EDUCATIONAL COMMENTARY - ANTIBODIES TO MYCOPLASMA PNEUMONIAE

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LEARNING OBJECTIVES

Upon completion of this exercise, the participant should be able to

- list the characteristics of *Mycoplasma pneumoniae*.
- discuss the mechanism and symptoms of infection.
- discuss the laboratory tests performed to detect *M pneumoniae*.

Organisms of the genus *Mycoplasma* are the smallest free-living organisms known today, ranging from 0.2 to 0.8 µm. Because *Mycoplasma* have no cell wall and can pass through filters that retain bacteria, researchers initially classified them as viruses. Because of results of DNA and RNA analysis and the fact that *Mycoplasma* can be grown in cell-free culture, they are now classified as bacteria.

Only a few species of *Mycoplasma* cause disease in humans. One of these is *Mycoplasma pneumoniae*. *M pneumoniae* is responsible for about 20% of all cases of community-acquired pneumonia. Infections with *M pneumoniae* occur worldwide in every season, and epidemics occur every four to eight years. The bacterium is an extracellular parasite that attaches to the epithelial cells of the respiratory tract, inhibiting ciliary action and producing toxins that cause cell necrosis. Activation of the immune response also causes cellular damage. Infection is transmitted through respiratory droplets and occurs most commonly in crowded environments, such as schools, day care facilities, and military barracks. About 80% of infections result in tracheobronchitis, but a type of atypical pneumonia, also known as primary atypical pneumonia or walking pneumonia, may also occur. Primary atypical pneumonia most commonly affects children and young adults. Usually, infections occur in children between two and five years of age but, in most cases, clinical symptoms do not present until the child is between five and fifteen years old. It is conjectured that repeated subclinical infections must occur before classic symptoms appear. The incubation period spans a period of two to three weeks. Approximately two to four days before the onset of respiratory symptoms, the patient may experience fever, headache, and malaise. Symptoms of primary atypical pneumonia include dry cough, pharyngitis, headache, chills, and muscle pain. The disease is usually mild and does not require hospitalization, although infections may be more severe in patients with sickle cell anemia, Down syndrome, or compromised immune systems. Complications of
the infection may include rash, arthritis, encephalitis, inflammation of the lining of the heart, and hemolytic anemia. The organism may cause symptomatic disease or colonize an individual's lungs and not result in pneumonia. Persistence of Mycoplasma infection of the lungs has also been linked to chronic asthma.

Laboratory testing for Mycoplasma infection may include bacterial culture, DNA testing, and serological assays of blood, respiratory secretions, fluid, or tissue samples may be evaluated. *M pneumoniae* is an aerobic bacterium. The organism is difficult to culture - it requires special media for culture and up to three weeks for growth. Colonies of *M pneumoniae* have a "fried egg" appearance. Presence of the organism alone does not distinguish between an atypical pneumonia infection caused by *M pneumoniae* and colonization by the organism. In many cases, culture of specimens from infected individuals does not result in the growth of the organism. A recent article suggests that "culture is not recommended for these pathogens, and this method should be eliminated from routine practice."¹

Molecular testing can be performed to detect the DNA of *M pneumoniae*. DNA testing can be done in a much shorter period of time than culture, but is considerably more expensive. It is not commonly used to identify *M pneumoniae* infection but often is used to differentiate infections with this organism from respiratory infections caused by other pathogens, such as *Chlamydia pneumonia, Bordetella pertussis, or Legionella* bacteria.

One of the earliest serological laboratory tests to determine the pathogen in atypical pneumonia was the assay for cold agglutinins. Cold agglutinins are antibodies produced in atypical pneumonia that make red blood cells (RBCs) clump, or agglutinate, at low temperatures, often even at room temperature, and dissociate at body temperature. The patient's serum is serially diluted and the dilutions are incubated with the patient's RBCs or Group O RBCs at 4°C. If clumping of the RBCs occurs at this temperature and disappears when the serum is rewarmed, cold agglutinins are present. The test is considered positive for *M pneumoniae* if the titer is 64 or higher. Unfortunately, this test is not specific for atypical pneumonia because it may also give positive results in other diseases such as infectious mononucleosis, measles, mumps, and some types of hemolytic anemia.

The enzyme-linked immunosorbent assay (ELISA) is the method most commonly used to test for *Mycoplasma* infection. ELISA’s sensitivity and specificity is much superior to those of cold agglutinin testing. In response to an infection, the body produces IgM antibodies directed against the antigen. These antibodies appear about seven days after infection and remain in the bloodstream for two to three weeks. Production of IgG antibodies occurs about two weeks after the onset of the infection and may circulate in the blood for many years. In many infectious diseases, IgG antibodies provide immunity when the individual is re-exposed to the causative agent. ELISA testing for atypical pneumonia usually includes an assay for specific IgM antibodies directed against the antigens of the bacterium and an assay for IgG
specific for the antigen. If the IgM test is positive, the patient has a current or recent infection. If the IgG is positive, the person may be currently infected or may have been infected in the past.

If only an IgG assay is performed, current or recent infection may be determined by performing acute and convalescent testing. The patient's serum is tested when symptoms appear (acute) and retested approximately two weeks later (convalescent). If the titer of the convalescent specimen is at least four times the titer of the acute specimen, the patient has a current or recent infection and this increase in titer indicates that the patient continues to produce IgG antibodies in response to the presence of the antigen. If the titer increases only slightly or does not increase at all, the IgG antibodies present are in response to a past infection. No test is 100% sensitive or 100% specific, but many ELISA tests closely approach that mark.

Atypical pneumonia is fairly common in the United States. In most cases, the disease is not severe and resolves without antibiotics. Diagnosis is important in patients with chronic diseases and in those whose immune systems are compromised. The diagnosis of an infectious disease such as atypical pneumonia relies not on laboratory test results alone, but also on the patient's clinical symptoms, physical examination, and other diagnostic procedures.

Reference