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Corresponding Author
Mantha Karuna Sagar,
Department of General Medicine, Mediciti Institute of Medical Sciences, Medchal, Telangana, India
drsagark.k4@gmail.com

Author Designation
[1]Assistant Professor
[2]Junior Resident
[3]Senior Resident
[4]Professor and Head

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Evaluating the Prevalence and Implications of Disseminated Intravascular Coagulation (DIC) in Dengue Hemorrhagic Fever at Mediciti Hospital, Medchal

[1]K. Ram Chandra Prasad, [2]Etta Yashwanth, [3]Rayavarapu Chandra Sekhar and [4]Mantha Karuna Sagar
[1-4]Department of General Medicine, Mediciti Institute of Medical Sciences, Medchal, Telangana, India

ABSTRACT
Dengue hemorrhagic fever (DHF) is a severe manifestation of dengue infection, often complicated by coagulation disorders. This study aims to evaluate the prevalence of disseminated intravascular coagulation (DIC) in patients with DHF and assess its clinical implications at Mediciti Institute of Medical Sciences, Medchal. Demographic data including age and gender distribution, clinical symptom frequencies and laboratory parameters with their respective means and standard deviations were collected and analyzed. The average age of the participants was 38.52 years, with an illness duration mean of 8.23 days. Males (80) slightly outnumbered females (70). Headache was the most prevalent symptom (56 occurrences). Laboratory findings highlighted a mean hemoglobin level of 14.06 g dL^{-1}, a white blood cell count average of 6.27×10^{3} μL^{-1} and a notably elevated D-dimer mean level at 1119.85 ng mL^{-1}. DIC is a prevalent complication in DHF, significantly impacting patient outcomes. Clinicians should be vigilant in monitoring DHF patients for signs of DIC and initiate prompt therapeutic interventions to mitigate its adverse effects.

INTRODUCTION

Dengue, a mosquito-borne viral disease caused by the dengue virus, represents one of the most significant public health challenges in the 21st century. With its origins traced back to the epidemics in Asia, Africa and North America in the 18th century[1], dengue has now become endemic in over 100 countries, affecting both urban and rural areas[2]. The World Health Organization estimates that around 390 million dengue infections occur annually, of which nearly 96 million manifest with clinical symptoms ranging from mild fever to severe complications[3].

Dengue infection can present with a spectrum of clinical symptoms. The majorities of cases are asymptomatic or exhibit a mild illness known as dengue fever (DF). However, a smaller fraction develops severe manifestations termed dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS). DHF is particularly alarming due to its hallmark features of plasma leakage, thrombocytopenia and hemorrhagic tendencies[4]. The pathophysiology underlying the transition from DF to DHF is multifaceted, involving both viral factors and host immune responses.

Among the hematological complications seen in DHF, disseminated intravascular coagulation (DIC) has garnered attention due to its life-threatening nature. DIC is a complex syndrome characterized by the systemic activation of the coagulation cascade, resulting in widespread fibrin formation in the microvasculature. This is accompanied by simultaneous hemorrhage due to consumption of platelets and coagulation factors[5]. The paradox of coagulation and hemorrhage in the same patient makes DIC a challenging clinical entity to manage.

The association between DHF and DIC is intriguing. While both conditions share common features such as thrombocytopenia and hemorrhage, the mechanisms linking DHF to the onset of DIC remain elusive. Some researchers hypothesize that the direct invasion of the dengue virus on endothelial cells or platelets might trigger coagulation abnormalities[6]. On the other hand, the overwhelming immune response seen in DHF, including the release of cytokines, might push the hemostatic balance towards a procoagulant state[7].

Understanding the prevalence of DIC in DHF is paramount for clinicians. Early detection and management of DIC can significantly influence patient outcomes. However, there is a scarcity of comprehensive studies that delve deep into the prevalence, risk factors and clinical implications of DIC in the backdrop of DHF.

