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Mycoplasma Pneumoniae Infections of Adults and Children

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Although the hallmark of Mycoplasma pneumoniae infection is pneumonia, the organism is also responsible for a protean array of other symptoms. With an increased awareness of the broad clinical spectrum of M. pneumoniae disease and the ready availability of the cold agglutinin and M. pneumoniae complement-fixation tests, interested clinicians will note additional clinical-mycoplasmal associations in their patients.

MYCOPLASMA PNEUMONIAE INFECTIONS are responsible for a considerable number of human illnesses. Although there is a vast amount of scientific knowledge available, there is still much confusion related to the spectrum and management of clinical diseases due to mycoplasmas. The purpose of this article is to review M. pneumoniae infections of children and adults in a way that will be useful to clinicians. Particular attention will be given to the less well-known manifestations of M. pneumoniae infections.

Definition and History

Mycoplasmas are the smallest free-living microorganisms; they lack a cell wall, they grow on lifeless media but require sterol for growth, and they are resistant to penicillin but sensitive to several other antibiotics.[1,2] Nocard and Roux[3] isolated the first mycoplasma species (now known as M. mycoides var mycoides) from cattle with contagious pleuropneumonia in 1898. Following this, numerous other mycoplasmas were isolated from cattle and other animals.[1] These other mycoplasmas were originally called pleuropneumonia-like organisms (PPLO). Presently, the term PPLO has been replaced by Mycoplasma; this is one genus of the family Mycoplasmataceae. Mycoplasmas have been isolated from many different animals including man. M. pneumoniae, initially called the Eaton agent, was identified in association with primary atypical pneumonia in 1944.[4] The Eaton agent was originally believed to be a virus until Marmion and Goodburn[5] in 1961 showed that it was identical to pleuropneumonia-like organisms. During the same year, Chanock and colleagues[6] administered a tissue culture grown Eaton agent strain to human volunteers and produced respiratory illness similar to primary atypical pneumonia. Although several different mycoplasmas have been recovered from humans (Table 1), the present report is only concerned with M. pneumoniae infections.

It is important to point out at the onset that in this report many of the clinical manifestations commented on were sporadic events and therefore may not necessarily have had a cause and effect

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TABLE 1.—*Mycoplasmas* Recovered from Humans*[7]

Respiratory tract	*Genital tract*
M. pneumoniae	M. hominis
M. orale (three types)	M. fermentans
M. salivarium	"T" - strains

*Listed by site of most common recovery.

relationship with M. pneumoniae infection. There is always the possibility of dual infection with the unrecovered infectious agent being responsible for the symptoms. It is the opinion of the authors, however, that these isolated cases should be included, with reservation, as they offer valuable points of reference for the observers. (See Figure 1 for clinical associations.)

Clinical Disease

Pneumonia

Incidence. The incidence of pneumonia due to M. pneumoniae in the general population is approximately one case per 1,000 persons per year. During epidemic periods, rates as high as three per 1,000 have been noted.[8] M. pneumoniae infections account for about 10 to 20 percent of all cases of pneumonia.[9-11] Since isolation rates do not vary greatly during the year, M. pneumoniae causes a greater proportion of pneumonia during the summer months when pneumonia due to other organisms is less common.[9,12]

The incidence of pneumonia due to M. pneumoniae is greatest in persons between the ages of 5 and 15 years while the percentage of all pneumonia attributable to M. pneumoniae is highest in late teenage and early adult years, when pneumonia due to all other causes is less common.[8-10,12] Pneumonia due to M. pneumoniae is uncommon in persons less than 4 or greater than 60 years of age.[9,10]

Symptoms and Signs.[9-14] Illness usually presents with the gradual onset of malaise and fever. Headache may also be a predominant early symptom. Cough begins after three to five days and becomes increasingly prominent. Initially nonproductive, the cough may later produce frothy, white or even blood-tinged sputum. Findings on Gram stain of the sputum show polymorphonuclear leukocytes with no predominant bacterial type evident. Gastrointestinal symptoms of anorexia, nausea and abdominal pain may occur. A pertussis-like syndrome with paroxysms of coughing has been described.[15]

