens processed during 1978, 46 (44 percent) and 18 (19 percent) yielded *M. pneumoniae*. In contrast, during 1980, only five (throat, three; sputum, two) specimens (total 108, 5 percent) were positive for the organism. Bronchoalveolar lavage fluids may be more productive than throat or sputum specimens in severely ill patients.\(^69\) Despite new media formulations designed to improve the rate of growth of *M. pneumoniae*, comparative evaluations in our laboratory have revealed no additional advantage compared to the composition described almost 30 years ago.\(^68\)

Collection of convalescent phase serum specimens for complement fixation serology testing, especially for outpatients, was difficult in our experience. Similarly, the assay for cold agglutinins for the laboratory diagnosis of *M. pneumoniae* infections lacks both sensitivity and specificity. Because of these problems, we have replaced these procedures with the indirect immunofluorescence test that is capable of detecting both IgM and IgG class antibodies. Of 14 acute phase sera (that when tested with a convalescent specimen had $\geq$ fourfold rises in antibody to *M. pneumoniae*), 13 (93 percent) had IgM class antibodies indicative of a recent infection with *M. pneumoniae*.\(^70\) Because of the efficiency of this serologic approach for the laboratory diagnosis of *M. pneumoniae* infections, we no longer process specimens for culture that so often required over 20 days for recovery of the bacterium. Alternatively, tests for antigen or nucleic acid hybridization, specific for *M. pneumoniae* may provide the rapid diagnostic methodology required for specific and timely management of patients with those infections.\(^7\)

None of the antimicrobial agents currently used in clinical practice are mycoplasmal. Both erythromycin and tetracycline have been shown to shorten...
the duration of symptoms in patients with respiratory tract illness. The efficacy of antibiotics in extrapulmonary complications is unknown.

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ICU for intubation and mechanical ventilation. In the last four years, however, eight published studies\(^7\)\(^9\)\(^1\)\(^4\) have addressed the outcome of AIDS patients who have received intensive care.

Murray et al\(^7\) reviewed the outcome of intubation and mechanical ventilation for 102 patients with AIDS at six institutions. Eighty-eight of these patients (86 percent) died in the hospital. Information about the etiology of respiratory failure, prognostic factors, therapy, or outcome of AIDS patients receiving intensive care for other indications was not provided in this review.

Stover et al\(^8\) reported their experience with patients with AIDS-related pulmonary diseases at New York and Memorial Sloan-Kettering Hospitals. Of 61 patients with pulmonary diseases, 22 (36 percent) required intubation for respiratory support at some time during their illness. None of these 22 patients survived to hospital discharge. Again, information about etiology, therapy, or the outcome of intensive care for AIDS patients without respiratory failure was not available.

Schein et al\(^9\) documented their experience at the University of Miami. Of the 31 AIDS patients receiving intensive care there, 23 (74 percent) died in the hospital. Of the eight survivors of intensive care, four were patients admitted for monitoring after a brain biopsy. Twenty-three of the 31 patients were admitted because of respiratory failure. Of these, 21 (91 percent) died in the hospital. Of the 16 patients with respiratory failure because of PCP, 15 (94 percent) died in the hospital.

Rosen et al\(^10\) studied the outcome of 36 patients with AIDS admitted to the Medical ICU at Mount Sinai Hospital, New York. Thirty-one of these patients required mechanical ventilation for respiratory failure; of these, 27 (87 percent) died during the hospitalization. Twenty-five of the 31 patients with respiratory
discharge. On the other hand, 43 of the 49 patients who received mechanical ventilation for respiratory failure died in the hospital (39 of 45 patients with PCP—87 percent; four of four patients with other opportunistic infections—100 percent), for an overall mortality rate of 88 percent. In this study, subgroup analysis was unable to accurately identify patients with an improved chance of survival. Specifically, younger patients, patients with first episodes of PCP, or patients admitted after more experience with the disease had been accumulated were not significantly more likely to survive their ICU stays.

Baggott and Baggott\(^12\) recently reported a similar experience from Bellevue Hospital in New York, where 45 of 49 intubated AIDS patients (91 percent) with severe PCP died in the hospital. As was the case at San Francisco General Hospital, the investigators at Bellevue were unable to predict the outcome of patients based on admission clinical criteria, including admission arterial oxygen saturation, alveolar-arterial oxygen gradient or lactate dehydrogenase level.

In the last year, two studies documenting a more favorable outcome for AIDS patients receiving intensive care have been published. Montaner and co-workers\(^13\) from St. Paul’s Hospital in Vancouver, British Columbia, recently reported that only 12 of 24 (50 percent) of their AIDS patients who received mechanical ventilation died in the hospital. This cohort was comprised (in a nonrandomized fashion) of six mechanically ventilated patients who received conventional therapy (trimethoprim-sulfamethoxazole or pentamidine) and 18 who received, in addition, high-dose hydrocortisone. Five of the six patients (84 percent) who did not receive corticosteroids died, while only seven of the 18 patients (39 percent) who received hydrocortisone died before hospital discharge. The authors speculated that corticosteroids