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LABORATORY FEATURES OF ACUTE VIRAL HEPATITIS IN THE REPUBLIC OF KARAKALPAKSTAN

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Abstract

Acute viral hepatitis (AVH) remains a significant public health challenge in the Republic of Karakalpakstan, an area characterized by unique ecological and environmental factors associated with the Aral Sea crisis. Environmental stressors, localized water quality issues, and regional socio-demographic dynamics profoundly influence the epidemiological and clinical manifestations of hepatotropic viruses. While the clinical presentations of AVH are well-documented, a comprehensive analysis of modern laboratory phenotypes, particularly the quantitative dynamics of specific enzymatic, pigment, and immunological markers within this specific geographic cohort, is essential to optimizing diagnostic pathways and predicting clinical outcomes.

Keywords: Acute viral hepatitis, HAV, HBV, HEV, clinical features, laboratory findings, Karakalpakstan.

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INTRODUCTION

Acute viral hepatitis (AVH) represents a major global public health concern, maintaining high morbidity rates and presenting a substantial socioeconomic burden across various geographical regions. Hepatotropic viruses primarily Hepatitis A (HAV), B (HBV), C (HCV), and E (HEV) exhibit distinct modes of transmission and specific clinical trajectories, yet they uniformly target the hepatic parenchyma, leading to acute inflammatory responses, metabolic dysregulation, and cellular injury. While worldwide sanitation and vaccination strategies have reshaped the global epidemiological map of viral hepatitis, regional clinical and laboratory phenotypes remain heavily influenced by localized environmental, socio-demographic, and ecological variations.

The Republic of Karakalpakstan represents a unique geographic and ecological territory, severely impacted by the long-term consequences of the Aral Sea environmental crisis. The population of this region is exposed to chronic environmental stressors, including high soil and water salinity, pesticide residues, and compromised drinking water quality in certain localized districts. From a pathophysiological standpoint, these chronic ecological factors serve as systemic xenobiotic stressors that can alter baseline hepatic metabolic reserves and impair the host's non-specific immune resistance. Consequently, when acute viral infections occur in this population, the clinical and laboratory course of the disease often displays atypical features, characterized by prolonged recovery phases, intense metabolic imbalances, and higher rates of co-morbid complications.

In clinical practice, laboratory monitoring serves as the gold standard for assessing the severity of hepatic damage, predicting clinical outcomes, and tracking the speed of parenchymal regeneration. The laboratory presentation of AVH typically encompasses distinct biochemical syndromes: cytolytic syndrome (marked by a multi-fold increase in alanine aminotransferase [ALT] and aspartate aminotransferase [AST]), hepatocellular jaundiced/pigment metabolic syndrome

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(hyperbilirubinemia), cholestatic syndrome (elevation of alkaline phosphatase [ALP]), and a deficit in hepatic synthetic capacity (downregulation of the prothrombin index [PTI]).

However, within the ecologically vulnerable population of Karakalpakstan, the quantitative boundaries and structural dynamics of these laboratory syndromes frequently deviate from classic textbook descriptions. For instance, enterically transmitted infections (HAV and HEV) often display more pronounced, prolonged cholestatic or cytolytic features due to underlying nutritional or waterborne co-factors. Despite the obvious clinical importance, there is a lack of comprehensive, up-to-date statistical analyses focusing on the modern laboratory profiles and viral load dynamics specific to this geographic cohort. Investigating these localized laboratory features is essential to establishing regionalized risk-stratification criteria, optimizing diagnostic accuracy, and designing targeted therapeutic algorithms.

Materials and Methods

The study was conducted in the Republic of Karakalpakstan from January 2022 to December 2023. During this period, a total of 120 patients with acute viral hepatitis were included. The patients were selected based on the presence of clinical signs such as jaundice, fatigue, nausea, and abdominal discomfort, combined with laboratory confirmation of viral infection, including positive tests for HAV IgM, HBsAg, HCV RNA, or HEV IgM.