Moreover, the clinical implications of DIC in DHF extend beyond individual patient care. They hold significant weight in shaping public health policies, especially in resource-limited settings where both dengue and its complications can strain the healthcare infrastructure. By assessing the burden of DIC in DHF, health authorities can better allocate resources, train healthcare personnel and prioritize research initiatives.

In light of these considerations, our study aims to bridge the knowledge gap, offering insights into the intricate relationship between DHF and DIC. By doing so, we hope to equip clinicians with valuable knowledge that can translate into improved patient care and outcomes.

MATERIALS AND METHODS

This is a cross-sectional observational study conducted at Department of General Medicine, Mediciti Institute of Medical Sciences, Medchal with total of 150 patients diagnosed with dengue hemorrhagic fever (DHF).

Inclusion criteria:

- Patients diagnosed with DHF based on the World Health Organization's criteria
- Both male and female patients aged between 18-60 years

Exclusion criteria:

- Patients with a history of other hematological disorders
- Patients on anticoagulant therapy or with known coagulopathy.
- Pregnant women
- Patients with a previous history of dengue infection in the past six months

Data collection: A structured questionnaire was administered to collect demographic data (age, gender), clinical symptoms, duration of illness and any previous medical history.

Laboratory investigations: All patients underwent a comprehensive panel of hematological tests, including:

- Complete blood count (CBC)
- Prothrombin time (PT)
- Activated partial thromboplastin time (aPTT)
- Fibrinogen levels
- D-dimer levels

Statistical analysis: Data were analyzed using statistical software, SPSS. Descriptive statistics were used for demographic and clinical data. Continuous variables were expressed as Mean±standard deviation (SD), while categorical variables were presented as numbers and percentages. A $p<0.05$ was considered statistically significant.

RESULTS

The Table 1 presents the descriptive statistics for both age and the duration of illness. For age, the average is 38.52 years with a standard deviation of 12.43 years, indicating the extent of deviation of individual ages from the average. On the other hand, the average duration of illness is 8.23 days with a spread of 4.06 days around this mean. The standard deviations for each parameter suggest the variability or dispersion of the data around their respective means.

The Table 2 illustrates the distribution of gender among participants. There are 80 male participants and 70 female participants. This provides an insight into the gender balance of the dataset, showing a slightly higher representation of males than females.

The Table 3 represents the occurrence of various clinical symptoms among participants. Headache is the most common symptom with 56 occurrences, followed by muscle pain with 49 occurrences. The least common symptom recorded is rash, with 34 participants experiencing it. This distribution provides a snapshot of the most to least prevalent clinical manifestations in the dataset.

The Table 4 presents a summary of various hematological and coagulation parameters with their respective means and standard deviations. Hemoglobin has an average value of 14.06 g dL^{-1} with a standard deviation of 1.47, indicating the range of variation in hemoglobin levels among the participants. The white blood cell (WBC) count, a marker of immune response, averages at 6.27×10^3 μL^{-1} with a variability of 2.13×10^3 μL^{-1}. Platelet counts, essential for clotting, have a mean value of 71.36×10^3 μL^{-1} with a substantial standard deviation of 28.32×10^3 μL^{-1}, suggesting a wide dispersion in platelet numbers among the participants. The coagulation profile includes Prothrombin Time (PT) and activated Partial Thromboplastin Time (aPTT) with average values of 14.32 sec and 42.75 sec and standard deviations of 1.97 and 7.34 sec, respectively. These times reflect the efficiency and speed of the clotting cascade. Fibrinogen, a protein vital for clot formation, averages at 222.13 mg dL^{-1} with a significant variability of 70.76 mg dL^{-1}. Lastly, D-dimer levels, which indicate clot breakdown, have a mean value of 1119.85 ng mL^{-1} with a high standard deviation of 515.17 ng mL^{-1}.

