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LABORATORY DIAGNOSIS AND TREATMENT OF MYCOPLASMA PNEUMONIAE INFECTION IN CHILDREN

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Abstract
Mycoplasma pneumoniae (MP) is the cause of Mycoplasma pneumoniae pneumonia (MPP) in children and adolescents, with the clinical manifestations highlighted by intermittent irritating cough, accompanied by headache, fever and muscle pain. This paper aimed to study the research status and focal points in MP infection, especially the common laboratory diagnostic methods and clinical treatment of Mycoplasma pneumoniae. Laboratory diagnostic methods include molecular assay, serological antibody detection, rapid antigen detection and isolation and culture. Polymerase chain reaction (PCR) is the gold standard with high sensitivity and specificity. The serological antibody can detect various immune antibodies qualitatively or quantitatively in serum. Rapid antigen can be detected faster, with no equipment environment requirements, which can be used for the early diagnosis of MP infection. While the culture growth cycle is long and insensitive, not recommended for routine diagnosis.

Keywords: Mycoplasma pneumoniae, Mycoplasma pneumoniae pneumonia, laboratory diagnosis, treatment, children.

Introduction

Mycoplasma pneumoniae (MP) is the smallest pathogenic microorganism, small prokaryotic cells without a rigid cell wall, which is between bacteria and viruses and can live independently, and the adhesion ability to host cells is positively correlated with virulence [1]. The genome size of MP is extremely small, about 816 kilo base-pairs [2]. 6 of the 16 species of human mycoplasma can cause diseases, and the most important and the most predominant pathogen is MP [3, 4]. The lack of a cell wall barrier in mycoplasma makes them insensitive to cell wall antimicrobials (such as beta-lactam), not stained by Gram staining, difficult to survive in dry environments, and also affects their appearance under the microscope [5]. MP attaches to ciliated cells within the respiratory epithelium via attachment organelles and produces an ADP-ribosyl transferase, also known as community-acquired respiratory distress syndrome toxin (CARDS toxin), which is responsible for entering host cells through clathrin-mediated endocytosis [6, 7].

MP can induce upper and lower respiratory tract infections, and cause Mycoplasma pneumoniae pneumonia (MPP), tracheobronchitis, etc., with headache, fever, muscle pain, sore throat, cough, dry cough or mucus-like sputum representing a predominant form of community-acquired pneumonia in pediatric populations, constituting a significant threat to children health [8, 9]. It can also cause various extrapulmonary manifestations, involving almost all organs, including skin and nerves, blood, cardiovascular, genitourinary system, musculoskeletal system,

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and can cause pseudomembranous necrotizing laryngotracheobronchitis, myelin oligodendrocyte glycoprotein antibody-associated meningoencephalitis [10–13]. Infections often occur in summer or early autumn, as well as at any time of the year. The main route of transmission is fulminant, the incubation period is 2–3 weeks, and the incidence rate is the highest among children and adolescents [14]. MP re-infects over some time probably because it can hide in host cells to protect it from antibodies and antibiotics; the second is the lack of protective immunity due to some important factors such as variation and rearrangement of surface antigens [15]. Studies have shown that clinical signs, symptoms and laboratory findings are not sufficient to distinguish pneumonia caused by MPP and other pathogens, and correct etiological diagnosis, as well as drug treatment largely depend on accurate and rapid laboratory diagnosis.

Materials and Methods

PCR is considered the new "gold standard" with the higher sensitivity, most assays can detect <100 CFU/mL; The specificity is strong and there is no cross-reactivity when appropriate target selection and amplification conditions are validated. Nucleic acid amplification techniques used to detect MP DNA or RNA differ in the selection of target genes used (e.g. P1 gene, 16S rDNA, 16S rRNA, ATPase operon gene, etc.) (PCR versus isothermal amplification techniques) and the form of detection (conventional versus real-time, single versus multiple) [17]. The most problematic issue with PCR is colonization or asymptomatic carriage.

