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Clinical Presentation and Chest CT Abnormalities in Adults with *Mycoplasma Pneumoniae* CAP During the 2023-2024 Outbreak

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Abstract

Background: The recent increase in the incidence of *Mycoplasma pneumoniae* has renewed interest in this pathogen and the range of clinical manifestations it can cause. This study aims to describe clinical and CT features of community-acquired pneumonia caused by *Mycoplasma pneumoniae* (MCAP).

Methods: We prospectively collected data on hospitalized adults with MCAP during the 2023-2024 outbreak. Clinical manifestation, laboratory data, and radiological abnormalities were evaluated. The data were analyzed using descriptive statistics.

Results: A total of 40 patients were enrolled, with a median age of 35 (22; 45) years, and 24 (60%) were male. The primary symptoms were cough (40 patients, 100%), fever (38 patients, 95%), and general weakness (35 patients, 87.5%). Laboratory tests revealed a moderate increase in C-reactive protein levels, with a median of 77.1 (37.3;123.0) mg/L. The most common radiological findings were ground-glass opacity in 36 patients (90%) and bronchial wall thickening in 33 patients (82.5%). No patients required admission to the intensive care unit, and there were no deaths during the hospital stay.

Conclusion: In our study, MCAP predominantly affected young and middle-aged adults with a favorable course and prognosis. The current outbreak requires attention in terms of using optimal diagnostic and treatment methods.

Keywords: Mycoplasma pneumoniae, Community-acquired pneumonia, Chest computed tomography

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↑What is "already known" in this topic:
During the COVID-19 pandemic, a decrease in the incidence of Mycoplasma pneumoniae infection was observed. Since 2023, an outbreak of Mycoplasma pneumoniae infection has occurred worldwide.

→What this article adds:
The radiological findings, usually described in patients with "typical" pneumonia pathogens, such as consolidation and pleural effusion, were frequently observed in our sample with Mycoplasma pneumoniae CAP.

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Introduction

Mycoplasma pneumoniae (M. pneumoniae) is one of the most frequent causative agents of community-acquired pneumonia (CAP), responsible for both sporadic incidents and outbreaks (1). During the COVID-19 pandemic, *M. pneumoniae* was rarely detected (2). However, since 2023, there has been a significant increase in the incidence of *M. pneumoniae* CAP (MCAP) in both children and adults (3, 4). Limited data was collected during this outbreak in Russia; however, Korneenko et al. describe intermediate rates of macrolide resistance and high incidence of co-infection in hospitalized children with *M. pneumoniae* pneumonia during 2023-2024 (5).

This study aimed to describe the clinical features and chest computed tomography (CT) abnormalities in a cohort of adult patients hospitalized with MCAP during the 2023-2024 outbreak.

Methods

A prospective clinical and microbiological study from July 2023 to February 2024 included patients aged 18 years and older with CAP according to national guidelines (6), who had not received systemic antibiotics for a given episode of pneumonia (administration of 1 dose of an antibiotic was allowed). Exclusion criteria were pregnancy or lactation, the presence of cystic fibrosis, tuberculosis, pulmonary embolism, lung cancer or tumor metastases in the lungs, use of injection drugs, documented immunosuppression or immunosuppressive therapy, or hospitalization for any reason within the previous 14 days. The study included patients who were treated in 6 multidisciplinary hospitals in different cities of the Russian Federation (Moscow, Irkutsk, Smolensk, Chelyabinsk, and Kotlas).

Sub-analysis included patients with polymerase chain reaction (PCR)-confirmed MCAP and available high-resolution chest CT (HRCT) scans. Demographic characteristics, symptoms, signs, laboratory abnormalities, and outcomes of MCAP were recorded. HRCT findings were analysed by an independent radiologist.