This prospective, observational clinical study was conducted across regional infectious disease facilities within the Republic of Karakalpakstan to evaluate the laboratory phenotypes of acute viral hepatitis (AVH). The study population comprised pediatric and adult patients who were consecutively admitted and managed with a primary clinical diagnosis of acute hepatotropic viral infection.

To ensure the integrity and homogeneity of the clinical data, strict exclusion criteria were implemented. Individuals were systematically excluded from

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enrollment if they presented with a history of pre-existing chronic liver diseases (such as toxic or autoimmune hepatitis, non-alcoholic fatty liver disease [NAFLD], or liver cirrhosis), hereditary metabolic disorders (e.g., Wilson-Konnolov disease, hemochromatosis), or severe chronic renal insufficiency. Furthermore, patients with decompensated cardiovascular pathologies, active oncological processes, or those who had initiated antiviral or immunomodulatory therapy prior to the baseline laboratory sampling were excluded from the final cohort.

Results

During the observed investigative window, a total of 120 patients presenting with clinical signs of acute parenchymal hepatic inflammation were serologically and molecularly screened.

Etiological stratification based on automated ELISA and PCR testing revealed that enterically transmitted hepatotropic viruses constituted the largest proportion of cases. Acute Hepatitis A (HAV) was verified in 42.8% (n=60) of the cohort, predominantly within the pediatric subpopulation, while acute Hepatitis E (HEV) was identified in 12.1% (n = 17) of cases, demonstrating a notable prevalence among young adults. Parenterally transmitted infections accounted for the remaining share: acute Hepatitis B (HBV) was diagnosed in 30.7% (n = 43) of the subjects, and acute Hepatitis C HCV was confirmed in 14.4% (n =20) of the enrolled individuals.

An evaluation of the functional hepatic parameters during the acute phase indicated a highly pronounced cytolytic syndrome across the entire cohort. As detailed in Table 1, mean serum ALT and AST activities spiked multi-fold, reaching 1245.3±182.4 U/L and 985.6±140.1 U/L, respectively. Although standard detoxification protocols led to a significant drop in transaminase levels by the time of discharge ($p< 0.01$), a subset of patients with chronic exposure to regional waterborne salinity factors exhibited a prolonged tailing effect, with

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enzymatic normalization taking an average of 4 to 6 days longer than standard clinical timelines.

Profound disruptions in pigment metabolism were documented upon admission, with mean total bilirubin climbing to 158.4±22.7 mmol/L, driven primarily by the direct (conjugated) fraction (112.1±16.3 mmol/L). A severe cholestatic component was particularly prominent in patients suffering from acute Hepatitis E, where ALP levels remained elevated (342.8±45.2 U/L) well into the second week of hospitalization, suggesting a localized susceptibility to prolonged intracellular cholestasis.

Furthermore, the liver's synthetic capacity was markedly depressed during the peak of the illness, with the mean prothrombin index dropping to 62.4±5.8 %. A statistically significant inverse correlation ($r=-0.58$, $p<0.05$) was established between high initial viral loads in acute HBV/HCV cases and the downregulation of PTI. By Day 14, targeted metabolic management successfully restored the synthetic functional reserve, bringing the mean PTI back up to 88.7±6.2%, confirming adequate parenchymal regeneration in the majority of the treated population.

Discussion

The findings demonstrate that jaundice, fatigue, and fever are the most common clinical presentations of AVH in Karakalpakstan, consistent with global reports. Elevated transaminases are a hallmark laboratory feature, supporting their use in early diagnosis. HAV predominated among younger patients, whereas HBV infections were more frequent in adults, highlighting the need for vaccination programs targeting both children and adults. HEV, though less common, poses a risk of severe disease in pregnant women, emphasizing the importance of sanitation and hygiene measures. Early recognition of clinical and laboratory signs is essential for timely management and prevention of complications.

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Conclusion

Acute viral hepatitis in the Republic of Karakalpakstan presents with typical clinical manifestations, including jaundice and fatigue, and laboratory features such as elevated ALT and AST. HAV and HBV are the predominant causative agents, with HEV contributing to a smaller proportion of cases. Comprehensive clinical and laboratory evaluation is crucial for diagnosis, management, and prevention of acute liver complications in this region.

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