It is extremely rare to compare the performance of PCR methods with different Mycoplasma pneumoniae target areas and primers. P1 adhesin gene primers were found to be more sensitive than 16S rRNA primers, which may be due to the presence of multiple copies of the P1 cell adhesion gene. Studies have compared three different PCR detection methods: the detection method initially described by Bernet, with and without additional hybridization steps for amplicon detection, and the newly developed nested PCR [18]. All three PCR methods are reliable in detecting MP in respiratory specimens, but nested PCR is the most sensitive [19]. Due to the differences in sample collection, transportation and extraction procedures, input sample size, target genes, primers, cycle parameters, and detection systems, the comparison of sensitivity data for different PCRs becomes complicated.

Clinical Treatments

When MP infection is clearly defined, the main treatment method is drug treatment. Rational and standardized use of antibiotics can reduce symptoms and shorten the course of disease [37].

Mild MPP is more common in school-age children over 5 years old [38], with a course of 7–10 days, most patients have a good prognosis. The main clinical manifestations are fever and cough, wheezing and dyspnea can be detected in a small number of infants and young children. Imaging findings are bronchitis and bronchopneumonia; only a few patients can develop into severe [39]. Severe MPP refers to the severe condition of MPP, which conforms to any of the following manifestations: high fever ≥ 5 days or fever ≥ 7 days, or wheezing, shortness of breath, dyspnea, chest pain, hemoptysis and other symptoms. These manifestations are related to severe lesions, combined with plastic bronchitis, asthma attacks, pleural effusion and pulmonary embolism; extrapulmonary complications occurred, but did not meet the criteria for critical illness; finger pulse oxygen saturation ≤ 93% when breathing air at rest. The imaging findings were one of the following: large area of pulmonary consolidation; single lung diffuse or double lung multi-

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leaf segmental bronchiolitis showed [40, 41]. Critically MPP refers to severe MPP with rapid progression, respiratory failure or life-threatening extrapulmonary complications that require life-support treatment [39].

Antibiotics

MP lacks a cell wall and is resistant to all antimicrobials targeting the cell wall, susceptible to antibiotics that act on the bacterial ribosome and inhibit protein synthesis. Commonly used antibiotics include macrolides such as azithromycin, clarithromycin, roxithromycin, etc., new tetracycline antibiotics such as doxycycline, minocycline and omarcycline, quinolones such as levofloxacin, ciprofloxacin, moxifloxacin. Tetracyclines can inhibit peptide chain lengthening of protein synthesis by acting on the 30 S subunit of MP ribosomes. The treatment time is generally 10 ~ 14 days, and some severe patients can be extended to about 3 weeks [40].

Macrolide antibiotics, represented by azithromycin and erythromycin, are the preferred drugs and have been widely used in children with MPP in recent years, while the drug resistance rate is also increasing, marked by point mutations in the 23S rRNA gene [41]. Given the increasing prevalence of macrolide resistance worldwide, especially in East Asian countries such as Japan, China and South Korea, the search for alternative antibiotics to treat macrolide-resistance MPP is accelerating.

Conclusion

The laboratory examination of MP is very important for identifying the pathogens of MPP, and the rational and safe use of antibiotics is also crucial for the treatment of MPP in children. MP is easily under-reported due to the lack of clinical and chest X-ray features, the relative lack of rapid and specific laboratory diagnostic techniques, and the difficulty of isolation and culture of MP. In most cases where the specific pathogen cannot be identified, doctors will give empirical beta-lactam antibiotic treatment, which is ineffective for atypical pathogens, and correct and timely use of macrolide antibiotics can significantly shorten the course of the disease, so a rapid and accurate laboratory diagnosis of MP is very important. The common laboratory diagnostic methods of MP include PCR, serological antibody detection, rapid antigen detection and isolation culture. PCR is the gold standard with high sensitivity, specificity and no cross-reaction. Serological antibody detection can qualitatively detect various immune antibodies in serum or quantitatively detect antibody titers, which have a certain guiding role in the diagnosis of the disease and the progression of the disease. The rapid antigen detection time is the fastest, and there is no equipment and environmental requirements, which can be used for the early diagnosis of MP infection. The growth cycle of isolation culture is long and insensitive, and it is not recommended for routine diagnosis. For mild MPP, macrolides are the first choice. For drug-resistant MPP, new tetracyclines and symptomatic treatment can be used instead, which will generally improve. For severe MPP, on the basis of symptomatic treatment and corresponding antibiotics, glucocorticoid and gamma globulin can be added, which can have obvious curative effects. For critically ill MPP, bronchoalveolar lavage can be added.