Temperatures from 100° to 103°F (37.8° to 39.4°C) are common while higher temperatures are unusual.[19] Physical findings are generally of little aid in distinguishing M. pneumoniae pneumonia from that of other causes. However, as noted in Table 2, coryza is less common and lymphadenopathy more apparent in persons with

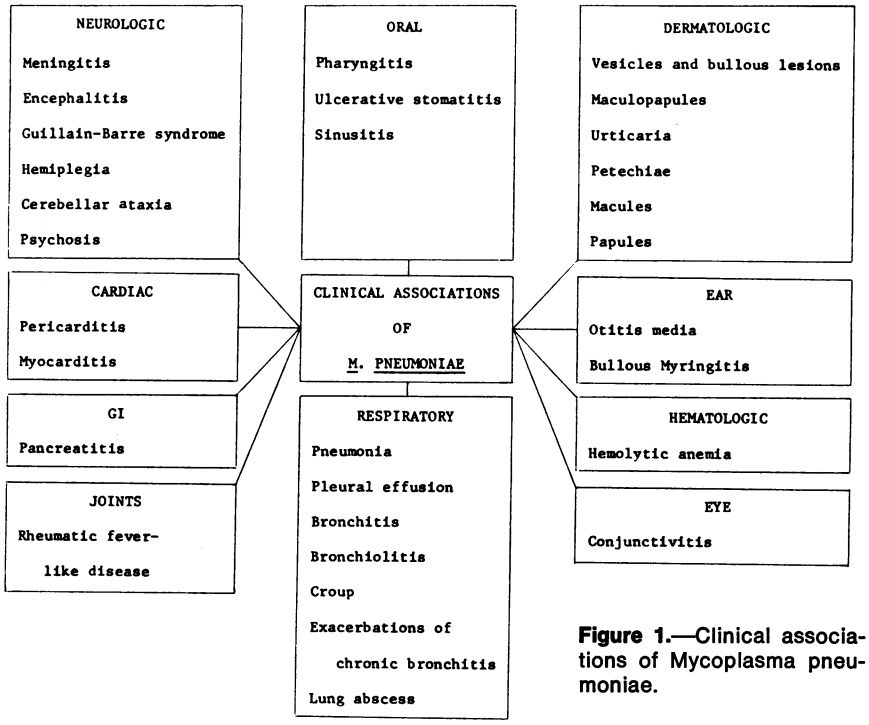

Figure 1.—Clinical associations of Mycoplasma pneumoniae.

TABLE 2.—*Relative Frequency of Selected Symptoms and Signs in Patients with Mycoplasma pneumoniae Pneumonia and Patients with Pneumonias of other Types*[11]

Findings	*M. Pneumoniae Pneumonia*	*Pneumonias of Other Types*
Cough	++++	++++
Headache	+++	+++
Pharyngitis	+++	+++
Sputum	+++	+++
Lymphadenopathy	+++	++
Conjunctivitis	++	++
Temperature ≥40°C	++	++
Coryza	++	+++
Pleuritis	±	+

M. pneumoniae pneumonia than in patients with pneumonias of other causes.

Dry rales are the most common finding on auscultation of the chest. They may persist for four weeks or more even though the patient is clinically improved. Symptoms of consolidation and friction rub may occur, substernal pain may be present but pleuritic pain is uncommon.

M. pneumoniae pneumonia is more severe in patients with sickle cell anemia,[16] with immunodeficiency syndromes[17] and with severe preexisting cardiorespiratory problems.[18,19] Although rare deaths have occurred, recovery is usual, although the clinical course is variable if untreated. Cough persists for three to four weeks in adults and usually for a shorter time in children,[8,10] while nonrespiratory symptoms of headache, myalgia and malaise may remit 7 to 10 days after their onset.

