

Blood Laboratory Test as a Predictive and Prognostic Marker for Dengue Infection

Wiwiek Probowati

Duta Wacana Christian University

Loury Priskila

loury@staff.ukdw.ac.id

Duta Wacana Christian University

Pradipta Putramachristy Bararinda

Duta Wacana Christian University

Research Article

Keywords: Dengue hemorrhagic fever, Blood laboratory tests, Prognostic markers, Platelet count, Comorbidity, Disease severity

Posted Date: September 24th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10924327/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Dengue hemorrhagic fever (DHF) remains a major public health problem in tropical countries, including Indonesia. Clinical diagnosis of dengue infection is often difficult, and simple, affordable blood laboratory tests may help predict disease prognosis, particularly in patients with comorbidities.

Objective

To evaluate the role of routine blood laboratory parameters as predictive and prognostic markers of severity in patients with dengue infection, comparing patients with and without comorbidities in Yogyakarta, Indonesia.

Methods

This was an observational analytic study using secondary data from the medical records of adult patients (18–40 years) hospitalized with DHF at Bethesda Hospital, Yogyakarta, between January and December 2024. Patients with comorbidities (diabetes mellitus, obesity, hypertension) were compared with a control group without comorbidities. Bivariate analysis was performed using the chi-square test (or the Kolmogorov–Smirnov test where chi-square assumptions were not met), followed by multivariate logistic regression for variables with $p < 0.25$ on bivariate analysis.

Results

A total of 358 patients were analyzed. Most were male (52.8%), with a median age of 26 years (range 18–45). The severity distribution was DF 29.0%, DHF 67.9%, and DSS 3.1%. Age group ($p = 0.044$) and platelet count ($p = 0.011$) were significantly associated with severity on bivariate analysis. On multivariate analysis, the early/late-adulthood age group (26–45 years) was associated with lower odds of more severe disease (OR 0.595, 95% CI 0.374–0.948; $p = 0.029$), while thrombocytopenia was associated with higher odds of more severe disease (OR 1.924, 95% CI 1.206–3.068; $p = 0.006$). A low APRI score showed a non-significant trend toward lower risk (OR 0.727, 95% CI 0.426–1.241; $p = 0.242$). Sex, complication status, hemoglobin, hematocrit, leukocyte count, neutrophil count, lymphocyte count, SGOT, SGPT, IgM, IgG, NS1, SII, NLR, and PLR were not significantly associated with severity (all $p > 0.05$).

Conclusion

Among the parameters assessed, platelet count and age were independently associated with dengue severity, whereas most other routine hematological, hepatic, and immunoserological markers were not.

More complete documentation of comorbidity- and complication-related data is needed to further explore prognostic factors for DHF.

1. Introduction

Dengue hemorrhagic fever (DHF) remains a significant health problem in tropical countries, particularly in Indonesia. According to Indonesia's National Medium-Term Development Plan (RPJMN) 2020–2024, dengue still has the potential to cause extraordinary outbreak events, underscoring the government's continued commitment to disease control. One of the strategies pursued is to increase the coverage of case finding, treatment, and strengthening of case management.

Dengue virus infection is one of the most common mosquito-borne diseases, generally occurring in tropical regions. Dengue virus (DENV) is transmitted mainly through the *Aedes aegypti* mosquito, and in some cases by *Aedes albopictus*. *Aedes aegypti* is the principal vector for dengue transmission and is commonly found in tropical and subtropical areas worldwide.¹

According to a report from the Indonesian Ministry of Health in 2020, the number of DHF cases in Indonesia reached 95,893, resulting in 661 deaths. DHF cases were distributed across 472 districts/cities in 34 provinces, with DHF-related deaths reported from 219 districts/cities. By the end of 2022, approximately 143,000 dengue cases had been reported in Indonesia, with the highest numbers occurring in West Java, East Java, and Central Java provinces.²

According to a report from the Indonesian Ministry of Health in 2020, the number of DHF cases in Indonesia reached 95,893, resulting in 661 deaths. DHF cases were distributed across 472 districts/cities in 34 provinces, with DHF-related deaths reported from 219 districts/cities. By the end of 2022, approximately 143,000 dengue cases had been reported in Indonesia, with the highest numbers occurring in West Java, East Java, and Central Java provinces.²

According to a report from the Yogyakarta City Health Office, Special Region of Yogyakarta, there were 296 DHF cases in 2020, and DHF remained among the ten most important diseases that year in Yogyakarta City. The DHF case-fatality rate in the city in 2020 exceeded the national average, reaching 73.35%, with approximately 377 districts/cities nationally having achieved an incidence rate (IR) below 49 per 100,000 population.² The 2020 Profile Program of the Special Region of Yogyakarta Health Office also reported 296 DHF cases with an incidence rate of 71.4 per 100,000 population.³

According to the World Health Organization (WHO), dengue can be classified according to severity.⁴ WHO categorizes dengue as dengue without warning signs, dengue with warning signs, and severe dengue.

