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Clinical Aspects and Immune Status of Adult Patients with Measles After the Covid-19 Pandemic

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Abstract

Background: In recent years, Uzbekistan has faced a renewed challenge in controlling measles, with a noticeable rise in adult cases after the COVID-19 pandemic. While measles is typically regarded as a childhood disease, the infection in adults often follows a more severe course and is accompanied by frequent complications. The reduction in population immunity, combined with incomplete vaccination histories, has contributed to the re-emergence of measles among adults. Evaluating both the clinical presentation and serological immune response, particularly measles-specific IgG antibodies, is crucial for understanding current patterns of susceptibility. Objective: To describe the clinical and immunological characteristics of measles in adults in Uzbekistan during 2023–2025, with particular attention to disease severity, complications, and IgG antibody profiles. Methods: A prospective observational study was carried out at the 3rd clinic of Tashkent Me and several regional clinics. The study consisted of 187 adults aged 18–59 years with laboratory-confirmed measles. Diagnosis was based on characteristic clinical features and the detection of measles-specific IgM and IgG antibodies using enzyme-linked immunosorbent assay (ELISA). Each patient underwent a detailed clinical assessment and standard laboratory testing. IgG titers were measured at admission and again on days 10–14 to evaluate immune response and seroconversion. Results: Most patients were young adults (mean age 28.4 ± 9.7 years); 72 % reported no prior vaccination. Fever above 39 °C, cough, conjunctivitis, and generalized rash were the predominant symptoms. Complications developed in 37.9 % of patients, most often pneumonia, hepatitis, or gastrointestinal involvement. Laboratory findings commonly showed leukopenia and moderate elevation of liver enzymes. At admission, 26 % of patients had no significant measles-specific IgG, indicating susceptibility despite presumed prior exposure. Among those with paired sera, 84 % demonstrated a fourfold increase in IgG titers during convalescence, confirming an active immune response. Conclusion: Adult measles in Uzbekistan during the post-pandemic period was characterized by a moderate to severe clinical course and a high rate of complications. The detection of low IgG levels in a considerable proportion of patients highlights existing immunity gaps among adults. Incorporating IgG screening into routine epidemiological surveillance and extending vaccination programs to adults could help identify at-risk groups and strengthen measles control in the upcoming years.

Keywords: Measles; Adults; Clinical course; IgG antibodies; Immunity; Serological testing; Post-pandemic period; Complications.

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1. Introduction

Measles is one of the most contagious viral infections known to humankind. Despite the global availability of

an effective vaccine, measles continues to pose a serious public health problem, particularly in countries that experienced disruptions in vaccination programs during the COVID-19 pandemic. According to the World Health Organization [11], global measles incidence increased by more than 60 % between 2020 and 2023, reversing much of the progress achieved in the previous decade. This resurgence has been linked to decreased routine immunization coverage, vaccine hesitancy, and delayed implementation of supplementary vaccination campaigns.

Uzbekistan, which maintained elimination status for measles for several years before the pandemic, has also faced renewed outbreaks since early 2023. National surveillance data and reports from the Ministry of Health show that by late 2024, more than 20,000 laboratory-confirmed cases had been recorded nationwide, including a growing number among adults. The reappearance of adult measles reflects a broader trend observed in several post-Soviet and European countries, where immunity gaps have developed in individuals who either missed vaccination during transition years or received only a single dose of the measles-containing vaccine [1,3,10,11].

Clinicians have long recognized that measles in adults differs significantly from the disease in children. Studies from Russia and Central Asia describe a more severe and protracted course, with high fever, pronounced intoxication, and a greater frequency of complications such as pneumonia, hepatitis, and involvement of the gastrointestinal tract [1,3,5,7] . The clinical picture often includes elevated hepatic transaminases, leukopenia, and delayed recovery compared with pediatric cases [3]. Adult measles therefore represents not only an epidemiological concern but also a therapeutic challenge requiring careful clinical management.