Roentgenography. Inconsistent relationships among the degree of symptoms, physical findings and results of chest roentgenographs are a hallmark of mycoplasma infection.[9,10,14,15,20] In many persons in whom significant infiltrates are seen on chest roentgenographs, there are no or minimal pulmonary findings. The radiologic pattern of M. pneumoniae pneumonia cannot be distinguished from other nonbacterial pneumonias.[21] Early in the course of M. pneumoniae pneumonia, the pattern is reticular and interstitial; subsequently, small patchy areas of superimposed consolidation are noted. Lower lobe involvement is most common and radiating infiltrates from the hilum are a frequent finding. Occasionally, lobar involvement is noted and pleural effusion also occurs.[22,23] In untreated patients, roentgenographic findings may persist for a month or longer.[24]

Routine Laboratory Data. The total leukocyte count in pneumonia due to M. pneumoniae is usually normal.[8,11] However, Turner and colleagues noted that the total leukocyte count was greater than 10,000 cells per cu mm in 13 of 22 children with M. pneumoniae infections; in 15 children, the differential percentage showed greater than 60 percent polymorphonuclear cells.

The sedimentation rate is frequently quite elevated.[25] Serologic tests for syphilis are occasionally noted to be falsely positive, serum cold agglutinins are frequently observed and antibodies to streptococcus MG antigen are found.[6,10,28,31] Serum IgM is frequently elevated while levels of IgG and IgA are normal.[30] The direct Coombs' test occasionally gives positive findings.[30]

Respiratory Disease other than Pneumonia

General. M. pneumoniae infections account for a significant amount of respiratory illness other than pneumonia.[10,13,20,31-35] Between 0 and 8 percent of all upper respiratory infections are due to M. pneumoniae. Pharyngitis is not uncommonly associated with M. pneumoniae infection; the peak incidence of M. pneumoniae pharyngitis is at 12 to 14 years old.[32] Bronchitis, bronchiolitis and croup have all been noted in association with M. pneumoniae infection.[10,13,33-35] Symptoms in these illnesses of children are usually mild.

In adults, exacerbations of chronic obstructive pulmonary disease have been associated with M. pneumoniae infections.[36,37]

Lung Abscess. Three patients with lung abscess in association with M. pneumoniae infection have been reported.[38,39] All three patients were males, aged 17, 24 and 45 years. All had two to four week histories of productive cough and pleuritic chest pain. In one patient, who was treated with tetracycline, there was dramatic improvement and on a follow-up roentgenograph six weeks later only minimal lingual scarring was seen. In the other two patients there was transient relief of symptoms during a week of therapy with tetracycline, but relapse occurred when the medication was discontinued. Both of these two patients eventually recovered although in neither was optimal antibiotic therapy carried out.

In a review of chest roentgenograms of 180 patients with pneumonia thought to be due to M. pneumoniae, four cases were found in which pneumatoceles were present, all clearing eventually.[21]

Otitis Media. Both acute otis media and the less common bullous hemorrhagic myringitis have been observed in M. pneumoniae infec-

tions.[9,10,20,33,35,40-42] In volunteer studies with tissue culture grown M. pneumoniae, Rifkind and associates[40] noted that in 13 of 52 subjects myringitis developed. Interestingly, myringitis occurred in 12 of 27 men without preinoculation of M. pneumoniae antibody and in only one subject with preinoculation antibody. The myringitis had an incubation period of six to nine days, was usually bilateral and was associated with throbbing pain. The appearance of the eardrum varied from mild infection to severe inflammation with edema. In five patients, hemorrhagic areas were noted and in two of these subjects serous-filled blebs which later contained blood were noted. Bullous myringitis has also been noted in several occasions with natural M. pneumoniae infections.[9,20,33,42]

The significance of M. pneumoniae infection in the etiology of common acute otitis media in children is unclear. In a study of 106 children with acute otitis media, Halsted and colleagues[41] were unable to recover M. pneumoniae from middle ear fluid. However, in 12 percent of the children there was serologic evidence of M. pneumoniae infection. Jensen and associates[35] noted laboratory evidence of M. pneumoniae infection in 47 of 79 children with otitis media. In this investigation, study children were selected because of suspected M. pneumoniae infection in a family member.