Dengue without warning signs can be diagnosed when a patient has a history of travel to an endemic area, accompanied by fever and two associated symptoms. Dengue with warning signs means the patient has one or more warning signs. Severe dengue requires at least one severe-dengue criterion,

comprising severe plasma leakage — generally referred to as dengue shock syndrome (DSS); fluid accumulation with respiratory distress; severe bleeding; and severe organ involvement, such as aspartate aminotransferase (AST) or alanine aminotransferase (ALT) ≥ 1000 U/L, impaired consciousness, and organ failure.⁴

Approximately 80% of patients with dengue infection do not develop clinical symptoms. In individuals with dengue fever (DF), symptoms typically include headache, mild fever, flushing of the extremities, muscle and joint pain, and may be accompanied by nausea or vomiting.⁴ Patients with DHF generally experience more severe symptoms; DHF is typically seen in children under 15 years of age, although it is also found in adults. Patients with DHF experience higher fever, hepatomegaly, bleeding (commonly gingival bleeding), prolonged menstruation or dark/black stools, and are generally accompanied by cardiovascular disturbances.⁴

Clinical diagnosis of dengue infection is generally difficult and highly dependent on the stage of infection. One common and affordable examination is a complete blood count, which includes blood cell counts, white-cell ratios, liver enzyme tests, and immunoserological testing.⁴

Patients with comorbidities tend to have a higher risk of death, particularly when combined with severe dengue,¹ especially patient with a history of cardiovascular disease, diabetes mellitus (DM), and hypertension.¹

Nevertheless, detection tests that generally rely on serology or antigen testing still face challenges in their application. Identifying prognosis and developing alternative serological tests have become urgent needs to support more effective diagnosis and patient management. The long-term aim of this study is to serve as an initial step in identifying the prognosis and incidence of DHF; it is hoped that this line of research can continue to develop, particularly in the diagnostic and molecular aspects of understanding DHF.

In this context, this study focuses on assessing the role of simple blood tests in DHF patients without comorbidities compared with DHF patients with comorbidities in Yogyakarta City. The comorbidities evaluated include older age, diabetes mellitus, hypertension, obesity, and coronary heart disease. Other relevant laboratory findings were also identified to calculate odds ratios.

This study has the potential to provide a deeper understanding of prognostic factors and the incidence of DHF, as well as the role of simple blood tests in influencing patient prognosis. Its results are expected to make a meaningful contribution to improving the management and control of DHF, particularly in tropical regions such as Indonesia.

2. Materials and methods

2.1. Study design and data source

This was an analytic observational study using secondary data. Data was obtained from the medical records of patients diagnosed with dengue hemorrhagic fever who were hospitalized at Bethesda Hospital, Yogyakarta, between January and December 2024. The study itself was conducted from June 2024 to March 2025. Variables assessed included patient comorbidities – namely diabetes mellitus, obesity, and hypertension – as well as sociodemographic factors and clinical profiles in the patient and control groups.

2.2. Study population and sample size

The target population comprised DHF patients at Bethesda Hospital, Yogyakarta. Inclusion criteria were: adult patients aged 18–40 years diagnosed with DHF by an internal medicine specialist, with a comorbidity – diabetes mellitus, obesity, or hypertension (case group); or, for the control group, adult patients aged 18–40 years diagnosed with DHF by an internal medicine specialist without comorbidities. Patients were required to have complete clinical and demographic data; the exclusion criterion was incomplete medical record data.

Sample size was calculated assuming a 95% confidence level using OpenEpi software. Based on the estimated population frequency, the minimum required sample size was 384; accounting for an anticipated 15% drop-out rate, the total required sample size was 440. A total of 358 medical records meeting the inclusion criteria were available for analysis.

2.3. Statistical analysis

Bivariate associations between individual variables and dengue severity were assessed using the chi-square test, with the Kolmogorov–Smirnov test used as an alternative where chi-square assumptions were not met (statistical significance set at $p < 0.05$). Variables with $p < 0.25$ on bivariate analysis were subsequently entered into a multivariate binary logistic regression model to identify independent predictors of dengue severity, expressed as odds ratios (OR) with 95% confidence intervals (CI). Data were processed using SPSS.

