

Mycoplasma Pneumonia

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9.1 Overview

Mycoplasma pneumoniae (MP) is an acute respiratory infection with pneumonia caused by *mycoplasma pneumoniae*, which can cause epidemic, accounting for about 10% of all pneumonia, and can also lead to death in severe cases. *Mycoplasma pneumoniae* can be found in respiratory secretions from 2 to 3 days before onset until several weeks after recovery. It grows between ciliated epithelium through contact infection and does not invade lung parenchyma. There are neuraminic acid receptors on its cell membrane, which can be attached to the surface of respiratory epithelial cells of the host, inhibit cilium activity, destroy epithelial cells, and produce hydrogen peroxide to further cause local tissue injury. Its pathogenicity may be related to the allergic reaction of patients to the pathogen or its metabolites. Humoral immunity can be caused after infection, and antibodies exist in serum of most adults, which leads to less incidence of disease.

The incubation period of this disease lasts for 2–3 weeks, the onset of the disease is slow, and about 1/3 cases are asymptomatic. The disease is manifested as tracheobronchitis, pneumonia, and tympanitis. Pneumonia is the most serious disease. At the beginning of the disease, symptoms include fatigue, headache, sore throat, chills, fever, muscle soreness, loss of appetite, nausea, vomiting, and significant headache. The degree of fever varies and may be up to 39 °C. After 2–3 days, obvious respiratory symptoms occur, such as paroxysmal irritating cough, with a small amount of sticky sputum or mucopurulent sputum, sometimes with blood in sputum. Fever can last for 2–3 weeks. After the

body temperature returns to normal, there may still be cough with substernal pain, but no chest pain. The total number of leukocytes in patients with *mycoplasma pneumoniae* is mostly in the normal range and occasionally increased. Neutrophils or eosinophils in leukocytes are slightly increased. Direct antiglobulin test may be positive, and erythrocyte sedimentation rate may increase in the early stage of the disease. Complement fixation test is a widely used serological diagnostic method for diagnosing *mycoplasma pneumoniae* infection. Indirect hemagglutination test mainly detects IgM antibodies. Enzyme-linked immunosorbent assay (ELISA) is used to detect IgM and IgG antibodies. This method is sensitive, specific, rapid, and economical, as a practical and reliable means to diagnose *mycoplasma pneumoniae* infection. ELISA kits are now available for sale. Cold agglutination test is a nonspecific test for diagnosing *mycoplasma pneumoniae* infection. Polymerase chain reaction (PCR) can examine clinical specimens of *mycoplasma pneumoniae* infection.

9.2 Pathological Manifestations

Mycoplasma pneumoniae is manifested as patchy or confluent bronchopneumonia or interstitial pneumonia with acute bronchitis. Alveoli may contain a small amount of exudate, sometimes accompanied by focal atelectasis, lung consolidation, and emphysema. Neutrophils and macromonocyte infiltration occurs in the alveolar wall and septum. Bronchial mucosal cells may have necrosis and exfoliation, with neutrophil infiltration. There may be fibrin exudation and a small amount of exudate in the pleura.

9.3 Imaging Manifestations

Without specificity, the imaging manifestations of *mycoplasma pneumoniae* may be normal.

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1. Segmental or lobar consolidation: The lesions can be mainly distributed in lobes or segments, manifested as large patchy consolidation. The density is high or uneven, and most are unilateral lesions, in more right lung than left lung, and more common in lower lobe than in upper lobe. The lesions are the most common in the lower lobe of right lung.
2. Small patchy or fan-shaped infiltration opacities: The lesions are mainly distributed in pulmonary lobules, manifested as bronchitis, which mostly occurs in the lower fields of both lungs, extending in a fan-shaped or radially outward from the hilum of the lung. The lesions can be manifested as patchy opacities of different sizes in the paracardiac area, with uneven density and blurred edges (Fig. 9.1). HRCT is more likely to detect centrilobular

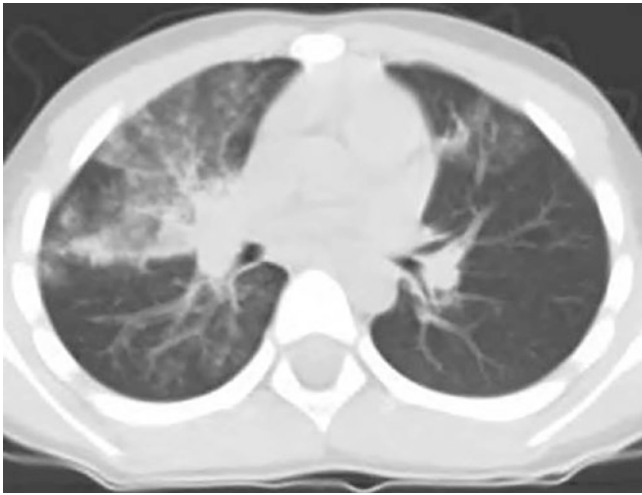


Fig. 9.1 Mycoplasma pneumoniae (I). The patient, a 6-year-old female. CT lung window showed multiple patchy opacities and small nodules in both lungs with blurred edges

