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**ТИББИЁТДА ЯНГИ КУН
НОВЫЙ ДЕНЬ В МЕДИЦИНЕ
NEW DAY IN MEDICINE**

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MODERN LABORATORY CHARACTERISTICS OF INFECTIOUS MONONUCLEOSIS CAUSED BY EPSTEIN-BARR VIRUS AND CYTOMEGALOVIRUS

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✓ Resume

Infectious mononucleosis (IM), primarily caused by Epstein-Barr virus (EBV) and less frequently by cytomegalovirus (CMV), remains a significant clinical and diagnostic challenge, especially in pediatric populations. This study aims to highlight the modern laboratory features that distinguish IM caused by EBV and CMV, emphasizing diagnostic accuracy and early differentiation. A combined retrospective and prospective analysis was conducted on 320 children with IM. Clinical and laboratory markers were evaluated, including hematological parameters, enzyme-linked immunosorbent assay (ELISA) for viral antigens, and polymerase chain reaction (PCR) for viral DNA detection. The presence of atypical mononuclear cells, elevated liver enzymes, and specific viral serology patterns allowed for reliable differentiation between EBV and CMV etiologies. EBV-related IM showed a higher incidence of lymphocytosis, atypical monocytes, and splenomegaly, whereas CMV-related cases were more frequently associated with mild or subclinical presentations and less pronounced hematological abnormalities

Key words: IM, CMV-infections, PCR, Elisa, immunological test, Epstein-Barr virus

EPSTEIN-BARR VIRUSI VA SITOMEGALOVIRUS CELTIRIBUS CHIKARADIGAN YUQUMLI MONONUKLYOZ ZAMONAVIY LABORATORIYA XUSUSIYATLARI

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✓ Rezyume

Infeksion mononukleoz (IM) asosan Epstein-Barr virusi (EBV) va kamroq hollarda sitomegalovirus (CMV) tomonidan chaqiriladi va ayniqsa bolalar orasida klinik va diagnostik jihatdan muhim muammo bo'lib qolmoqda. Ushbu tadqiqot EBV va CMV sababli yuzaga kelgan IM ni zamonaviy laborator tahlillar asosida farqlash imkoniyatlarini o'rganishga qaratilgan. 120 nafar bolada retrospektiv va prospektiv tahlil o'tkazilib, gematologik ko'rsatkichlar, ELISA usulida virus antigenlari va PCR orqali virus DNKsi aniqlangan. EBV bilan bog'liq holatlarda limfositoz, atipik mononuklear hujayralar va splenomegaliya ko'proq uchragan bo'lsa, CMV bilan bog'liq holatlar yengil yoki belgisiz kechgan. Tadqiqot natijalari shuni ko'rsatdiki, zamonaviy serologik va molekulyar usullarning birgalikda qo'llanilishi IM etiologiyasini aniq aniqlashga, to'g'ri davolashga va asoratlar xavfini kamaytirishga xizmat qiladi

Kalit so'zlar: IM, CMV-infeksiyalari, PZR, Eliza, immunologik test, Epshtein-Barr virusi

СОВРЕМЕННАЯ ЛАБОРАТОРНАЯ ХАРАКТЕРИСТИКА ИНФЕКЦИОННОГО МОНОНУКЛЕОЗА, ВЫЗВАННОГО ВИРУСОМ ЭПШТЕЙНА-БАРР И ЦИТОМЕГАЛОВИРУСОМ

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✓ **Резюме**

Инфекционный мононуклеоз (ИМ), в первую очередь вызываемый вирусом Эпштейна-Барр (ВЭБ) и реже цитомегаловирусом (ЦМВ), остается значительной клинической и диагностической проблемой, особенно в педиатрической популяции. Целью данного исследования является выявление современных лабораторных признаков, которые отличают ИМ, вызываемый ВЭБ и ЦМВ, подчеркивая диагностическую точность и раннюю дифференциацию. Был проведен комбинированный ретроспективный и проспективный анализ 320 детей с ИМ. Оценивались клинические и лабораторные маркеры, включая гематологические параметры, иммуноферментный анализ (ИФА) на вирусные антигены и полимеразную цепную реакцию (ПЦР) для обнаружения вирусной ДНК. Наличие атипичных мононуклеарных клеток, повышенных печеночных ферментов и специфических вирусных серологических паттернов позволило надежно дифференцировать этиологии ВЭБ и ЦМВ. ИМ, связанный с ВЭБ, показал более высокую частоту лимфоцитоза, атипичных моноцитов и спленомегалии, тогда как случаи, связанные с ЦМВ, чаще были связаны с легкими или субклиническими проявлениями и менее выраженными гематологическими отклонениями