3. Results

3.1. Baseline characteristics of patients

Table 1 presents the baseline characteristics of the 358 patients included in the analysis. The cohort was slightly male-predominant (52.8%), with a median age of 26 years (range 18–45); the largest group was late adolescents (18–25 years, 47.5%). Most patients had hemoglobin, hematocrit, leukocyte, neutrophil, and lymphocyte values within the normal range, whereas thrombocytopenia (52.0%) and an elevated SGOT (82.7%) were common findings. Serologically, most patients were IgM-positive (86.3%), IgG-negative (67.0%), and NS1-negative (94.1%). Most patients were classified as DHF (67.9%), and 95.3% had no recorded complications.

Table 1
Baseline characteristics and prevalence of dengue hemorrhagic fever findings at Bethesda Hospital, 2022–2024.

Variable	Frequency (n = 358)	Percentage
Sex		
Male	189	52.8%
Female	169	47.2%
Age (y)		
Late adolescence (18–25)	170	47.5%
Early adulthood (26–35)	92	25.7%
Late adulthood (36–45)	96	26.8%
<i>Hemoglobin (Hb)</i>		
Low	73	20.4%
Normal	272	76.0%
High	13	3.6%
<i>Hematocrit (HCT)</i>		
Low	99	27.7%
Normal	235	65.6%
High	24	6.7%
<i>Leukocyte count</i>		
Leukopenia	229	64.0%
Normal	107	29.9%
Leukocytosis	22	6.1%
<i>Neutrophil count</i>		
Normal	266	74.3%
Neutrophilia	92	25.7%
<i>Lymphocyte count</i>		
Lymphopenia	207	57.8%
Normal	140	39.1%
Lymphocytosis	11	3.1%

Variable	Frequency (n = 358)	Percentage
<i>Platelet count</i>		
Thrombocytopenia	186	52.0%
Normal	171	47.8%
Thrombocytosis	1	0.3%
<i>SGOT</i>		
Low	1	0.3%
Normal	61	17.0%
High	296	82.7%
<i>SGPT</i>		
Low	1	0.3%
Normal	163	45.5%
High	194	54.2%
<i>IgM</i>		
Negative	49	13.7%
Positive	309	86.3%
<i>IgG</i>		
Negative	240	67.0%
Positive	118	33.0%
<i>NS1</i>		
Negative	337	94.1%
Positive	21	5.9%
<i>Disease severity</i>		
DF	104	29.0%
DHF	243	67.9%
DSS	11	3.1%
<i>Complications</i>		
Without complications	341	95.3%
With complications	17	4.7%

Values are n (%) unless otherwise stated; age is presented as median (range).

3.2. Bivariate analysis

3.2.1. Individual factors and disease severity

Age group was significantly associated with dengue severity ($p = 0.044$): patients aged 26–45 years had a higher proportion of DHF/DSS than those aged 18–25 years. Sex and complication status were not significantly associated with severity ($p = 0.551$ and $p = 0.753$, respectively) (Table 2).

Table 2
Association between individual factors and severity of dengue hemorrhagic fever.

Variable	Disease severity			<i>p</i> -value
	DF (%)	DHF (%)	DSS (%)	
Age				0.044*
Late adolescence (18–25 y)	59 (34.7%)	108 (63.5%)	3 (1.8%)	
Early/late adulthood (26–45 y)	45 (23.9%)	135 (71.8%)	8 (4.3%)	
Sex				0.551*
Male	58 (30.7%)	124 (65.6%)	7 (3.7%)	
Female	46 (27.2%)	119 (70.4%)	4 (2.4%)	
Complications				0.753*
Without complications	99 (29.0%)	231 (67.6%)	11 (10.5%)	
With complications	5 (29.4%)	12 (70.6%)	0 (0%)	

*Chi-square test, significant at $p < 0.05$.

3.2.2. Laboratory findings and disease severity

Among the laboratory parameters examined, only platelet count was significantly associated with disease severity ($p = 0.011$); patients with thrombocytopenia had a higher proportion of DHF/DSS than those with normal or elevated platelet counts. Hemoglobin, hematocrit, leukocyte count, neutrophil count, lymphocyte count, SGOT, SGPT, IgM, IgG, and NS1 status were not significantly associated with severity (all $p > 0.05$) (Table 3).

Table 3
Association between routine laboratory findings and severity of dengue hemorrhagic fever.