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References

1. Steinbach WJ, Fisher BT. International collaborative on contemporary epidemiology and diagnosis of invasive fungal disease in children. J Pediatric Infect Dis Soc. (2017) 6:S1–2. doi: 10.1093/jpids/pix039
2. Ahangarkani F, Shokohi T, Rezai MS, Ilkit M, Mahmoodi Nesheli H, Karami H, et al. Epidemiological features of nosocomial candidaemia in neonates, infants and children: a multicentre study in Iran. Mycoses. (2020) 63:382–94.
3. Pfaller MA, Diekema DJ. Epidemiology of invasive candidiasis: a persistent public health problem. Clin Microbiol Rev. (2007) 20:133–63.
4. Пайманов Н. В., Герасимова В. П., Орлов А. Е. Применение ОВО-Д в лечении хронических вирусных гепатитов.;; Рос. журн. гастроэнтерол., гепатол., колопроктол. 2007; 17.: (1): 37.
5. Armstrong G. Z., Wasley A., Simard et al. The prevalence of hepatitis C virus infection in the United States, 1999 through. 2002. Ann. Intern. Med. 2006; 144: 705-741.
6. Melhem A., Stem M., Shibolet O. et al, Treatment of chronic hepatitis C virus infection via antioxidants. Results of a phase clinical trial. J. CIin. Gastroenterol. 2005; 39: 737-742.
7. Okanue L, Sakamoto S., Iton Y. et al. Побочные эффекты лечения хронического гепатита С высокими дозами интер¬ферона. J. Hepatol. 1996; 25: 283-291.
8. Ibrokhimovna, M. M. . (2024). Improvement of Primary Prophylaxis and Treatment of Spontaneous Bacterial Peritonitis Complicated in Virus Etiology Liver Cirrhosis. Journal of Intellectual Property and Human Rights, 3(4), 19–25. Retrieved from http://journals.academiczone.net/index.php/jiphr/article/view/2506
9. Elmurodova A.A. (2023). Viral Hepatitis Delta: An Underestimated Threat. *Texas Journal of Medical Science*, *26*, 1–3. Retrieved from https://zienjournals.com/index.php/tjms/article/view/4610
10. Oblokulov Abdurashid Rakhimovich Mukhammadieva Musharraf Ibrokhimovna Sanokulova Sitora Avazovna Khadieva Dora Isakovna. (2023). CLINICAL AND LABORATORY FEATURES OF SPONTANEOUS BACTERIAL PERITONITIS IN PATIENTS WITH VIRAL LIVER CIRRHOSIS. Journal of Advanced Zoology, 44(S2), 3744–3750. Retrieved from http://www.jazindia.com/index.php/jaz/article/view/1716
11. Mukhammadieva M.I. (2022). Modern clinical and biochemical characteristics of liver cirrhosis patients of viral etiology with spontaneous bacterial peritonitis //Texas Journal of Medical Science. – 2022.- P. 86-90
12. Abdulloev Mukhriddin Ziyodulloevich. (2023). Modern Therapy of Viral Hepatitis. Texas Journal of Medical Science, 26, 66–69. Retrieved from https://www.zienjournals.com/index.php/tjms/article/view/4636
13. Nabiyeva, Z. . (2023). CLINICAL MANIFESTATIONS OF CHRONIC DISEASES ОРГАНОВ OF THE DIGESTIVE SYSTEM IN CHILDREN. Инновационные исследования в современном мире: теория и практика, 2(15), 27–28. извлечено от https://in-academy.uz/index.php/zdit/article/view/13239
14. Mukhammadieva M.I. (2023). Вирус этиологияли жигар циррози беморларида спонтан бактериал перитонит билан асоратланишнинг профилактикаси ва давосини такомиллаштириш//Oriental Renaissance: Innovative, educational, natural and social sciences. -2023.-P.947-953.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