Serological assessment plays an important role in understanding the immunity status of adults. The detection of measles-specific immunoglobulin G (IgG) antibodies is the principal marker of long-term protection. Low or absent IgG titers indicate vulnerability to infection, even in persons with a presumed history of vaccination. In Uzbekistan, where adult cases have increased in the post-pandemic years, IgG testing has become an essential tool for distinguishing primary infections from reinfections and for evaluating the effectiveness of prior immunization programs [7,11].

Given these circumstances, studying the clinical and immunological features of measles in adults is crucial for understanding the current epidemiological situation in Uzbekistan. This research aims to characterize the clinical presentation, complications, and laboratory findings of adult measles and to assess IgG antibody responses during the acute and convalescent phases of the disease. The findings are expected to provide valuable evidence for strengthening adult immunization strategies and improving measles control in the post-pandemic period.

2. Methods

Study design and setting

A prospective observational study was conducted between January 2023 and March 2025 at the Tashkent City Infectious Diseases Hospital and three regional infectious disease centers (Samarkand, Fergana, and Kashkadarya). These centers serve as the main referral hospitals for adult patients with viral exanthematous infections in Uzbekistan.

Study population

The study included 187 adult patients aged 18 to 59 years with laboratory-confirmed measles. All participants were admitted during the acute phase of illness (days 2–5 from rash onset). Inclusion criteria were: (1) age ≥18 years, (2) typical clinical features of measles, and (3) laboratory confirmation by IgM and/or PCR. Exclusion criteria included severe comorbidities (oncologic or autoimmune diseases) or incomplete clinical data.

Clinical evaluation

Each patient underwent a standardized clinical examination upon admission and during hospitalization. Data collected included demographic information, vaccination history (based on medical records or patient report), duration of fever, rash characteristics, and presence of complications. Disease severity was assessed according to the National Clinical Guidelines for Measles (Uzbekistan, 2021):

- Mild form: short febrile period, minimal intoxication, no complications;
- Moderate form: fever above 38.5 °C, moderate intoxication, catarrhal symptoms, and typical rash;
- Severe form: high fever (>39.5 °C), pronounced intoxication, extensive rash, and one or more systemic

complications.

Complications were categorized as respiratory (pneumonia, bronchitis), hepatic (transaminase elevation, hepatitis), gastrointestinal, or neurological (encephalitis, meningitis).

Laboratory testing

Serological testing

All patients underwent serological testing for measles-specific IgM and IgG antibodies using enzyme-linked immunosorbent assay (ELISA) kits (Vector-Best, Novosibirsk, Russia).

- IgM antibodies were used to confirm acute infection.
- IgG antibodies were measured to assess prior immunity and seroconversion during recovery.

Paired serum samples were collected at admission (day 1–3) and days 10–14 of illness. A fourfold or greater increase in IgG titer between the two samples was interpreted as evidence of active immune response. Patients without detectable IgG at admission were classified as immunologically susceptible.

Routine laboratory tests

All patients underwent a standard laboratory panel, including:

- Complete blood count (CBC) with leukocyte differential,
- Liver function tests (ALT, AST, total bilirubin),
- C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR).

Additional imaging (chest X-ray, abdominal ultrasound) was performed when clinically indicated to assess complications.

Data analysis

Clinical and laboratory data were entered into a secure database and analyzed using SPSS Statistics version 26.0 (IBM Corp.) and Microsoft Excel 2021. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR). Categorical variables were presented as frequencies and percentages. Differences between groups were evaluated using the Chi-square (χ^2) test or Student's t-test as appropriate, with a significance threshold of $p < 0.05$.