Sinusitis. Acute sinusitis is not an uncommon complication of a variety of acute infectious respiratory illnesses. However, clinically recognizable sinusitis was infrequently noted in persons with M. pneumoniae pneumonia.[29] However, when a radiographic search for evidence of sinusitis was made in 80 persons with M. pneumoniae infection, two thirds had sinusitis.[43] In these cases, the presence of sinusitis significantly prolonged the illness. In 30 patients with chronic suppurative maxillary sinusitis, Sprinkle[44] was unable to isolate mycoplasmas from antral lavage specimens.

Hemolytic Anemia

Clinical. Hemolytic anemia associated with M. pneumoniae infection has been reported on several occasions, but its occurrence is uncommon.[10,30,31,45-49] Hemolysis may be severe with a 50 percent reduction in hemoglobin occurring acutely. Severity correlates with high titers of cold agglutinins. A clinically inapparent, compensated hemolysis may also occur.[30]

Laboratory. In severe cases, the first evidence of hemolysis may be the rapid agglutination of blood in the syringe used for venipuncture.[47] Examination of a blood smear shows red cell agglutination, moderate spherocytosis, presence of polychromatic cells and at times erythrophagocytosis.[46-48] The serum bilirubin is usually between 1 and 3 mg per 100 ml. The leukocyte count may be elevated to a pronounced degree with a predominance of neutrophils, thereby confusing the diagnosis of M. pneumoniae infection. The direct Coombs test usually gives positive findings.[30,46-48]

Pathogenesis. The pathogenesis of acute hemolytic anemia in M. pneumoniae infection is unclear. *In vitro,* M. pneumoniae liberates peroxide which is a vigorous hemolysin.[31] However, in an organ culture system that is more akin to *in vivo* conditions, excessive peroxide liberation could not be shown.[50] Since the occurrence of hemolytic anemia has only been noted in association with notably elevated cold-agglutinin titers, it would seem that autoimmunity is of importance on pathogenesis. It would seem reasonable to suggest that mycoplasma organisms cause a temporary alteration of red blood cell membranes so that an autoantibody response occurs. In the patient studied by Fiala and co-workers,[45] bone marrow suppression also contributed to the anemia.

Prognosis. Hemolytic episodes are usually brief and self-limited, but have resulted in renal failure and death.[48] A beneficial effect of prednisone administration has been suggested but not adequately evaluated.[46] Since cold-agglutination may play a role in pathogenesis, it would seem wise to warm blood for transfusion to body temperature in patients with suspected M. pneumoniae infections.

Central Nervous System Disease

Clinical. A surprising spectrum of acute neurologic illness has been associated with M. pneumoniae infection.[10,11,15,18,28,34,48,51,52] The frequency of specific types of clinical involvement in 50 cases reviewed by Lerer and Kalavsky[51] is presented in Table 3. Combination involvement occurred in 36 percent of the cases. In 79 percent of the patients there was a history of antecedent respiratory illness. Neurologic illness occurred from 3 to 23 days after the onset of respiratory illness; the average interval was 10 days. The youngest patient was 6 years old and 47 percent were less than 20 years old. Of the patients less than 20 years old, 77 percent were males.

TABLE 3.—*The Frequency of Specific Clinical Involvement in 50 Patients with Neurologic Disease Associated with Mycoplasma pneumoniae Infection*[51]

Clinical Involvement	*Frequency (Percent)*
Generalized encephalitis	30
Spinal nerve roots	30
Meningitis	20
Cranial nerves	20
Focal encephalitis	16
Cerebellum	14
Psychosis	8
Spinal cord	2

Five patients were older than 50 years of age. This surprising number of cases in an age group in which M. pneumoniae infections are unusual would suggest a greater relative incidence of neurologic disease in older persons.

Prognosis. Five deaths have been noted, and major complications unrelated to the nervous system had played a significant role in all (for example, pulmonary embolus, pneumonia, sepsis).[51] In other patients there has been residual evidence of neurologic damage, mostly weakness but including hemiparesis, paraplegia and aphasia. Residua occurred more frequently in patients younger than 14 years of age who presented with focal encephalitis or radiculitis. There is no apparent correlation between severity of neurologic disease and height of cold-agglutinin or M. pneumoniae complement-fixation antibody titers.