M. pneumoniae DNA was detected using real-time PCR in sputum or nasopharyngeal swabs. Additionally, sputum was sent for culture. Urinary antigen tests for *Streptococcus pneumoniae* and *Legionella pneumophila,* as well as real-time PCR for the DNA / RNA of respiratory viruses (respiratory syncytial virus (Orthopneumovirus hominis), parainfluenza viruses (Respirovirus laryngotracheitidis, Orthorubulavirus laryngotracheitidis, Respirovirus pneumoniae, Orthorubulavirus hominis), human coronaviruses (Human Coronavirus 229E, HKU1, NL63, Betacoronavirus 1), rhinoviruses (Human Rhinovirus), adenoviruses (Human Mastadenovirus), bocavirus (Bocaparvovirus primate1) and metapneumovirus (Metapneumovirus hominis), as well as influenza viruses (Alphainfluenzavirus influenza (formerly Influenza A virus) and Betainfluenzavirus influenza (formerly Influenza B virus) and SARS-CoV-2) and *Chlamydia pneumoniae,* were performed.

Other examinations and treatments were carried out according to national guidelines (6). The data were analyzed using descriptive statistics. Continuous variables were presented as medians with interquartile range (Med (Q1; Q3)), categorical variables – as absolute numbers and percentages.

Results

A total of 40 patients with MCAP who had available HRCT scans were enrolled, with a median age of 35 (22; 45) years. In six cases, co-infection was observed: in three patients, rhinovirus was identified, and SARS-CoV-2, *Streptococcus pneumoniae,* and *Staphylococcus aureus* were found once. Most of the patients were previously healthy. Cough was the most common symptom, reported by all 40 patients (100%), followed by fever in 38 patients (95%) and general weakness in 35 patients (87.5%). Detailed patient characteristics and laboratory findings are presented in Table 1.

Radiological changes in the lungs were bilateral in 15 of the 40 patients (37.5%). The most frequently detected abnormalities were ground-glass opacity (GGO) in 36 patients (90%), and bronchial wall thickening (BWT) in 32 patients (82.5%). Consolidation occurred in 28 patients (70%), tree-in-bud sign (TIB) – in 25 patients (62.5%), and lymphadenopathy – in 21 patients (52.5%). Pleural effusion was observed in 5 patients (12.5%). Combinations of different CT features usually included BWT + GGO + TIB + consolidation (35%) or BWT + GGO + consolidation (22.5%).

Antibiotics effective against *M. pneumoniae* were prescribed to 36 of the 40 patients (90%), with fluoroquinolones being most frequently used (80.6%). There were no cases of severe CAP, no admissions or transfers to the intensive care unit, and no deaths recorded during the hospital stay.

Discussion

The rapid spread of SARS-CoV-2 in 2020-2022, along with accompanying restrictive measures, led to a temporary reduction in cases caused by other respiratory pathogens (7). While most of these pathogens quickly re-emerged once distancing measures were relaxed, the resurgence of *M. pneumoniae* took longer compared to others (2, 8).

An increase in *M. pneumoniae* cases was noted in early 2023, and subsequent outbreaks of *M. pneumoniae* infection have been reported in various European countries (3, 4, 9-11).

In this study, we described a cohort of adult inpatients with CAP in whom *M. pneumoniae* was identified and HRCT scans were available for review. The data were collected as part of a prospective study aimed at investigating the etiology of CAP, which revealed an unexpectedly high rate of MCAP.

Overall, our group predominantly consisted of young individuals without comorbidities, and CAP generally had a mild and mostly uncomplicated course. This finding is consistent with data from other studies conducted during the 2023-2024 season, as well as with previously known characteristics of MCAP (1, 9, 10). However, an exception is

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Table 1. Main Characteristics of the Patients (n=40)

No.	Characteristic	Value
Demographic characteristics and comorbidities		
1	Age, years	35 [22; 45]
2	Male, n (%)	24 (60%)
3	Arterial hypertension, n (%)	5 (12.5%)
4	Coronary artery disease, n (%)	2 (5%)
5	Coinfection, n (%)	5/30* (16.7%)
Main complaints and clinical presentation of CAP		
1	Cough, n (%)	40 (100%)
2	Fever, n (%)	38 (95%)
3	General weakness, n (%)	35 (87.5%)
4	Presence of sputum, n (%)	32 (80%)
5	Chills, n (%)	26 (65%)
6	Breathlessness, n (%)	21 (52.5%)
7	Chest pain, n (%)	6 (15%)
8	Respiratory rate, min^{-1}	20 [20; 22]
9	Temperature (max), C°	39 [38.7; 39.5]
10	On-air SpO_2 at admission, %	95 [94; 96]
Laboratory findings		
1	WBC level × 10^9/L	7.5 [5.8; 10.4]
2	Lymphocyte level × 10^9/L	1.50 [1.02; 2.00]
3	CRP, mg/L	77.1 [37.3; 123.0]
Outcomes		
1	Admission/transfer to ICU, n (%)	0 (0%)
2	Discharge, n (%)	40 (100%)