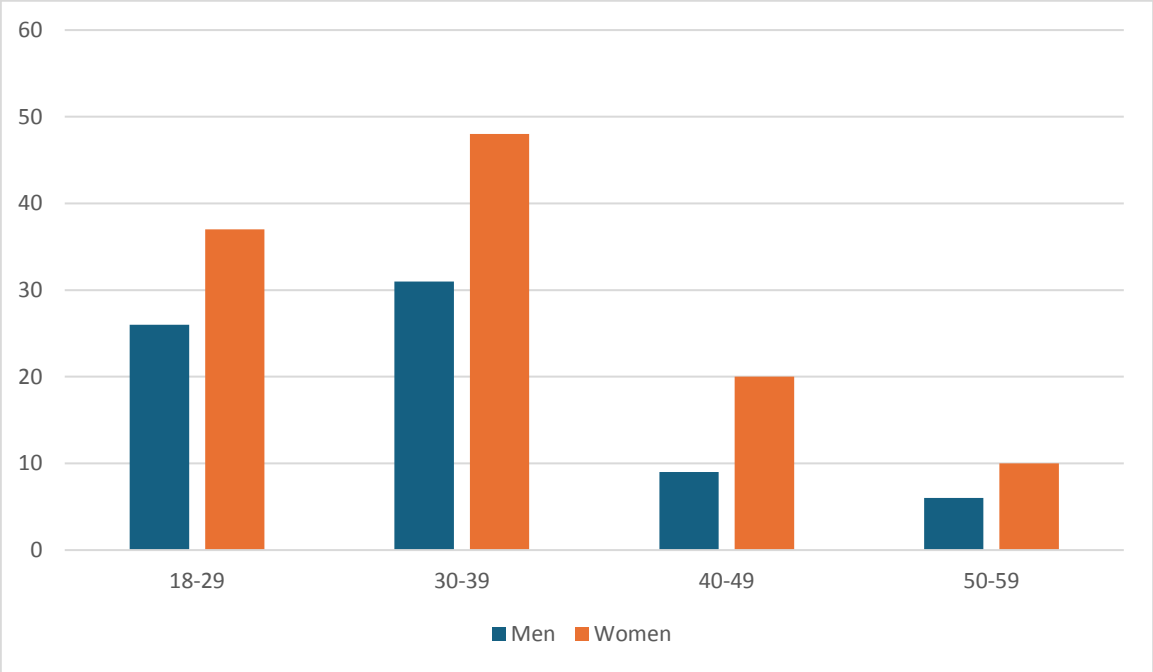
Ethical considerations

The study was conducted in accordance with the Helsinki Declaration (2013 revision). Written informed consent was obtained from all participants before enrollment. All personal identifiers were removed prior to data analysis to ensure confidentiality.

3. Results

General characteristics of the patients

A total of 187 adult patients with laboratory-confirmed measles were included in the study. The mean age of the participants was 28.4 ± 9.7 years (range 18–59), and 61.5 % were female. (See Picture 1.) Nearly three-quarters of patients (72 %) reported no prior measles vaccination, while 18 % had documentation of one vaccine dose, and only 10 % had received two doses. In most cases, the source of infection was traced to household contacts or healthcare settings. The median duration of hospitalization was 9 days (interquartile range 7–12 days).



Picture 1. Age and sex-distributions among patients.

Clinical manifestations

Fever above 39 °C was observed in all patients and persisted for an average of 5.2 ± 1.4 days. Catarrhal symptoms were common: cough (92.5 %), coryza (87.7 %), and conjunctivitis (78.1 %). Koplik spots were noted in 64 % of cases. The characteristic maculopapular rash appeared on average on day 4.1 ± 0.8 of illness, spreading from the face to the trunk and limbs.

According to disease severity, 102 patients (54.5 %) had moderate forms, 52 (27.8 %) had mild forms, and 33 (17.6 %) developed severe measles. Severe disease was most frequently observed among unvaccinated individuals and those over 30 years of age ($p < 0.05$).