Variable	Disease severity			<i>p-value</i>
	DF (%)	DHF (%)	DSS (%)	
<i>Hemoglobin</i>				0.991#
Low	25 (34.2%)	46 (63.0%)	2 (2.7%)	
Normal + High	79 (27.7%)	197 (69.1%)	9 (3.2%)	
<i>Hematocrit</i>				1.000#
Low	31 (31.3%)	66 (66.7%)	2 (2.0%)	
Normal + High	73 (28.2%)	177 (68.3%)	9 (3.5%)	
<i>Leukocyte count</i>				0.901#
Leukopenia	72 (31.4%)	152 (66.4%)	5 (2.2%)	
Normal + leukocytosis	32 (29.8%)	91 (70.5%)	6 (4.7%)	
<i>Neutrophil count</i>				1.000#
Normal	83 (31.2%)	175 (65.8%)	8 (3.0%)	
Neutrophilia	21 (22.8%)	68 (73.9%)	3 (3.3%)	
<i>Lymphocyte count</i>				1.000#
Lymphopenia	59 (28.5%)	143 (69.1%)	5 (2.4%)	
Normal + lymphocytosis	45 (29.8%)	100 (66.2%)	6 (4.0%)	
<i>Platelet count</i>				0.011*
Thrombocytopenia	42 (22.6%)	136 (73.1%)	8 (4.3%)	
Normal + thrombocytosis	62 (36.0%)	107 (62.2%)	3 (1.7%)	
<i>SGOT</i>				1.000#
Low	18 (29.0%)	40 (64.5%)	4 (6.5%)	
Normal + high	86 (29.1%)	203 (68.6%)	7 (2.4%)	
<i>SGPT</i>				0.791*
Low	49 (29.9%)	111 (67.7%)	4 (2.4%)	
Normal + high	55 (28.4%)	132 (68.0%)	7 (3.6%)	
<i>Immunoserology – IgM</i>				0.924#

Variable	Disease severity			<i>p-value</i>
	DF (%)	DHF (%)	DSS (%)	
Positive	94 (30.4%)	204 (66.0%)	11 (3.6%)	
Negative	10 (20.4%)	39 (79.6%)	0 (0%)	
<i>Immunoserology – IgG</i>				0.732#
Positive	28 (23.7%)	85 (72.0%)	5 (4.2%)	
Negative	76 (31.7%)	158 (65.8%)	6 (2.5%)	
<i>Immunoserology – NS1</i>				1.000#
Positive	8 (38.1%)	13 (61.9%)	0 (0%)	
Negative	96 (28.5%)	230 (68.2%)	11 (3.3%)	

**Chi-square test, significant at $p < 0.05$; #Kolmogorov–Smirnov test used as an alternative where chi-square assumptions were not met.*

3.2.3. Infection-marker scores and disease severity

None of the composite infection-marker scores – SII, APRI, NLR, or PLR – was significantly associated with dengue severity (all $p > 0.05$), although the APRI analysis yielded the lowest p-value among these markers ($p = 0.203$) (Table 4).

Table 4
Association between infection-marker scores and severity of dengue hemorrhagic fever.

Variable	Disease severity			<i>p-value</i>
	DF (%)	DHF (%)	DSS (%)	
<i>SII index</i>				1.000#
Low + normal	73 (29.1%)	169 (67.3%)	9 (3.6%)	
High	31 (29.0%)	74 (69.2%)	2 (1.9%)	
<i>APRI index</i>				0.203#
Low	40 (38.1%)	63 (60.0%)	2 (1.9%)	
Normal + high	64 (25.3%)	180 (71.1%)	9 (3.6%)	
<i>Neutrophil-to-lymphocyte ratio (NLR)</i>				1.000#
Low	12 (24.0%)	37 (74.0%)	1 (2.0%)	
Normal + high	92 (29.9%)	206 (66.9%)	10 (3.2%)	
<i>Platelet-to-lymphocyte ratio (PLR)</i>				1.000#
Low	103 (29.3%)	238 (67.6%)	11 (3.1%)	
Normal + high	1 (16.7%)	5 (83.3%)	0 (0%)	

#Kolmogorov–Smirnov test used as an alternative where chi-square assumptions were not met.

3.3. Multivariate analysis

Variables with $p < 0.25$ on bivariate analysis were entered into a multivariate logistic regression model (Table 5). Belonging to the early/late-adulthood age group (26–45 years) remained independently associated with lower odds of more severe disease (OR 0.595, 95% CI 0.374–0.948; $p = 0.029$), and thrombocytopenia remained independently associated with higher odds of more severe disease (OR 1.924, 95% CI 1.206–3.068; $p = 0.006$). A low APRI score was not independently associated with severity (OR 0.727, 95% CI 0.426–1.241; $p = 0.242$).

Table 5
Multivariate analysis of factors associated with severity of dengue hemorrhagic fever.