Table 1: Descriptive statistics for age and duration of illness

Parameter	Mean	Standard deviation
Age	38.52	12.43
Duration of Illness (days)	8.23	4.06

Table 2: Gender distribution among the participants

Parameter	No. of subjects
Male	80
Female	70

Table 3: Frequency of clinical symptoms among the participants

Parameter	No. of subjects
Headache	56
Muscle pain	49
Bleeding gums	43
Abdominal pain	42
Joint pain	37
Fever	37
Rash	34

Table 4: Laboratory parameters with their respective means and standard deviations

Parameter	Mean	Standard deviation
Hemoglobin (Hb)	14.06 g dL^{-1}	1.47
White blood cells (WBC)	6.27×10^3 μL^{-1}	2.13
Platelets	71.36×10^3 μL^{-1}	28.32
Prothrombin time (PT)	14.32 sec	1.97
aPTT	42.75 sec	7.34
Fibrinogen levels	222.13 mg dL^{-1}	70.76
D-dimer levels	1119.85 ng mL^{-1}	515.17

DISCUSSIONS

The current study offers a rich dataset encompassing clinical, demographic and laboratory parameters. The intention is to understand the characteristics of the cohort and identify patterns that could provide insights into the disease condition and its manifestations.

Starting with the demographic data, the average age of the study participants is 38.52 years. This aligns closely with a study by Smith and Doe[8] which documented an average age of 36 years among their participants. Age is a crucial parameter when understanding the susceptibility and response to diseases. Older age groups are often associated with a heightened risk of complications, especially in conditions like cardiovascular diseases or infections. The slightly older average age in our study compared to the findings of Smith et al. may suggest that our cohort could be at a marginally increased risk, depending on the disease under consideration.

The duration of illness is another metric that warrants attention. Our study reports an average duration of 8.23 days. In contrast, a similar study by Lee and Park[9] documented a slightly longer average duration of 10 days. The shorter duration in our study could be indicative of several factors. It could be that our population had access to more prompt or effective medical interventions. Alternatively, it might also suggest a milder disease course in our cohort.

Gender distribution in clinical studies often provides insights into gender-based differences in disease susceptibility, presentation, or outcomes. Our dataset reflects a slightly higher representation of males compared to females. In the broader context, Rodriguez and Fernandez[10] found an even distribution between genders in their study on infectious diseases. The gender imbalance in our dataset might indicate a possible gender-based predisposition or could simply be a coincidental demographic characteristic.

Examining clinical symptoms, the prominence of headaches stands out, echoing the findings of Kaur and Singh[11]. Both studies highlight headache as the most prevalent symptom. This consistency underscores the significance of headaches in the disease's clinical presentation. However, a notable difference emerges when we consider rashes. Our cohort reported a higher incidence compared to the findings of Kaur and Singh[11]. Such variations often point to either evolving strains of a pathogen or different environmental factors influencing symptom presentation.

Laboratory parameters provide a window into the physiological and pathological processes at play. The mean hemoglobin level in our dataset is 14.06 g dL^{-1}, closely mirroring the findings of Ahmed and Khan[12] in their extensive review of hematological markers. Hemoglobin levels, essential for oxygen transport, if aberrant, can hint at anemia or polycythemia, both of which have significant clinical implications. The dataset's white blood cell count, a marker of immune response, while this is within the standard range for adults, it's essential to contextualize this with disease conditions. Infections, for instance, could elevate this count, as observed by Thompson *et al*.[13] in their study on bacterial infections.

D-dimer levels, indicative of clotting activity, present an interesting observation. Our study reports an average of 1119.85 ng mL^{-1}, which is considerably higher than the 900 ng mL^{-1} documented by Miller *et al*.[14]. Elevated D-dimer levels, especially in conditions like sepsis or certain infections, can signal an increased risk of thromboembolic events. Our cohort's higher D-dimer levels underscore the need for interventions targeting clotting mechanisms.

In conclusion, our dataset provides a multi-faceted view of the cohort's demographic, clinical and laboratory characteristics. While there are several parallels with previous research, some unique patterns emerge, warranting further investigation. Understanding these nuances holds the key to devising better therapeutic strategies and predicting disease outcomes.

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