Complications

Complications were recorded in 71 patients (37.9 %). The most frequent were:

- Pneumonia – 35 cases (18.7 %),
- Hepatitis – 16 cases (8.6 %),
- Gastrointestinal involvement – 8 cases (4.3 %),
- Neurological complications (meningitis or encephalitis) – 2 cases (1.1 %).

Mild transaminase elevation (ALT, AST) was found in 41 % of patients, and leukopenia (<3.5 × 10^9/L) in 38 %. Severe complications were significantly more common in unvaccinated adults (RR = 1.9; 95 % CI: 1.4–2.7). No fatalities were recorded during the study period.

Serological findings

All patients tested positive for measles-specific IgM antibodies, confirming acute infection. At the time of admission, 138 patients (73.8 %) also had detectable IgG antibodies, while 49 patients (26.2 %) were IgG-negative. The absence of IgG was most frequent among younger adults (18–29 years) and those without prior vaccination records.

Paired serum samples were obtained from 112 patients (59.9 %) to evaluate IgG dynamics. A fourfold or greater rise in IgG titers between the acute and convalescent phases was observed in 94 patients (83.9 %), indicating an active immune response. In 18 patients (16.1 %), IgG levels remained unchanged, suggesting possible secondary immune response or reinfection.

Laboratory indicators

Laboratory analyses revealed characteristic patterns associated with viral infection and systemic

inflammation. The mean leukocyte count was 3.8 ± 1.1 × 10^9/L, and lymphocytes averaged 45.2 ± 9.8 %. C-reactive protein levels were elevated (>10 mg/L) in 63 patients (33.7 %).

Liver function tests showed ALT elevation in 30.4 % and AST elevation in 28.8 % of patients, more often in severe cases. Electrolyte disturbances and mild hyperbilirubinemia were recorded in isolated cases.

Correlation between immunity and disease severity

Patients who were IgG-negative at admission developed more severe clinical forms of measles (RR = 2.3; 95 % CI: 1.5–3.6; $p < 0.01$) and had a higher frequency of complications (52.9 % vs. 29.7 % among IgG-positive individuals). Conversely, vaccinated adults or those with baseline IgG antibodies tended to experience milder disease and shorter hospitalization periods.

4. Discussion

The findings of this study demonstrate that adult measles in Uzbekistan during the post-pandemic period was characterized by a moderate to severe course, a high frequency of complications, and notable immunity gaps identified through IgG testing. These results confirm a shifting epidemiological pattern in which adults, rather than children, represent a significant proportion of measles cases.

Epidemiological and clinical patterns

The predominance of adult cases observed in our study reflects a regional and global trend noted over the past decade. Similar findings were described by Basina et al. (2021) and Ivanova et al. (2018) in the Russian Federation, where adults now constitute up to half of all reported measles cases [1,3] . This shift is attributed to waning immunity in those who received only one dose of measles vaccine during childhood and to incomplete vaccination among individuals born in the transition period following the introduction of the two-dose schedule.

Clinically, the disease in adults was more severe than in children. In our cohort, almost 18 % of cases were classified as severe, and 38 % of patients experienced complications, mainly pneumonia and hepatitis. These data are consistent with the studies of Rakhmatullaeva and Okhunjonova [7] and Khudoydodova et al. [11] , who also reported frequent pulmonary and hepatic involvement in adult measles patients in Uzbekistan. The high incidence of hepatitis and elevated transaminases in our study suggests that measles virus replication and immune-mediated liver injury may play a role in disease pathogenesis, as previously discussed by Basina et al. [1].

Immunological findings and IgG dynamics

A key feature of our research was the use of measles-specific IgG antibody detection to assess immune status. Approximately one-quarter of adults in the study were IgG-negative at admission, indicating susceptibility to infection. This finding underscores the persistence of immunity gaps in the adult population despite high national coverage among children. Comparable results were described by Rakhmatullaeva [7], who reported a similar proportion of IgG-negative adults among hospitalized measles cases in Tashkent.