Variable	B	SE	<i>p-value</i>	OR (95% CI)
Early/late adulthood (26–45 y)	-0.518	0.237	0.029a	0.595 (0.374–0.948)
Thrombocytopenia	0.654	0.238	0.006a	1.924 (1.206–3.068)
Low APRI	-0.319	0.273	0.242a	0.727 (0.426–1.241)

B, regression coefficient; *SE*, standard error (binary logistic regression on variables with $p < 0.25$ on bivariate analysis). *a*Wald test.

4. Discussion

4.1. Hemoglobin (Hb)

Hemoglobin analysis showed that patients with normal Hb levels (272, 76.0%) predominated, compared with patients with low Hb (73, 20.4%) and high Hb (13, 3.6%). Bivariate analysis showed $p = 0.991$ for the Hb variable, indicating no statistically significant difference between hemoglobin level and DHF severity. In other words, hemoglobin level did not directly influence whether a patient experienced DF, DHF, or DSS. Although percentage differences were observed between the low and normal/high hemoglobin groups, these differences were not statistically significant.

4.2. Hematocrit (HCT)

HCT analysis showed that the majority of patients (65.6%) had normal hematocrit levels, while 27.7% had low hematocrit and 6.7% had high hematocrit. Bivariate analysis showed no significant association between hematocrit level and DHF severity ($p = 1.000$). This indicates that hematocrit, although often regarded as an important indicator in DHF diagnosis, did not significantly influence disease severity in this study.

4.3. NS1

The association between NS1 status and DHF severity was analyzed using the chi-square test. Because the data did not meet chi-square assumptions, the Kolmogorov–Smirnov test was used as an alternative. The result showed $p = 1.000$, indicating no statistically significant association between NS1 status and DHF severity ($p > 0.05$).

4.4. Disease severity

Analysis of disease severity showed that the majority of patients, 243 (67.9%), were diagnosed with DHF, while 104 (29.0%) had DF and 11 (3.1%) had DSS.

4.5. Complications

Bivariate analysis showed no significant association between the presence of complications and dengue severity ($p = 0.753$), indicating that complications did not directly determine whether a patient experienced DF, DHF, or DSS. In contrast, age was significantly associated with dengue severity ($p < 0.05$), suggesting that a patient's age — whether younger or older — may contribute to the severity of dengue infection experienced.

4.6. SGOT

Based on the distribution of SGOT levels, most patients had high SGOT, 296 (82.7%), while 1 patient (0.3%) had low SGOT and 61 (17.0%) had normal SGOT. These findings are consistent with the study by Rahayu et al,⁵ which reported elevated SGOT in 76.4% of cases. Bivariate analysis between SGOT and dengue severity showed $p > 0.05$, indicating no significant association between SGOT level and severity.

These findings differ from the study by Utari et al,⁶ which reported a significant association between SGOT level and platelet count in DHF patients at RSUDP NTB, where higher SGOT levels were associated with lower platelet counts. Overall, this study found no significant association between SGOT level and severity, although this discrepancy with other studies may be attributable to differing sample or contextual factors.

4.7. SGPT

Based on the distribution of SGPT levels, most patients had high SGPT, 194 (54.2%), while 1 patient (0.3%) had low SGPT and 163 (45.5%) had normal SGPT. These findings are consistent with the study by Rahayu et al,⁷ which found that 76% of patients had SGPT levels above 56 U/L and 24% had levels below 56 U/L. Elevated SGPT may occur because dengue virus infection causes liver damage, specifically reflected by increased SGPT levels. Hepatocytes can be directly injured by dengue virus infection, which disrupts cellular RNA and protein production; as an intracellular pathogen, dengue virus replication involves nucleic acids that ultimately disrupt protein production by the target cell. According to Umami et al,⁸ this leads to cell damage and can even cause cell death.

Bivariate analysis between SGPT and dengue severity showed $p > 0.05$, indicating no significant association. This finding differs from the study by Utari et al,⁶ which reported a significant association between SGPT level and platelet count in DHF patients at RSUDP NTB.

4.8. Platelet count

The association between platelet count and DHF severity was analyzed using the chi-square test, yielding $p = 0.011$, indicating a statistically significant association ($p < 0.05$). Patients with thrombocytopenia were more likely to experience DHF and DSS than patients with normal or elevated platelet counts. In DHF, thrombocytopenia occurs owing to increased platelet destruction caused by dengue virus infection and impaired bone marrow function; patients with thrombocytopenia are more susceptible to bleeding and plasma leakage, which are key features of DHF and DSS.

