IJIMM, Volume 2, Issue 5, 2024 ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM/issue/view/3
INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

# Modern Methods of Treatment of Mycoplasma and Candida Pneumonia

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**Abstract:** Fungal infections are common in pediatric intensive care units (PICU), but the monitoring methods are limited. This study analyzed the differences in clinical features, diagnosis, and treatment between PICU patients with and without fungal infection. Invasive fungal disease is among the main causes of morbidity and mortality of hospitalized pediatric patients, especially premature infants. Yeast and mold are the most common clinical fungal pathogens. According to a report by the Centers for Disease Control and Prevention, fungal infection is the sixth largest cause of nosocomial infections, and Candida spp. is the fourth-most common pathogen responsible for hospital-acquired infections.

**Keywords:** fungal infections, PICU, candida pneumonia, NICU, pathogen? legionella.

## Introduction

Atypical pathogens are intracellular bacteria causing community-acquired pneumonia (CAP) in a significant minority of patients. Legionella spp., Chlamydia pneumoniae and psittaci, Mycoplasma pneumoniae, and Coxiella burnetii are commonly included in this category. M. pneumoniae is present in 5–8% of CAP, being the second most frequent pathogen after Streptococcus pneumoniae. Legionella pneumophila is found in 3–5% of inpatients. Chlamydia spp. and Coxiella burnetii are present in less than 1% of patients. Legionella longbeachae is relatively frequent in New Zealand and Australia and might also be present in other parts of the world. Uncertainty remains on the prevalence of atypical pathogens, due to limitations in diagnostic means and methodological issues in epidemiological studies. Despite differences between CAP caused by typical and atypical pathogens, the clinical presentation alone does not allow accurate discrimination. Hence, antibiotics active against atypical pathogens (macrolides, tetracyclines and fluoroquinolones) should be included in the empiric antibiotic treatment of all patients with severe CAP. For patients with milder disease, evidence is lacking and recommendations differ between guidelines. Use of clinical prediction rules to identify patients most likely to be infected with atypical pathogens, and strategies of narrowing the antibiotic spectrum according to initial microbiologic investigations, should be the focus of future investigations.

Fungal infections are common in pediatric intensive care units (PICUs) and neonatal intensive care units (NICUs). Invasive fungal disease is among the main causes of morbidity and mortality of hospitalized pediatric patients, especially premature infants [1–4]. Yeast and mold are the most common clinical fungal pathogens. According to a report by the Centers for Disease Control and Prevention, fungal infection is the sixth largest cause of nosocomial infections, and Candida spp. is the fourth-most common pathogen responsible for hospital-acquired infections [5]. In the NICU, fungal infection is the third most common cause of mortality, with a rate as high as 20–40% [6]. In 2000, nosocomial fungal infections increased significantly compared with 2001–2004 (24.4 vs. 13.9%) [7]. Candidemia ranked fourth in the United States and seventh in Europe among blood infections responsible for the high mortality rate among children [8].

With improvements in diagnostic technologies and treatment methods, the incidence of fungal infections has shown a downward trend in recent years, but its mortality remains high [1, 4]. Unfortunately, the methods available to monitor fungal infections are limited and definitive diagnosis in many cases is still difficult. Despite their low sensitivity and long delays before providing results, the fungal culture of blood, body fluids, and respiratory secretions is still considered the gold standard.

Novel methods have shown promise, including serum marker tests such as the G test and galactomannan (GM) test, polymerase chain reaction (PCR), matrix-assisted laser desorption/ionization-time of flight, high-throughput pathogen sequencing, and other molecular approaches [9–12]. Because the diagnostic accuracy of culture and imaging is low for patients with fungal infections [12, 43], they are often misdiagnosed as tumors, tuberculosis, or inflammatory lesions [14–36], resulting in delayed treatment. Bronchoscopic manifestations and testing of the bronchoalveolar lavage fluid (BALF) in children with pulmonary fungal infections could have a high diagnostic accuracy [17, 18].

Accurate identification and timely diagnosis of fungal infections are crucial to the early control of the disease, as well as reducing medical costs and the economic burden on society and families. Therefore, this paper summarizes the clinical diagnosis and treatment of patients in the PICU of the Child Health Hospital from January 1, 2019 to January 1, 2023 and analyzes the general clinical manifestations, chest computed tomography (CT), laboratory examination, fiberoptic bronchoscopy examination, and BALF. The results could provide a reference for medical practitioners.