Note: * Data on 30 patients are available. Coinfection details: Rhinovirus - 2/5, SARS-CoV-2 - 1/5, Streptococcus pneumoniae – 1/5, Staphylococcus aureus – 1/5.

perhaps the report by Garzoni et al., who described an increase in severe cases of MCAP among otherwise healthy adults (3). Additionally, Zayet et al. observed a trend toward a more severe course of MCAP (4).

The causes of severe *M. pneumoniae* infection are not fully understood. Potential factors include an excessive immune response to the infection, involving various cytokines, and the production of the CARDS toxin (11, 12).

In our cases, the reasons for hospital admission varied, including high persistent fever, bilateral lung infiltrates, and, in some instances, failure of antibacterial therapy. Among respiratory symptoms, cough was the most common, while dyspnea was observed in half of the cases. Chest pain was a rare finding.

In terms of laboratory findings, most patients did not show significant elevations in WBCs or lymphopenia, but there was a moderate increase in CRP levels. Similar findings have been reported by other researchers, which differ from those in previously described cohorts of adults; this discrepancy may be due to a more severe course of the disease in those studies (3, 4, 13, 14).

HRCT has become essential for diagnosing MCAP, with common imaging findings including BWT, TIB, and intralobular or lobular GGO or consolidations (15, 16). Infiltrates are most often located in the central parts of the lungs, and MCAP is characterised by an obscure or absent air-bronchogram (15, 16).

Sui et al. reported imaging data from 200 adults with MCAP (16). They found that the combination of TIB and GGO was the most prevalent finding. The simultaneous presence of TIB, GGO patterns, and the absence of an air bronchogram effectively distinguished *M. pneumoniae* from CAP of other etiologies, with a sensitivity of 87.5%, specificity of 97.5%, and accuracy of 92.5%.

According to Nakanishi et al., significant predictors of MCAP in patients aged over 15 years included the absence of peripheral predominance, BWT, lateral BWT, intralobular or lobular GGO, intralobular GGO associated with a lateral bronchus, and reduced air bronchogram in infiltrates (15).

Among our patients, the most common findings were GGO and BWT, while consolidation and TIB were less frequently observed. However, it is important to note that different types of changes were often detected simultaneously, including combinations of BWT, GGO, TIB, and consolidation.

There are several limitations to our research that should be considered. Our data were drawn from a prospective study, not specifically designed to investigate MCAP, and included only patients with available HRCT scans. This introduces potential selection bias and the possibility of missing data. Additionally, the small sample size of patients with MCAP limits the ability to extrapolate these data to a broader population, though it does reveal some trends.

Conclusion

MCAP was mostly observed in young and middle-aged adults with a favorable course and prognosis in our study sample. The most common radiological findings were GGO and BWT. Nevertheless, the findings, usually described in patients with “typical” CAP pathogens, such as consolidation and pleural effusion, were also observed in a significant number of our cases.

Authors’ Contributions

Olga Kupriushina: Methodology, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Project administration

Rifat Aynetdinov: Methodology, Investigation, Data Curation, Visualization, Writing - Review & Editing

Svetlana Rachina: Conceptualization, Methodology, Writing - Original Draft, Writing - Review & Editing,

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Supervision, Funding acquisition

Daria Strelkova: Methodology, Investigation, Data Curation, Writing - Review & Editing, Project administration, Funding acquisition

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Vladimir Antonov: Investigation, Data Curation, Writing - Review & Editing

Tatiana Yudanova: Investigation, Data Curation, Writing - Review & Editing

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Oksana Barashko: Investigation, Data Curation, Writing - Review & Editing

Olga Tigunceva: Investigation, Data Curation, Writing - Review & Editing.

Ethical Considerations

The study was approved by the Local Ethics Committee of I.M. Sechenov First Moscow State Medical University (Ethics Approval Letter No. 11-23; dated 15.06.2023)..

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Conflict of Interests

The authors declare that they have no competing interests.

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