15. Oblokulov A.R., M.I.Mukhammadieva.(2022). Clinical and biochemical characteristics of liver cirrhosis patients of viral etiology with spontaneous bacterial peritonitis//Academicia Globe: Indersciense Research.-2022.- P. 210-216.
16. Khadieva Dora Isakovna. (2024). Diagnosis and Prediction of Liver Fibrosis in Chronic Viral Hepatitis C in Hiv-Infected. *International Journal of Integrative and Modern Medicine*, *2*(6), 89–94. Retrieved from https://medicaljournals.eu/index.php/IJIMM/article/view/515
17. Карроматов Иномжон Джураевич, Набиева Зумрад Тухтаевна Адаптоген - элеутерококк, свободоягодник колючий (обзор литературы) // Биология и интегративная медицина. 2017. №11. URL: https://cyberleninka.ru/article/n/adaptogen-eleuterokokk-svobodoyagodnik-kolyuchiy-obzor-literatury (дата обращения: 19.12.2023).
18. Mukhammadieva Musharraf Ibrokhimovna. (2024). TREATMENT OF SPONTANEOUS BACTERIAL PERITONITIS COMPLICATED IN VIRUS ETIOLOGY LIVER CIRRHOSIS. *JOURNAL OF EDUCATION, ETHICS AND VALUE*, *3*(6), 73–80. Retrieved from https://jeev.innovascience.uz/index.php/jeev/article/view/723
19. Sanokulova Sitora Avazovna. (2023). Factors of Development of Hepatorenal Syndrome in Patients with Liver Cirrhosis of Viral Etiology. Texas Journal of Medical Science, 26, 4–9. Retrieved from https://www.zienjournals.com/index.php/tjms/article/view/4611
20. Tukhtaboevna, M. Z. . (2022). ACUTE INTESTINAL INFECTIONS IN CHILDREN, MODERN PRINCIPLES OF CORRECTION AND RESTORATION OF WATER-ELECTROLYTE BALANCE. *IJTIMOIY FANLARDA INNOVASIYA ONLAYN ILMIY JURNALI*, 101–105. Retrieved from https://sciencebox.uz/index.php/jis/article/view/3249
21. Tukhtaboevna M. Z. Choosing an Antihistamine to Treat Seasonal Allergies //INTERNATIONAL JOURNAL OF HEALTH SYSTEMS AND MEDICAL SCIENCES. – 2022. – Т. 1. – №. 4. – С. 401-407.
22. Jalilova, A.S. (2022). THE SPREAD OF CIRRHOSIS OF THE LIVER BY ETIOLOGICAL FACTORS. Oriental renaissance: Innovative, educational, natural and social sciences, 2 (6), 253-257.\
23. A. A., E., A. S., D., & A., M. S. (2022). Modern Approaches to Treatment of Chronic Giardiasis. Central Asian Journal of Medical and Natural Science, 3(2), 102-105. Retrieved from https://www.cajmns.centralasianstudies.org/index.php/CAJMNS/article/view/631
24. Облоқулов, А., & Муҳаммадиева, М. (2022). КЛИНИКО-ЛАБОРАТОРНАЯ ХАРАКТЕРИСТИКА СПОНТАННОГО БАКТЕРИАЛЬНОГО ПЕРИТОНИТА ПРИ ЦИРРОЗЕ ПЕЧЕНИ ВИРУСНОЙ ЭТИОЛОГИИИ. Журнал вестник врача, 1(3), 66–69. извлечено от https://inlibrary.uz/index.php/doctors_herald/article/view/2016
25. Oblokulova Z.I, Oblokulov A.R, & Jalilova A.S. (2022). Diagnostic Significance of Hepatic Fibrosis in Patients with Extrahepatic Chronic Viral Hepatitis C. Central Asian Journal of Medical and Natural Science, 3(3), 438-443. Retrieved from https://www.cajmns.centralasianstudies.org/index.php/CAJMNS/article/view/806
26. Aslonova.M.R. (2022). Determination of suicidality against the background of Parasitic Diseases in children // INTERNATIONAL JOURNAL OF PHILOSOPHICAL STUDIES AND SOCIAL SCIENCES. – 2022.- P. 9-12.
27. Jalilova, A. S. (2022). Approaches to Etiotropic Therapy of Covid-19 in Outpatient Patients. INTERNATIONAL JOURNAL OF HEALTH SYSTEMS AND MEDICAL SCIENCES, 1(1), 41-44.

