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An Occurrence and Character of Haematological Factors and Liver Enzymes in Diagnosis of Dengue Infection

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Abstract

Introduction: Dengue the most common viral illness spread by the bite of mosquitoe, is an acute infectious disease caused by four serotypes of the dengue virus. Dengue disease is found in tropical and subtropical regions of the world. Early detection of dengue infection during the fever stage is critical for determining optimal treatment.

Aim: The aim of our study was to assess the prevalence of hepatic dysfunction in patients with dengue and to correlate between the severity of the disease with the extent of hepatic dysfunction.

Material and Methodology: This is Cross-sectional observational study including 100 patients with confirmed dengue serology admitted**.** All the samples received in the lab were tested for NS1 antigen using an enzyme-linked immunosorbent assay.

Results: Serum glutamic-oxaloacetic transaminase and serum glutamic-pyruvic transaminase levels negatively correlated with platelet count ($p<0.0001$). Thrombocytopenia was common in positive cases and significantly higher levels of ALT, AST, and hematocrit was also seen among them.

Conclusion: Effective and prompt diagnosis is required for the treatment of the disease. Declining platelet counts, deranged liver enzymes and increasing hematocrit levels are linked to warning indications of dengue fever and, consequently, to the severity of the infection. Therefore, the severity of dengue can be predicted by closely monitoring the laboratory parameters of the patients.

Keywords: Dengue Fever, Hepatic Dysfunction, Serum glutamic.

Introduction

Dengue fever (DF), an arbovirus disease, is a major global health threat, affecting millions of people each year. Dengue fever has increased substantially in recent decades, with an estimated 390 million illnesses occurring globally each year. Dengue viruses (DENV) are classified into four serotypes (DENV-1 to DENV-4), each with its own set of characteristics that add to the complexities of disease manifestation and management. The virus is transmitted to people via the bite of infected Aedes mosquitos, specifically Aedes aegypti and, to a lesser extent, Aedes albopictus. The clinical signs of dengue fever (DF), vary from mild flu-like symptoms to severe and potentially fatal dengue shock syndrome (DSS) and dengue hemorrhagic fever.

Within the intricate landscape of DENV infection, the NS1 antigen appears as a pivotal player, holding significant importance in both the pathogenesis of the disease and its diagnosis. In situations of severe dengue, it can trigger the creation of pro-inflammatory cytokines and chemokines, which can lead to a cytokine storm. Moreover, vascular leakage and organ dysfunction may be made worse by NS1-mediated endothelial cell activation and apoptosis. The DENV genome encodes NS1, a non-structural protein that infected cells release as a soluble hexameric lipoprotein. By interfering with complement activation, endothelial barrier integrity, and cytokine production, NS1 helps viruses evade the immune system. Accurate and timely diagnosis of dengue fever is essential for timely clinical intervention and effective management of the outbreak. Dengue diagnosis has been transformed by NS1 antigen detection assays, which provide a quick and accurate way to identify acute DENV infection.

These tests, which are based on lateral flow immunoassays or enzyme-linked immunosorbent assays (ELISA), identify the presence of the NS1 antigen in patient serum or plasma during the first few days after symptom onset, even before dengue-specific antibodies emerge.

Materials and Methods

Study design and participants

This is Cross-sectional observational study including 100 patients with confirmed dengue serology admitted**.** All the samples received in the lab were tested for NS1 antigen using an enzyme-linked immunosorbent assay.

Methodology

All blood samples were received in the serology section of Microbiology lab in plain vial and serum separated after centrifugation.

Statistical analysis

The data was collected and entered into MS Excel, and the statistical analysis was performed using the SPSS software 2022 version for Windows. A p- value of ($p<0.0001$). was considered significant.

Results

A total of 8772 samples were received in the lab in both the seasons (2022 and 2023), 1426 samples tested positive for NS1 Ag. The incidence rate of dengue in the study population came out to be 16.2% (n= 1426/8772) inclusive of both the seasons.

Out of total positive cases males (58.9%, n= 841/1426) outnumbered females (41%, n= 585/1426) as shown in fig 1. The mean age of patients positive for dengue was 27.5 with youngest being one-year-old and oldest being 97 years of age. However, gender came out to be statistically insignificant with a p-value of 0.059.

All the confirmed NS1 positive cases presented with fever. Musculoskeletal manifestations like arthralgia (95.5%, n= 1326/1426) headache (85.8%, n= 1224/1426), retro-orbital pain (78.6%, n= 1121/1426) and myalgia (76.5%, n= 1091/1426) were seen in majority of the cases followed by gastrointestinal manifestations like vomiting (48.8%, n= 696/1426), abdominal pain (55.6%, n= 793/1426), and cutaneous manifestations like rash which was seen in 57.2% (n= 816/1426) of cases.