## Materials and Methods

This retrospective study examined the data of 157 patients with proven or probable pulmonary fungal infection admitted to the PICU of the Child Health Hospital, between January 1, 2019, to January 1, 2023. All data were prospectively collected in a database. The study was approved by Child Health Hospital of Bukhara. Informed consent was waived due to the retrospective nature of the study.

According to the European Organization for Research and Treatment of Cancer/Mycoses Study Group, fungal diagnostic criteria include clinically diagnosed and suspected patients [12, 19]. Therefore, the inclusion criteria were (1) patients younger than 18 years and (2) patients who met the diagnostic criteria of severe pneumonia in community-acquired pneumonia [20]. Patients with incomplete data, a hospital stay of < 3 days and serum and BALF were not simultaneously tested for 1,3-beta-D-glucan (BDG), and GM were excluded.

## Data Collection and Grouping

Demographic data and clinical characteristics such as clinical manifestation and acute physiology and chronic health evaluation (APACHE) score were obtained from medical records. Routine blood biochemical tests, chest CT, and serum 1,3-beta-D-glucan (BDG) and GM tests were performed on days 1 and 2 of PICU admission. For suspected patients and those with unfavorable outcomes after routine anti-infection treatment, fiberoptic bronchoscopy and alveolar lavage were performed from days 3 to 7; BALF was tested using BDG and GM tests. Chest CT was performed for all patients after 10–14 days of antifungal infection treatment . All test results and clinical data were recorded and retrospectively analyzed. Patients were divided into fungal (F) and non-fungal (NF) groups, depending on the presence or absence of fungal infection. The diagnostic criteria for fungal infection were the child had a history of cough, wheezing, and fever, pulmonary rales and sounds, no obvious improvement with antibiotic treatment, pulmonary CT showed signs of fungal infection, fungi were cultivated in blood or BALF, the G and GM tests were positive in blood or BALF, and the condition was significantly improved with antifungal treatment [21–23].

The GM test was performed to detect GM levels in serum and BALF samples using the one-step enzyme immunoassay sandwich method (Aspergillus antigen detection kit). The BDG test was mainly performed to detect BDG in serum and BALF samples using the dynamic turbidimetric method (fungal dextran detection kit). All tests were conducted following the manufacturer's instructions.

Serum GM > 0.5, BALF GM > 0.7, serum BDG > 100 pg/mL, and BALF BDG > 200 pg/mL were defined as positive values for fungal infection [9, 20].

## Results

Of the total 157 patients in the PICU, 69 were in the F group, and 88 were in the NF group. The incidence of fever (56.2 vs. 42.6%, P = 0.01), moist rales (46.2 vs. 33.0%, P < 0.01), coarse rales (71.6

vs. 55.9%, P < 0.01), shortness of breath (79.3 vs. 63.9%, P < 0.01), and sepsis (60.9 vs. 44.7%, P < 0.01) were higher in the F group than in the NF group, while wheezing rale (50.9 vs. 67.6%, P < 0.01) was lower. Furthermore, the days in the hospital and PICU were significantly increased (days in PICU: 12.80 ± 9.20 vs. 9.91 ± 6.84 days, P < 0.01; duration of hospital stay: 19.55 ± 9.29 vs. 15.93 ± 9.23 days, P < 0.01;).

**Results of the BDG and GM Tests**

The BDG and GM values of serum and BALF in the F group were significantly higher than those in the NF group. More patients in the F group had positive serum BDG and GM than in the NF group (BDG: 20.7 vs. 5.9%; GM: 11.8 vs. 4.3%; both P < 0.01). Similarly, more patients in the F group had positive BALF BDG and GM than in the NF group (BDG: 50.9 vs. 18.6%; GM: 39.1 vs. 17.0%; both P < 0.01). Fewer patients in the F group had negative serum BDG and GM than the NF group (67.5 vs. 87.8%, P < 0.01). In addition, fewer patients in the F group had negative serum and BALF BDG and GM than the NF group (20.1 vs. 62.8%, P < 0.01.

**Chest CT Imaging and Fibroscopy of Both Groups**

Chest CT imagining revealed that the F group showed a significant increase in wedge-shaped, patchy, streaky shadow and subpleural reticulation (all P < 0.05); however, halo sign, cavity, and consolidation did not significantly increase in the F group.

Pulmonary fibroscopy findings were compared between both groups . Changes in the bronchoscopy results observed in the F group could contain bronchial congestion, edema, paleness, necrosis, and bleeding. The lavage fluid could contain pus and blood and have a sticky, jelly, or foamy consistency. Tracheobronchial stenosis was more common in the F group than in the NF group (55.0 vs. 44.1%, P = 0.04). There was no significant difference in the properties of lavage fluid and tracheomalacia between the two groups.