4.9. Leukocyte count

Based on the distribution of leukocyte counts, most patients had low leukocyte counts, 229 (64.0%), while 22 (6.1%) had high counts and 107 (29.9%) had normal counts. This is consistent with the study by Agung et al,⁹ which similarly found that most patients had leukocyte counts below 5,000/ μ L (57.6%).

Bivariate analysis showed $p > 0.05$, indicating no significant association between leukocyte count and severity. This finding is consistent with the study by Hidayat et al,¹⁰ which also reported a p-value of

Leukopenia, or reduced leukocyte count, can occur in dengue infection owing to bone marrow suppression, either from direct dengue virus infection or the effect of proinflammatory cytokines, on days 3, 5, or 7 after infection onset. Leukocyte counts in patients with dengue infection can vary from low to normal. From day 3 of infection, relative lymphocytosis (> 45% of total leukocytes) accompanied by atypical (plasmacytoid) lymphocytes (> 15% of total leukocytes) may be observed; during the shock phase, the proportion of these atypical lymphocytes increases further. Leukopenia typically occurs on days 1 and 3 in approximately 50% of mild dengue infection cases. According to Hidayat et al,¹⁰ this is attributable to degeneration of mature polymorphonuclear (PMN) cells together with the formation of immature PMN cells.

Nevertheless, this finding differs from the study by Yanti et al,¹¹ which found a significant association between leukopenia (leukocyte count < 5,000/ μ L) and the risk of DHF severity. This discrepancy is thought to be influenced by a higher incidence of shock among patients aged over 10 years in that study population.

4.10. Neutrophil count

Analysis showed that 74.3% of patients had normal neutrophil counts, while 25.7% had neutrophilia. Bivariate analysis showed no significant association between neutrophil status and dengue severity, indicating that although neutrophils are part of the body's immune response to infection, neutrophil count was not directly correlated with DHF severity in this study.

4.11. Lymphocyte count

Lymphocyte analysis showed that the majority of patients, 207 (57.8%), had lymphopenia, while 39.1% had normal counts and 3.1% had lymphocytosis. Among patients with lymphopenia, 59 (28.5%) had DF, 143 (69.1%) had DHF, and 5 (2.4%) had DSS; among patients with normal counts or lymphocytosis, 45 (29.8%) had DF, 100 (66.2%) had DHF, and 6 (4.0%) had DSS. Statistical testing showed no significant association between lymphocyte status and DHF severity ($p = 1.000$).

4.12. IgM

IgM analysis showed that the majority of patients (86.3%) were IgM-positive, while 13.7% were IgM-negative. Among IgM-positive patients, 94 (30.4%) had DF, 204 (66.0%) had DHF, and 11 (3.6%) had DSS; among IgM-negative patients, 10 (20.4%) had DF and 39 (79.6%) had DHF, with no DSS cases. Statistical testing showed no significant association between IgM status and DHF severity ($p = 0.924$).

4.13. IgG

IgG analysis showed that 33.0% of patients had positive IgG results, while 67.0% were negative, suggesting that most patients in this study likely experienced primary dengue infection, in which the body has not yet mounted a substantial IgG response. Bivariate analysis showed no significant difference between IgG-positive and IgG-negative status with respect to DHF severity ($p = 0.732$),

indicating that the presence of IgG — which typically reflects secondary dengue infection — did not significantly influence disease severity in this study.

4.14. Age

Data from this study showed that the 18–25-year age group had the highest number of DHF cases, far exceeding other age groups. This finding is consistent with the study by Milaviwanda et al,¹² which reported that dengue virus tends to infect individuals of productive age owing to their higher mobility. High mobility among individuals of productive age, such as late adolescents, may increase the incidence of DHF, as *Aedes aegypti* activity — the main vector for dengue transmission — predominantly occurs between 08:00–12:00 and 15:00–17:00. Many routine activities, such as school and work, take place during these hours, placing the late-adolescent age group at higher risk of dengue infection.

4.15. Sex

Male patients were the majority (52.8%) compared with female patients (47.2%). Among male patients, 58 (30.7%) had DF, 124 (65.6%) had DHF, and 7 (3.7%) had DSS; among female patients, 46 (27.2%) had DF, 119 (70.4%) had DHF, and 4 (2.4%) had DSS. Statistical testing showed no significant association between sex and DHF severity ($p = 0.551$).

4.16. APRI (AST-to-platelet ratio index)

Bivariate analysis showed no significant association between APRI score and dengue severity ($p > 0.05$). On multivariate analysis, a low APRI score was associated with a lower risk of more severe dengue than a high APRI score. This finding is consistent with the study by Jamil et al,¹³ which reported that the APRI score can be used to predict potential plasma leakage and the risk of dengue shock syndrome. The APRI score may serve as a useful indicator for assessing hepatic involvement in dengue patients and for predicting the risk of more serious complications.