3. Perihilar localized interstitial inflammation: Perihilar interstitial infiltration and lymphadenovariation. Unilateral cases are more common than bilateral cases, manifested as enlarged hilar shadow with unclear structure, and the absorption time of lesions is more than 2–3 weeks.
4. Lung interstitial infiltration changes: The lesions are mostly distributed in the lower lung field, showing thickened and increased lung markings, reduced transparency of local lung field, blurred lung field, showing reticular and nodular opacities.
5. Atelectasis: It may occur during the absorption of large patchy opacity lesions.
6. Pleural effusion: The incidence is low, mostly with a small amount, distributed in the costophrenic angle area. The CT observation may need lateral horizontal projection.
7. Mycoplasma pneumoniae in children: The lesion types include ground-glass opacities, reticular nodule opacities (Fig. 9.2), and consolidation. The main pathological features include air bronchogram, thickened bronchial wall, lymphadenovariation, and pleural changes. Children younger than 3 years old tend to have lesions in double lobes, while children older than 4 years old mostly have lesions confined to single lobe, and lesions are slightly more common in lower lobe than the upper lobe [1].

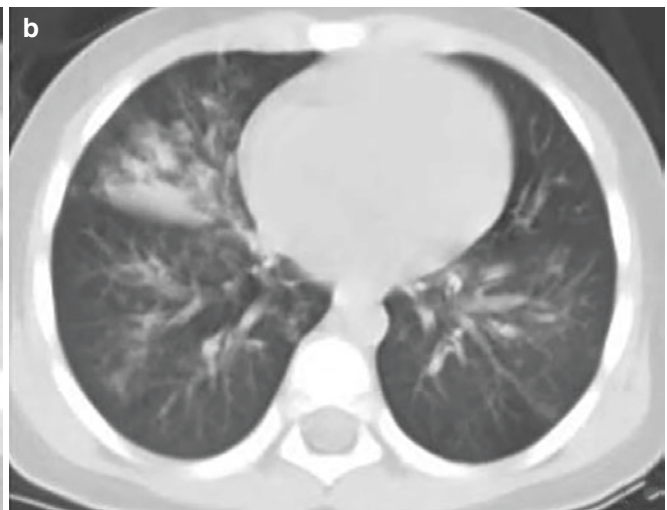
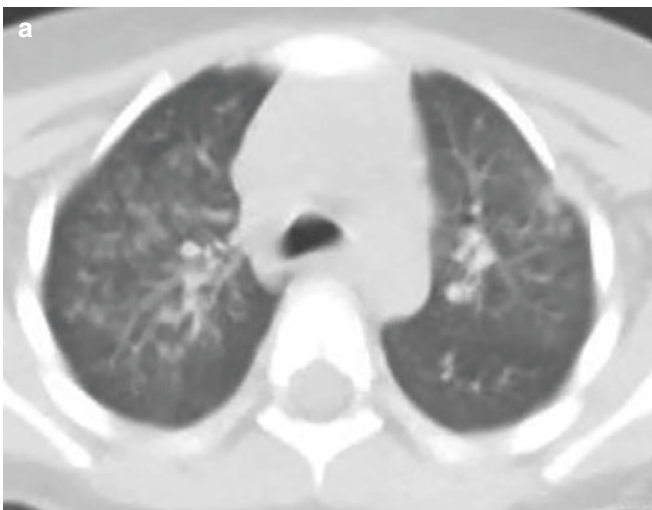


Fig. 9.2 Mycoplasma pneumoniae (II). The patient, a 3-year-old male. (a and b) CT lung window showed multiple reticular nodular opacities in both lungs with blurred edges and partial consolidation in the middle lobe of the right lung

9.4 Diagnostic Key Points

Imaging manifestations include large patchy consolidation, small patchy opacities, or fan-shaped infiltration opacities. Pulmonary interstitial changes can also be found.