28. Mukhtarova Sh.A. (2022) Age-related features of clinical manifestations of giardiasis // International journal of medical sciences and clinical research 2022;17-21.
29. Jalilova A.S. (2022). FEATURES OF CLINICAL MANIFESTATIONS OF CYTOMEGALOVIRUS INFECTION IN CHILDREN. International Journal of Medical Sciences And Clinical Research, 2(09), 12–16. https://doi.org/10.37547/ijmscr/Volume02Issue09-04
30. Raximovich, O. A., Sadilloyevna, J. A., Abdulloyevna, M. S., & Farxodovich , R. F. (2022). Microbiological Indicators of Patients with Confirmed Sars-Cov-2 - Infection. Central Asian Journal of Medical and Natural Science, 3(2), 289-294. https://doi.org/10.17605/OSF.IO/9CFP6
31. Жалилова А. С. Дилноза Саётовна Косимова. Клинико–Лабораторная Характеристика Пациентов С Covid-19 И Предиктор Антибактериальной Терапии //CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES. – 2021. – С. 81-86.
32. Abdulloyevna, M. S. . (2023). Tez-Tez Kasal Bo'lgan Bolalarda O'tkir Respirator Kasalliklarning Klinik-Laboratoriya Xususiyatlari. AMALIY VA TIBBIYOT FANLARI ILMIY JURNALI, 2(12), 29–34. Retrieved from https://sciencebox.uz/index.php/amaltibbiyot/article/view/8680
33. Muxtorova, S. A. (2022). Clinical and laboratoriya features of acute respiratory disease in frequently ill children. Web of scientist: International scientific research journal, 1026-1030.
34. Mukhtarova, S. H. (2022). A.(2022) AGE-RELATED FEATURES OF CLINICAL MANIFESTATIONS OF GIARDIASIS. INTERNATIONAL JOURNAL OF MEDICAL SCIENCES AND CLINICAL RESEARCH, 17-21.
35. Mukhtorova Shokhida Abdulloevna. (2023). Microbiological Indicators of Patients Infected with SarsCov-2. Texas Journal of Medical Science, 21, 41–45. Retrieved from https://www.zienjournals.com/index.php/tjms/article/view/4116
36. Mukhtorova Shokhida Abdulloevna. (2023). CYTOMEGALOVIRUS INFECTIONS IN CHILDREN WITH PRIMARY AND SECONDARY IMMUNE DEFICIENCIES. Academia Science Repository, 4(06), 23–28. Retrieved from http://academiascience.com/index.php/repo/article/view/832
37. Aslonova.M.R. (2023). VITAMIN DEFICIENCY CASES RESULTING FROM PARASITIC DISEASES // Galaxy International Interdisciplinary Research Journal.-2023.-P. 404-409
38. Mukhtorova Shokhida Abdulloevna. (2023). CHARACTERISTIC FEATURES OF THE COURSE OF CITOMEGALOVIRUS INFECTION IN CHILDREN. Galaxy International Interdisciplinary Research Journal, 11(4), 484–487. Retrieved from https://giirj.com/index.php/giirj/article/view/5150..
39. Raximovich, O. A., Sadilloyevna, J. A., Abdulloyevna, M. S., & Farxodovich , R. F. (2022). Microbiological Indicators of Patients with Confirmed Sars-Cov-2 - Infection. *Central Asian Journal of Medical and Natural Science*, *3*(2), 289-294. https://doi.org/10.17605/OSF.IO/9CFP6
40. Ш. А, М. (2023). Профилактика Сезонного Распространения Орви Среди Детей Раннего Возраста. AMALIY VA TIBBIYOT FANLARI ILMIY JURNALI, 2(12), 22–28. Retrieved from https://www.sciencebox.uz/index.php/amaltibbiyot/article/view/8678
41. M. I., M. . (2024). Features of the Clinical Course of Virus-Associated Glomerulonephritis in Children and Adolescents. *Research Journal of Trauma and Disability Studies*, *3*(10), 163–169. Retrieved from https://journals.academiczone.net/index.php/rjtds/article/view/3676

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