4.17. SII

Among patients with low/normal SII, 73 (29.1%) had DF, 169 (67.3%) had DHF, and 9 (3.6%) had DSS; among patients with high SII, 31 (29.0%) had DF, 74 (69.2%) had DHF, and 2 (1.9%) had DSS. Statistical testing showed no significant association between SII level and DHF severity ($p = 1.000$).

This finding is not aligned with several previous studies, including that of Xia et al,¹⁴ who reported a linear relationship between an increasing SII index and COVID-19 severity. However, as no prior studies have specifically examined the relationship between the SII index and DF/DHF, several factors may account for the non-linear finding observed here.

4.18. NLR

Bivariate analysis showed no significant difference between low and high NLR in determining DHF severity ($p = 1.000$). Although NLR is commonly used as a marker of inflammation and severity in both infectious and non-infectious disease, it was not significantly associated with DHF severity in this study.

This may be attributable to the unique characteristics of dengue infection, such as neutropenia and lymphopenia during the acute phase, which may make NLR a less consistent severity marker. In addition, individual variability in immune response and other factors such as thrombocytopenia and age may play a more dominant role in determining DHF severity – consistent with the study by Huy et al,¹⁵ which reported that factors such as age, thrombocytopenia, and plasma leakage are more important in determining DHF severity.

5. Conclusions

Based on the study findings, 15 variables were compiled as examination parameters for this study. Most patients had hemoglobin, hematocrit, leukocyte, lymphocyte, platelet, and neutrophil levels within normal limits, and the majority showed positive results for IgM, IgG, and NS1. On this basis, this study provides blood-marker data as a reference point for DF/DHF assessment that can be used for further research, including the APRI (AST-to-platelet ratio index), SII, and NLR scores derived from patient medical records at Bethesda Hospital, Yogyakarta. Of the parameters assessed, only platelet count and age were independently associated with dengue severity.

Several recommendations arise from this study. For Bethesda Hospital, Yogyakarta, it is recommended that patient medical record data be made more complete, particularly vital-sign and laboratory data. For the present researchers, this study is intended to serve as a reference for further research into laboratory findings. Future studies could employ different study designs and could be expanded by adding other variables, such as additional laboratories or supporting examinations, or other factors related to the clinical severity of dengue infection, with the aim of identifying further factors that may influence the clinical severity of dengue virus infection.

Declarations

Ethics Approval Statement: This study was approved by the Health Research Ethic Committee of Bethesda Hospital Yogyakarta, Indonesia (Approval No. 48/KEPK-RSB/X/24) on October 3, 2024.

Participant Consent Statement: Informed consent was obtained from all participants (or their legal guardians) prior to inclusion in the study, in accordance with the 7 WHO 2011 Standards and the 2016 CIOMS Guidelines as reviewed and approved by the ethics committee.

Author Contribution

Wiwiek Probowati contributed to the conceptualization of the study, patient preparation and management, investigation, and data collection. Loury Priskila contributed to the conceptualization, statistical analysis, data curation, and writing of the original draft, as well as reviewing and editing the manuscript. Pradipta Putramachristy Bararinda contributed to statistical analysis, data curation, writing

of the original draft, and reviewing and editing the manuscript. All authors reviewed and approved the final version of the manuscript.

Acknowledgement

The authors would like to thank all individuals and staff who contributed to the preparation and management of the patients and supported the completion of this study.

Data Availability

The data that support the findings of this study are not publicly available due to restrictions related to patient privacy and the use of secondary medical record data. The data are available from the corresponding author upon reasonable request, subject to approval from the relevant institution and/or ethics committee.