**Conclusion**

The factors associated with fungal infections should be considered when evaluating pediatric patients. PICU pneumonia patients with fungal infection have specific clinical and laboratory features compared with those without fungal infection, including higher rates of BALF, serum BDG, GM positivity and tracheobronchial stenosis. Using antifungal therapies combined with tests like serum and BALF BDG and GM could enable a timely diagnosis of pulmonary fungal infections, possibly improving prognosis. Future prospective studies should examine the diagnosis and prognosis of PICU pneumonia patients with fungal infection.

**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. Pana ZD, Roilides E, Warris A, Groll AH, Zaoutis T. Epidemiology of invasive fungal disease in children. J. Pediatric Infect Dis Soc. (2017) 6:S3–11. doi: 10.1093/jpids/pix046
5. Wisplinghoff H, Ebbers J, Geurtz L, Stefanik D, Major Y, Edmond MB, et al. Nosocomial bloodstream infections due to Candida spp. in the USA: species distribution, clinical features and antifungal susceptibilities. Int J Antimicrob Agents. (2014) 43:78–81. doi: 10.1016/j.ijantimicag.2013.09.005

6. Jantarabenjakul W, Yodkitudomying C, Chindamporn A, Suchartlikitwong P, Anugulruengkitt S, Pancharoen C, et al. Pediatric and neonatal invasive candidiasis: species distribution and mortality rate in a Thai tertiary care hospital. Pediatr Infect Dis J. (2021) 40:96–102.
7. Wen XM, Ren N, Xu XH, Huang X. Distribution and drug resistance of pathogens causing nosocomial infections in national nosocomial infection surveillance network. J Chin Hosp Infect Sci. (2002) 16:241–4.
8. Tukhtaevna N. Z. The Relationship of Tuberculosis and Pneumonia in Children, Clinical Characteristics //INTERNATIONAL JOURNAL OF HEALTH SYSTEMS AND MEDICAL SCIENCES. – 2023. – Т. 2. – №. 5. – С. 168-172.
9. 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.
10. Mukhammadieva M. I. Improvement of primary prevention and treatment of complications with spontaneous bacterial peritonitis in patients with liver cirrhosis of viral etiology //Тиббиётда янги кун.-2023-9 (59). – 2023. – С. 247-252.
11. Jalilova A. S. et al. Approaches to Etiotropic Therapy of Covid-19 in Outpatient Patients //INTERNATIONAL JOURNAL OF HEALTH SYSTEMS AND MEDICAL SCIENCES. – 2022. – Т. 1. – №. 1. – С. 41-44.
12. Mukhammadieva Musharraf Ibrokhimovna. (2023). IMPROVING THE PREVENTION AND TREATMENT OF COMPLICATIONS OF SPONTANEOUS BACTERIAL PERITONITIS IN PATIENTS WITH LIVER CIRRHOSIS OF VIRAL ETIOLOGY. *Galaxy International Interdisciplinary Research Journal*, *11*(4), 388–394. Retrieved from https://giirj.com/index.php/giirj/article/view/5168
13. Sanokulova Sitora Avazovna. (2023). Acute Kidney Injury in Critically Ill Cirrhotic Patients with Spontaneous Bacterial Peritonitis. Texas Journal of Medical Science, 25, 65–70. Retrieved from https://zienjournals.com/index.php/tjms/article/view/4502
14. 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
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. 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.
17. 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
18. Облокулов, 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
19. 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.

20. 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
21. Aslonova.M.R. (2023). VITAMIN DEFICIENCY CASES RESULTING FROM PARASITIC DISEASES // Galaxy International Interdisciplinary Research Journal.-2023.-P. 404-409
22. 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..
23. 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).
24. 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.
25. Санокулова, Ситора Авазовна ОСОБЕННОСТИ ТЕЧЕНИЯ КОНТОГИОЗНЫХ ГЕЛЬМИНТОВ АССОЦИИРОВАННОГО С ЛЯМБЛИОЗОМ // ORIENSS. 2023. №2. URL: https://cyberleninka.ru/article/n/ocobennosti-techeniya-kontogioznyh-gelmintov-assotsiirovannogo-s-lyambliozom (дата обращения: 12.12.2023).
26. 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
27. 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.
28. Matniyova Zaynab Tukhtabayevna. (2022). Diagnosis and Treatment of Necrotizing Enterocolitis in Preterm Infants. *Indonesian Journal of Innovation Studies*, *18*. https://doi.org/10.21070/ijins.v18i.640