Exanthem and Enanthem

Incidence. Exanthem in association with M. pneumoniae infection is more common than generally appreciated.[53,54] In a five year study in Seattle, 17 percent of 319 persons with M. pneumoniae penumonia had exanthem.[9] Copps and colleagues[55] noted that 11 percent of children with M. pneumoniae infections in a community outbreak in La Crosse, Wisconsin had exanthem and Feizi and co-workers[56] noted rash in a third of 40 patients in an outbreak in Scotland.

Clinical Findings. In a recent review, 20 well-documented cases of exanthem with M. pneumoniae were analyzed.[53] All but four of the patients were males and 19 of the 20 cases occurred in persons 4 to 20 years of age. Selected clinical findings are presented in Table 4. Skin manifestations were varied although in nine persons there were vesicular or bullous lesions, or both. Pruritis was noted in five patients. The duration of the rash was approximately seven days in all but one patient. All patients were febrile and the exanthem most commonly had its onset during the febrile period.

Enanthem occurred in 15 persons and it was severe in 10. In four patients severe conjunctivitis was present. Severe conjunctivitis only occurred in persons in whom there were vesicular or bullous exanthems, and in all four patients with severe eye involvement, generalized ulcerative stomatitis also was present. Interestingly, vesicular or bullous exanthems were not noted in females nor was ulcerative stomatitis or severe conjunctivitis.

In most patients, the spectrum of other symptoms was similar to those in patients with M. pneumoniae infections without exanthem. Only two of the 20 cases analyzed did not have pneumonia. The occurrence of an isolated rash as the single manifestation of M. pneumoniae infection is probably rare. In a study of 112 patients with suspected acute infectious exanthems, no significant antibody titers to M. pneumoniae were noted.[57]

Pathogenesis. The pathogenesis of exanthem in M. pneumoniae infection is unknown. In many patients, the enanthem-exanthem complex is consistent with the Stevens-Johnson syndrome. These findings might suggest an autoimmune phenomena perhaps with events similar to those inducing hemolytic anemia. It is important to point out, however, that in two instances M. pneumoniae has been recovered from blister fluid of patients with erythema multiforme;[58] in these cases, the exanthem could result from a direct effect of the infectious agent.

Many of the patients with M. pneumoniae infection and exanthem have received antibiotics before the onset of the rash. Therefore, the possibility of a drug eruption must be considered. In the analysis of the 20 detailed cases,[53] 12 patients had received antibiotics before exanthems occurred but six patients had a definite history of exanthem before antibiotic therapy. Although it is obvious that antibiotics cannot be incriminated in all cases, it is possible that M. pneumoniae infection intensifies the dermosensitive potential of certain antibiotics in a manner similar to that noted between the Epstein-Barr virus and ampicillin in infectious mononucleosis.

Arthritis

Mycoplasmas are a common cause of arthritis in animals other than man.[59] Eleven types of mycoplasmas have been clearly implicated in arthritides of seven different animals. Because many

TABLE 4.—*Major Clinical Findings in 20 Patients with Mycoplasma pneumoniae Infection and Exanthem*[53]

Clinical Category	*Number of Patients*
Distinguishing characteristics of exanthem	
Vesicular and/or bullous	9
Maculopapular	6
Macular	2
Papular	1
Urticarial	1
Petechial	1
Duration of exanthem	
<7 days	1
7 to 14 days	10
≥14 days	5
Not specified	4
Enanthem	
Generalized ulcerative stomatitis	10
Tonsillitis or pharyngitis	5
Conjunctivitis	
Severe	4
Mild	3
Pneumonia	
Yes	18
No	2

of the diseases in animals are suggestive of human rheumatoid arthritis considerable search for mycoplasmas in human arthritides has been done. At present, several mycoplasmas other than M. pneumoniae have been noted in association with rheumatoid arthritis. However, the results of studies to date are controversial and raise more questions than they answer.