References

1. World Health Organization. Dengue and severe dengue. April 23 (2024) Available from: <https://www.who.int/news-room/fact-sheets/detail/dengue-and-severe-dengue>
2. Ministry of Health of the Republic of Indonesia. Dengue hemorrhagic fever data in Indonesia [Data DBD Indonesia; in Indonesian] (2021) Available from: https://p2pm.kemkes.go.id/storage/publikasi/media/file_1619447946.pdf
3. Ministry of Health of the Republic of Indonesia. Annual report on dengue hemorrhagic fever 2022 [Laporan Tahunan Demam Berdarah Dengue 2022; in Indonesian] (2022) Available from: https://p2p.kemkes.go.id/wp-content/uploads/2023/06/FINAL_6072023_Layout_DBD-1.pdf
4. World Health Organization. Dengue guidelines for diagnosis, treatment, prevention and control. April 21 (2009) Available from: <https://www.who.int/publications/i/item/9789241547871>
5. Rahayu C, Nugroho HP, Pangastuti A (2022) Overview of SGOT and SGPT enzyme activity in dengue haemorrhagic fever patients at Haji Hospital Jakarta in 2021 [Gambaran Aktivitas Enzim SGOT Dan SGPT Pada Pasien Dengue Haemorrhagic Fever Di Rumah Sakit Haji Jakarta Tahun 2021; in Indonesian]. *Anakes J Ilm Anal Kesehat* 8(2):188–199
6. Utari M, Setyowati E (2022) Association between SGPT and SGOT with platelet count in dengue hemorrhagic fever patients at RSUDP NTB [Hubungan SGPT Dan SGOT Dengan Jumlah Trombosit Pada Pasien Demam Berdarah Dengue (DBD) Di RSUDP NTB; in Indonesian]. *Nusantara Hasana J* 2(5):113–117
7. Rahayu M, Anggraini H (2022) Widiyastuti. Differences in De Ritis ratio (SGOT/SGPT) and troponin I in patients with ST-elevation versus non-ST-elevation myocardial infarction [Perbedaan Rasio De Ritis (SGOT/SGPT) Dengan Troponin I Pada Pasien Infark Miokard Elevasi Segmen ST (STEMI) Dengan Elevasi Non Segmen ST (NSTEMI); in Indonesian]. *J Fatmawati Lab Med Sci* 2(2):80–85

8. Umami S, Widyantara A, Amalia A (2024) Association between SGOT and SGPT levels in dengue hemorrhagic fever patients at PKU Muhammadiyah Hospital Yogyakarta [Hubungan Kadar SGOT dan SGPT Pada Penderita Demam Berdarah Dengue di Rumah Sakit PKU Muhammadiyah Yogyakarta; in Indonesian]. 8(3):41696–41701
9. Mulyadi AE, Sudrajat A (2024) Overview of leukocyte count in dengue hemorrhagic fever patients at Dr. Trisna Clinic, Garut [Gambaran Jumlah Leukosit pada Penderita Demam Berdarah Dengue di Klinik DR.Trisna Garut; in Indonesian]. Reslaj Relig Educ Soc Laa Roiba J 6(11):5006. 10.47467/reslaj.v6i11.3587
10. Hidayat et al (2021) Leukocyte count and clinical severity of dengue infection patients at Dr. H. Abdul Moeloek Hospital, Lampung [Jumlah Leukosit Dan Derajat Klinis Penderita Infeksi Dengue Di RSUD Dr. H. Abdul Moeloek Lampung; in Indonesian]. J Ilmu Teknol Kesehat Terpadu 1(1):45–52
11. Yanti EL, Suryawan WB, Widiassa M. Association between degree of leukopenia and severity of dengue hemorrhagic fever in pediatric patients treated in the Kaswari ward, Hospital W (2021) Denpasar, Indonesia [Hubungan Derajat Leukopenia Terhadap Tingkat Keparahan Penyakit Demam Berdarah Dengue (DBD) Pada Pasien Anak Yang Dirawat Di Ruang Kaswari RSUD Wangaya, Denpasar, Indonesia; in Indonesian]. Intisari Sains Med. ;12(3):908–911
12. Milaviwanda LK, Wande IN, Yasa IW et al (2024) Association between type of infection and severity of dengue hemorrhagic fever patients at Sanglah General Hospital Denpasar, 2021 [Hubungan Jenis Infeksi Dengan Derajat Keparahan Pasien DBD Di RSUP Sanglah Denpasar Tahun 2021; in Indonesian]. J Med Udayana 13(4):76–81
13. Jamil Z, Khalid S, Khan HMMH, Waheed I, Ehsan A, Alissa M et al (2024) Aspartate aminotransferase-to-platelet ratio index (APRI) as a novel score in early detection of complicated dengue fever. J Multidiscip Healthc 17:2321–2330. 10.2147/JMDH.S459929
14. Xia W, Tan Y, Hu S, Li C, Jiang T (2022) Predictive value of systemic immune-inflammation index and neutrophil-to-lymphocyte ratio in patients with severe COVID-19. Clin Appl Thromb Hemost 28:10760296221111391
15. Huy NT, Van Giang T, Thuy DHD, Kikuchi M, Hien TT, Zamora J et al (2013) Factors associated with dengue shock syndrome: a systematic review and meta-analysis. PLoS Negl Trop Dis 7(9):e2412