Ключевые слова: ИМ, ЦМВ-инфекции, ПЦР, ИФА, иммунологический тест, вирус Эпштейна-Барр

Relevance

Infectious mononucleosis is a globally prevalent disease, most commonly caused by the γ -herpesvirus Epstein-Barr virus (EBV), which affects approximately 80–90% of the population. In recent years, the incidence of infectious mononucleosis has increased, particularly among children [1–2]. This trend is partly attributed to insufficient advancements in diagnostic techniques [3]. According to official data, between 2000 and 2019, the incidence of EBV infection in Novokuznetsk rose 27-fold—from 0.9 cases per 100,000 population in 2000 to 24.7 in 2008 [4]. A high infection rate is also observed in Uzbekistan, where the incidence is 7.5 per 100,000 in the general population and up to 34 per 100,000 among children [5].

Researchers emphasize that the Epstein-Barr virus and its frequent manifestation as infectious mononucleosis hold a unique position among herpesviruses [6]. It has been demonstrated that EBV possesses multiple immunosuppressive mechanisms, allowing it to evade host immune responses. During infection, immune dysfunction becomes more pronounced, promoting the persistence of chronic viral infections. The virus impairs the immune response by halting natural interferon production and disrupting apoptosis pathways, thereby contributing to secondary immunodeficiency. EBV is also implicated in the development of autoimmune and neoplastic processes in genetically susceptible individuals [7].

Materials and methods

The clinical presentation of infectious mononucleosis in children is highly variable, complicating timely and accurate diagnosis and posing challenges for differential diagnosis. Misdiagnosis rates at the prehospital stage range from 40% to 90%, especially in young children. The development of more efficient diagnostic tools—such as enzyme-linked immunosorbent assays (ELISA) to detect viral antigens, and molecular techniques like polymerase chain reaction (PCR), which offer high sensitivity and specificity for detecting viral DNA in biological samples—has improved disease identification. Given the role of multiple pathogens and the complexity of infectious mononucleosis caused by EBV, there is a growing need to study the clinical features, diagnostic approaches, and immunopathogenesis of advanced cases [8]. This understanding is essential for developing pathogenetically justified treatment strategies.

Results and discussions

Study of laboratory characteristics of infectious mononucleosis caused by Epstein-Barr virus and cytomegalovirus.

Research materials and methods:

1. Clinical analyzes (general analyzes of blood, urine and feces);
2. Serological - immuno enzyme analysis (IFT) diagnostics;

3. Statistical processing.

According to the results of the study, 200 children with infectious mononucleosis were retrospectively analyzed, and 120 of them were prospectively analyzed, and all of them formed the main group of our study. 59 (49.1%) of our main group were children living in rural areas.

Figure 1 present the distribution of children under control, taking into account age and gender. 65% of the examined were boys, 35% were girls.