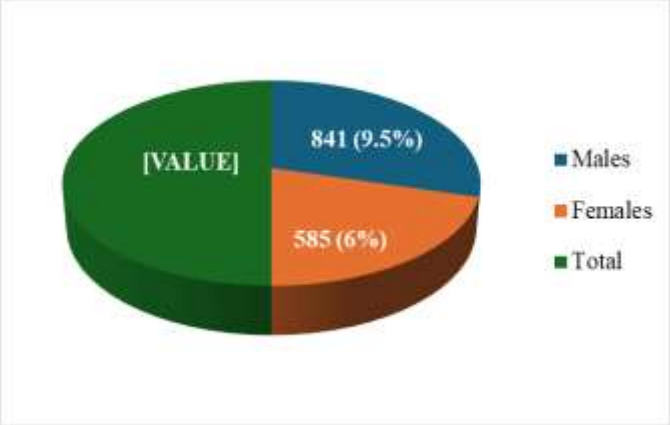

Fig 1: Gender wise distribution of positive cases

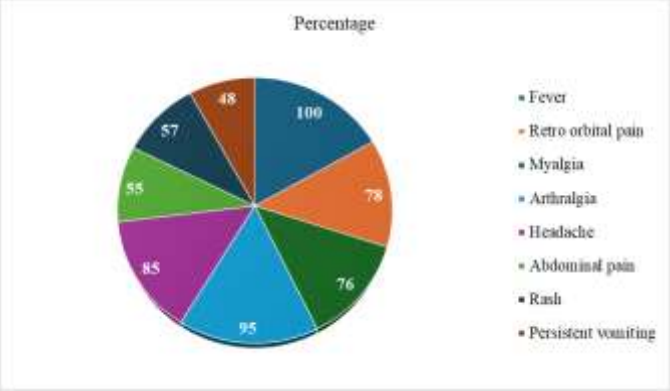

Fig 2: Clinical dengue infection

In the NS1 Ag positive samples, the lowest platelet was observed to be 6000 cells per mm and the highest platelet was seen to 3,19,000 cells per mm. The IQR and mean value calculated was 85 (100-15) and 62.44 respectively. The mean platelet count was low and was statistically significant (p= .000). The mean hematocrit value was high with a value of 52.04%. The IQR came out to be 26 (64-38). Hct had come out to be statistically significant with p= .000.

Serum ALT and AST were seen in the higher range with a maximum value of ALT and AST being 84.6 (IQR, 132.6- 48 U/L) and 115.8 (IQR, 172.8-57 U/L), respectively. Except for ALP (p= 0.120), ALT, AST shows a high mean value of 132.43U/L, 195.69 U/L with a significant p value of 0.000, 0.001 respectively.

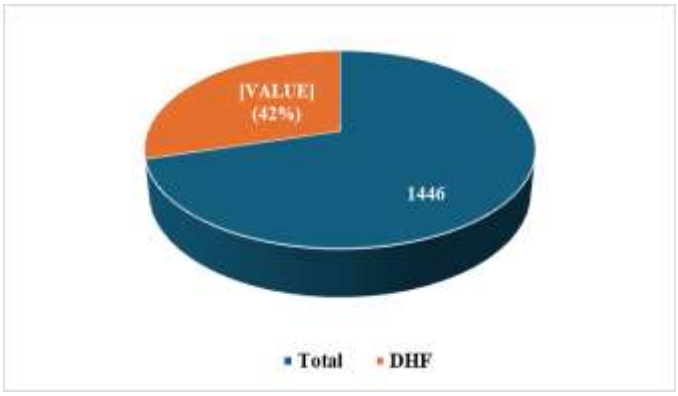

Fig 3: Progression towards dengue hemorrhagic fever

Out of total 1446 positive patients, 604 (42%) patients were seen to have low thrombocytopenia (<20,000), raised liver enzymes and rashes indicating a progression towards dengue hemorrhagic fever according to WHO criteria 2009.

Discussion

The current study examines the clinical and laboratory characteristics of dengue fever in a tertiary care setting. The outcomes of this study add to our understanding of dengue fever, its many symptoms, and therapy.

Only 1426 out of 8772 suspected cases were positive for NS1 Ag testing, with an incidence of 16.2%. Similar incidence rates of 14.6% and 11.8%. This disparity could be attributed to the different geographical areas. In our analysis, the male population with positive NS1 Ag predominated. The lower infection rates among females could possibly be attributed to the fact that many of them stay at home and are therefore less exposed to this vector-borne virus. Furthermore, females have a more

competent immune response than males, which results in increased cytokine production and protection.

The majority of patients exhibit clinical symptoms such as fever (100%), retro-orbital pain (78.6%), arthralgia (95.5%), myalgia (76.5%), abdominal pain (55.6%), and rashes (57.2%), which is consistent with a study conducted by Dr. N Krishna Geetha et al in 2024 (16), where fever was present in all cases (100%), however, retro-orbital pain (20%), arthralgia (12%), abdominal pain (16%), and rashes (8.7%) were less reported less. A global meta-analysis of dengue epidemics revealed a nearly identical picture: fever (98.1%), chills (65.3%), myalgia (64.2%), arthralgia (53.6%), and body pain (67.2%) (17).

Rising the hemocrit level by 20 percent or more over the baseline indicates hemoconcentration, which might be a helpful marker of plasma leakage before the shock occurs. The most frequent test result in dengue patients is thrombocytopenia, which is regarded as an early indicator and prognostic factor for the treatment and recovery of dengue fever. Our analysis shows a statistically significant drop in thrombocyte levels.

Conclusion

The clinical manifestations, such as fever, rash, and hemorrhagic symptoms, combined with laboratory indicators like platelet count, hematocrit levels, and liver enzyme elevations, provide valuable insights into the disease's progression and severity. By closely monitoring these parameters, healthcare professionals can make informed decisions, potentially reducing complications and improving patient outcomes in dengue cases. Continued research and awareness are essential to combat this public health challenge effectively. The study does, however, have certain limitations because we did not pursue viral serotyping or molecular analysis.

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