Although it is highly unlikely that M. pneumoniae has a role in the cause of rheumatoid arthritis, joint manifestations have been noted during infections with this agent.[15,26,60-67] In five reports[60-64] ten instances of illnesses resembling rheumatic fever and associated with M. pneumoniae infections have been described. Seven of the ten patients were males. One patient was three years old, six were adolescents and three were adults. Most of the patients had a history of preceding respiratory illness including sore throat. When tested, sedimentation rates were found to be elevated. Seven patients had arthritis with swelling or effusion, and three had only joint pain. The knees were involved in all ten patients. In seven of the ten patients there was roentgenographic evidence of pneumonia.

One of the ten patients, a 71-year-old man, died with pericarditis and pneumonia. In the other patients, recovery was complete but after a prolonged period.

In 175 patients with M. pneumoniae pneumonia, George and co-workers[26] noted that 20 percent complained of myalgia, backache or arthralgia. In contrast, only 9 percent of persons with adenovirus pneumonia had similar complaints.

Cardiac Disease

Cardiac involvement during M. pneumoniae infection is unusual. In a series of 300 cases of M. pneumoniae infection, Hers[49] noted one patient with myocarditis. Grayston and colleagues[14] noted one 20-year-old girl with transient pericarditis in a study of 69 proven M. pneumoniae cases. A recent case report describes a 71-year-old man with the acute onset of an illness suggestive of rheumatic fever. At autopsy, effusions were found in the pericardial sac, pleural space, subdiaphragmatic area and in both knee joints. Mycocarditis and mitral valve lesions without Aschoff bodies were found. There was no laboratory or histologic evidence to indicate streptococcal infection, but pure cultures of M. pneumoniae were obtained from blood and from the pericardial effusion.[63]

Lambert[15] reported the case of a 50-year-old man who had acute pericarditis. This patient's initial illness required a three week stay in hospital; three months later, the patient experienced a second attack.

Pancreatitis

Mardh and Ursing[65] reported six instances of pancreatitis in patients with pneumonia due to M. pneumoniae. Two of the patients had only vague symptoms of pancreatitis but increased concentrations of serum amylase were noted. In three of the other four patients, the pancreatic symptoms began one to two weeks after the onset of respiratory illness; in one patient respiratory and pancreatic symptoms were concurrent. Diabetes mellitus developed in two patients and one of them died in a hyperosmolar, nonketotic, hyperglycemic coma.

Leinikki and Pantzer[66] noted four-fold rises in complement fixation antibody titer to M. pneumoniae in 18 of 56 patients with pancreatitis. None of these patients had pneumonia. Since the illnesses in these patients were so different from other M. pneumoniae infections, the authors suggested that perhaps a different but antigenically-related mycoplasm was the cause. Alternatively, they also raised the possibility of a false positive complement fixation test due to auto-antibodies to necrotic pancreatic tissue.

Communicability of M. Pneumoniae Infections

The rate of infection with M. pneumoniae is high in areas of close personal contact, such as families,[20,34,35,67,70] armed service camps[68,69] and fraternities.[71] In family studies, the attack rates vary between 64 and 71 percent among children and between 17 and 53 percent among adults.[20,67,70] In 74 percent of new Marine recruits four-fold antibody titer rises to M. pneumoniae developed during their 10 to 16 week training period.[18]

In contrast with families and military recruit training groups, the communicability in schools is low.[70] It is more usual for school children to become infected by neighborhood playmates than general classroom exposure.

The incubation period of M. pneumoniae infection is about three weeks.[67,70] Community epidemics due to M. pneumoniae are frequently protracted. Even in families, slow spread of the infectious agent is common and household involvement may continue for two months. Infection is most commonly spread by children of school age and by those patients who have a cough.[10,67,71]

Diagnostic Laboratory Tests

Serum Cold Agglutinins

The determination of serum cold agglutinins in patients suspected of M. pneumoniae infections is a simple and useful procedure. In pneumonias due to M. pneumoniae infections, cold agglutinins at a titer of approximately 1:32 will be present about 75 percent of the time.[25,31] Conversely, in patients with pneumonia and positive cold agglutinins, a specific antibody to M. pneumoniae will develop in 72 to 92 percent. In general, the cold agglutinin response correlates directly with the severity of illness.