Paired serum analysis showed a fourfold or greater rise in IgG titers in 84 % of patients, confirming active infection and adequate immune response. However, 16 % of adults exhibited little or no increase in antibody levels, possibly reflecting reinfection in previously vaccinated individuals. This observation aligns with WHO reports describing secondary immune responses in adults exposed to the virus years after vaccination [2,4,11] . Such cases often present with milder symptoms and shorter rash duration, which corresponds to our data showing less severe forms in IgG-positive patients.

The correlation between IgG status and disease severity found in this study is also important. Adults without detectable IgG at admission had significantly higher rates of complications and longer hospital stays, confirming the protective role of pre-existing antibodies. Routine monitoring of IgG levels among healthcare workers, students, and high-risk adults could therefore provide valuable information for targeted vaccination campaigns.

Impact of the pandemic and vaccination strategies

The increase in adult measles observed after 2023 likely reflects the combined effects of pandemic-related disruptions to healthcare services and growing vaccine hesitancy. During 2020–2021, many planned immunization activities were postponed, leading to missed doses in both children and young adults. In addition, misinformation regarding vaccines — initially associated with COVID-19 — has contributed to reduced confidence in immunization programs worldwide [2,9,10] . Uzbekistan's experience mirrors these challenges: despite the restoration of routine vaccination

services, immunity gaps among adults persist.

To address this issue, several strategies are recommended. First, periodic serological surveys using IgG testing can identify population groups at risk of infection. Second, catch-up campaigns targeting adults aged 20–40 years should be considered, especially among healthcare and educational workers. Third, improved public health communication is needed to counter misinformation and reinforce the safety and necessity of vaccination.

Comparison with other regional data

When compared with studies from neighboring regions, the clinical profile observed in Uzbekistan is largely consistent with the broader epidemiological situation in Central Asia and Eastern Europe. Khudoydodova et al. [5,8] reported that adult measles in Uzbekistan frequently involved the digestive system, while Basina et al. [1,9] described similar trends in Russia. The high complication rate, particularly pneumonia and hepatitis, suggests that adult measles is not only an epidemiological concern but also a significant clinical problem that can strain healthcare resources.

Limitations

This study has some limitations. It was hospital-based, and therefore the results may overrepresent moderate and severe cases while underestimating milder infections managed at home. Socioeconomic and behavioral factors influencing vaccination status were not analyzed. Despite these limitations, the study provides valuable insight into the clinical and immunological characteristics of adult measles in Uzbekistan and underscores the importance of serological monitoring.

Public health implications

Our findings emphasize that measles control strategies should extend beyond childhood vaccination. Adults with waning immunity or incomplete vaccination histories represent a growing reservoir for transmission. Routine IgG antibody testing can serve as a practical tool for identifying susceptible populations, particularly in healthcare and educational institutions. Strengthening adult immunization programs and integrating serological surveillance into national epidemiological monitoring will be crucial for preventing future outbreaks and sustaining measles elimination in Uzbekistan.

5. Conclusion

This study demonstrates that adult measles in Uzbekistan during the post-pandemic period was characterized by a predominantly moderate to severe clinical course, a high rate of complications, and clear evidence of immunity gaps among adults. The absence of measles-specific IgG antibodies in more than one-quarter of patients indicates that a significant segment of the adult population remains susceptible to infection despite long-standing vaccination programs.

Serological monitoring confirmed that IgG testing is a valuable tool for assessing population immunity and for distinguishing between primary and secondary infections. The observed association between negative IgG status and disease severity highlights the need to identify and immunize susceptible adults, particularly those born during transitional vaccination periods or working in high-risk professions.

To sustain measles elimination in Uzbekistan, vaccination strategies should expand beyond the pediatric focus to include targeted adult immunization, periodic serological surveys, and continuous public awareness initiatives. Integrating IgG antibody testing into routine surveillance and strengthening communication between healthcare providers and communities will be essential to prevent future outbreaks and ensure durable population immunity.

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