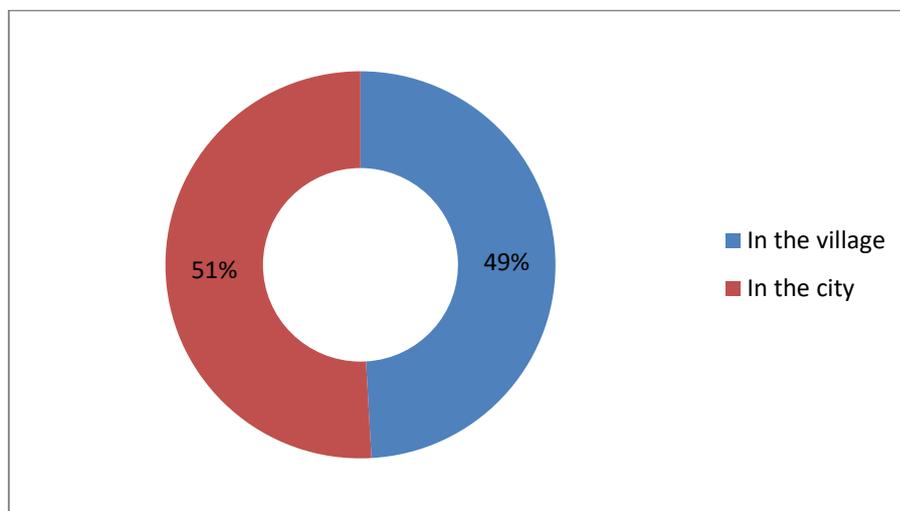


Figure 1

Classification of children in the examined group according to residence

According to the study results, 200 children with infectious mononucleosis were retrospectively analyzed, while 120 children were prospectively examined. All participants formed the main cohort of this study. Among them, 59 children (49.1%) resided in rural areas, and 61 children (50.9%) lived in urban areas.

To assess age-related patterns, the 120 prospectively observed children were divided into three subgroups:

- Subgroup 1 included 34 children (28.3%) aged 3 to 7 years,
- Subgroup 2 included 70 children (58.3%) aged 8 to 12 years,
- Subgroup 3 included 16 children (13.4%) aged 13 to 18 years.

It is notable that across all age groups, boys consistently outnumbered girls. The biological basis for this pattern remains unclear, and may be related to sex-specific physiological characteristics that require further investigation. The highest proportion of cases was found among children aged 8 to 12 years, accounting for 58.3% of the study population (see Fig. 1). This could be explained by the anatomical, physiological, pathomorphological, and immunological characteristics specific to children in this age group affected by infectious mononucleosis.

Clinical analysis conducted between days 4 and 10 of illness revealed that 108 children (90%) exhibited a body temperature between 38.0–38.5°C. The fever was typically persistent (monotonic) and lasted an average of 7.7 ± 1.3 days, regardless of antipyretic use. In 53 children (52.0% \pm 4.8%), a second wave of fever was observed on the 9th–10th day of illness. Facial and eyelid edema persisted in only 12 children (10%), while nasal breathing difficulties were identified in 70% of cases. In 39 patients (32.5%), purulent exudates were observed in the tonsillar region, though with diminished symptoms of tonsillitis.

Based on the total cohort analysis, most patients were between the ages of 1 and 7 years—73.1% (79 children). Patients aged 7 to 18 years comprised 21.3% (23 children), while 3.7% (4 children) were under one year old, and 1.8% (2 individuals) were adults.

Early hospitalization was recorded in 44.4% of patients within the first three days of symptom onset, 41% between days 4 and 7, and 13.9% between days 8 and 24. A history of fever ranging from subfebrile to 40°C was documented in nearly all cases. Common complaints included nasal congestion, rhinorrhea,

cough, sore throat, headache, and cervical lymphadenopathy in various combinations. In the prehospital phase, 12 children presented with rash, 9 with diarrhea, 8 with vomiting, 3 with abdominal pain, and 2 with signs of meningeal irritation.

Only 5 patients (4.6%) were referred to the hospital with a confirmed or suspected diagnosis of infectious mononucleosis. The remaining children were often misdiagnosed with conditions such as “acute respiratory viral infection,” “tonsillitis,” “intestinal infection of unknown etiology,” or “meningitis.”

These findings suggest that relying solely on clinical presentation for diagnosing infectious mononucleosis is insufficient. More accurate diagnostic tools and improved strategies for early detection and primary prevention are urgently needed.

Conclusion

Thus, the early stages of infectious mononucleosis were marked by fever and systemic intoxication, pronounced oropharyngeal involvement in the form of tonsillitis and nasal breathing difficulties, as well as hepatosplenomegaly. These clinical features enabled the presumptive diagnosis of the disease during its initial phase. Hyperthermia persisted throughout the course of the illness, while signs of tonsillitis gradually diminished. However, hepatomegaly tended to worsen. Hematological analysis revealed elevated erythrocyte sedimentation rate (ESR), leukocytosis, lymphocytosis, and the presence of atypical mononuclear cells—reaching up to 52% in some cases. Complications were observed in 27.4% of the patients.

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