Cold agglutinins have also been observed in 18 percent of adenovirus pneumonias in air force recruits[26] and in a variety of nonmycoplasmal respiratory illnesses of young children.[72] In general, the higher the cold agglutinin titer the more likely a specific infection is due to M. pneumoniae infection.

A rapid screening test for cold agglutinins can be done by an interested clinician.[73] In this test, four drops of blood are collected in a tube containing 0.2 ml of 3.8 percent sodium citrate solution. The tube is placed in ice water (0 to 4°C) for one-half minute and then examined for coarse agglutination by tilting the tube on its side.

Complement-Fixation Antibody Titers

Although there are several specific tests that can be used to measure antibodies to M. pneumoniae, the complement-fixation test is the only test readily available for routine laboratory use.[10] This test employs commercially available antigen and the results are satisfactory for usual diagostic purposes.

A four-fold rise in complement-fixation antibody titer is indicative of M. pneumoniae infection. Mycoplasma complement-fixing antibodies remain elevated for considerable periods so elevated single titers are of little value in disease diagnosis.[74] It is important to point out, however, that four-fold rises in antibody titer can occur in very short time periods. A second specimen collected within a week of the acute-phase serum will frequently show a four-fold titer rise.

Culture

With proper media and technique, M. pneumoniae is readily isolated from throat swabs of infected patients. However, M. pneumoniae is a relatively slow growing mycoplasma and therefore its isolation is of little use clinically. Serologic diagnosis is more practical.

Therapy

The therapeutic effectiveness of demethychlortetracycline in pneumonia due to M. pneumoniae was clearly shown in 1961 by Kingston and coworkers.[24] Since that time, several other antibiotics have been carefully studied and also found to be effective.[9,10,75] *In vitro* data indicate that M. pneumoniae strains are exquisitely sensitive to erythromycin, tetracycline, oxytetracycline and demethylchlortetracycline.[10] When expense and possible adverse drug reactions are considered, it would seem that the drugs of choice in M. pneumoniae infections are either erythromycin stearate or tetracycline hydrochloride.[9,10,75] Because of the adverse effect of tetracycline of dentition,[76] erythromycin is the drug of choice in children.

Despite the clinical effectiveness of antibiotics, organisms may still be recovered from throat cultures during and after therapy.[20,35] In the family situation, Jensen and colleagues[35] noted that the prophylactic use of oxytetracycline did not prevent infection of contacts but did render most infections asymptomatic.

Prevention

Inactivated M. pneumoniae vaccines have been tried with variable results. Mogabgab[77] reported significant protection following vaccination, whereas Smith and associates[78] noted that some vaccine recipients appeared to have more severe disease upon later exposure to M. pneumoniae. A recent trial with a live temperature sensitive mutant of M. pneumoniae gave encouraging results.[79] The mutant was avirulent in volunteers but appeared to stimulate resistance to subsequent challenge.

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Folk Remedies

Because of the number of Vietnamese people in the West, the use of folk remedies for illnesses may occasionally present unique diagnostic findings and should be recognized by practicing physicians. A 2½-year-old Vietnamese girl presented to the Emergency Room at Childrens Hospital of Los Angeles with a three to four day history of fever, cough and rhinorrhea. Positive physical findings included boggy erythematous nasal turbinates, mild erythema of the pharynx and a confluent petechial rash in the infraclavicular area of the chest bilaterally. A complete blood count showed a leukocyte count of 11,000 per cu mm with 60 percent lymphocytes and platelets within normal limits.

Several other Vietnamese children have been treated in our emergency room with similar rashes in the paraspinal and subscapular areas. Histories showed that these lesions are directly due to the popular practice among the Vietnamese population of using a coin to rub a mentholated compound vigorously into the skin in the infraclavicular, paraspinal and subscapular areas for approximately five minutes. The indications for this treatment include fever, rhinorrhea, cough and nonspecific symptoms in patients of all ages. Although less prevalent, coin massage with mentholated compounds may be used over the area of the biceps to treat abdominal pain.

The use of hyperthermia applied with a coin and mentholated compounds plays a major role in Vietnamese folk medicine and its external manifestations should be recognized.

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