1. Laboratory examination shows the normal or slightly increased total number of leukocytes, the increased erythrocyte sedimentation rate, and positive Coombs test.
2. The titers of serum lectin (IgM type) mostly increase to 1:32 or higher. The more severe the disease, the higher the positive rate.
3. Serum-specific antibody determination has a diagnostic value. Complement fixation test, indirect hemagglutination test, indirect immunofluorescence assay, and enzyme-linked immunosorbent assay are often used in clinical practice.

9.5 Differential Diagnosis

1. Primary pulmonary tuberculosis: It is common in children, which is similar to mild pneumonia, but primary pulmonary tuberculosis has a slow onset and may have systemic poisoning symptoms, such as low fever in the afternoon, night sweat, fatigue, weakness, etc. Imaging examination may have the characteristics of “dumb-bell” sign.

Secondary pulmonary tuberculosis: The cases with foci confined to the upper lung field sometimes need to be differentiated from secondary pulmonary tuberculosis mainly manifested as exudative infiltration. Mycoplasma pneumonia is generally absorbed significantly or completely in 1–2 weeks without special drug treatment, while tuberculosis is absorbed slowly without treatment, which can be distinguished by follow-up reexamination.

2. Acute lung abscess: The onset is acute, but it is characterized by coughing up a large amount of purulent smelly sputum with the progress of the disease, and sometimes cavity-like changes can be found by imaging examination.
3. Pneumococcal pneumonia: The onset is rapid, often caused by cold, being caught in the rain, upper respiratory tract infection, chills, with the symptoms of high fever, chest pain, cough with rust-colored sputum, obvious signs of lung consolidation. Blood routine examination shows significantly increased total number of leukocytes, mostly above $10 \times 10^9/L$. Pathogenic bacteria can be isolated from sputum and blood.
4. Hypersensitivity pneumonitis: Mycoplasma pneumonia has multiple lesions or lesion migration phenomenon, which should be differentiated from hypersensitivity pneumonitis. The eosinophil count in peripheral blood of

most patients with mycoplasma pneumonia is not high, which can be used for identification.

5. Viral pneumonia: The imaging manifestations are similar, and the differentiation mainly depends on cold agglutination test or mycoplasma culture.

9.6 Research Status and Progress

The studies of Gui et al. have shown that children with mycoplasma pneumonia have cellular immune disorder and humoral immune imbalance [2], and the more serious the disease is, the more obvious the disorder and imbalance are [3]. Vitamin D is a fat-soluble vitamin, which can regulate the metabolism of calcium and phosphorus, promote the growth and differentiation of cells, and also play an important role in immune regulation by regulating the local and systemic immune function of respiratory tract. Vitamin D receptor (VDR) exists in most immune cells. Vitamin D binds to VDR on immune cells, regulates the growth, differentiation and proliferation of various immune cells, and then affects the secretion of cytokines and antibacterial peptides, thus regulating innate immunity and adaptive immunity. The studies of Wang et al. have shown that serum 25-(OH)-D₃ level is related to mycoplasma pneumoniae pneumonia in children [4], suggesting that vitamin D deficiency may increase the risk of mycoplasma pneumonia and may be an independent predictor of its occurrence. The reason may be that vitamin D deficiency leads to the decreased immune regulation function and not being able to effectively regulate the immune disorder of mycoplasma pneumonia, thereby aggravating the severity of mycoplasma pneumonia.

At present, the detection of mycoplasma pneumonia mainly depends on mycoplasma culture, serological detection, molecular detection, and other means. As the gold standard for the detection of mycoplasma pneumonia, mycoplasma culture is seriously limited in the early detection of mycoplasma pneumonia because of its time-consuming and low positive rate. The recently popular molecular detection has not been widely used because of the high requirements of instrument operation and cumbersome procedures, so serological detection is still widely used in clinical practice. Serological detection of mycoplasma pneumonia includes passive agglutination method, gold standard method, and indirect immunofluorescence method. Indirect immunofluorescence method has the highest sensitivity and specificity. Passive agglutination method has the lowest sensitivity and complicated operation. The sensitivity of the gold standard method is slightly lower, but the specificity is the same as that of indirect immunofluorescence method, and the detection is rapid, providing results in only 20 min, so the gold standard method has high potential value for rapid diagnosis. For the detection of mycoplasma pneumonia

antibody, gold standard method combined with procalcitonin (PCT) and high-sensitivity C-reactive protein detection has significantly improved diagnostic efficiency of mycoplasma pneumonia infection and the detection duration is significantly shortened, which has good cost efficiency and practicability in clinical practice [5].

References

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