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(RESEARCH ARTICLE)

The relationship of complete blood count on the outcome of childhood patients with Dengue Shock Syndrome (DSS) in the Pediatric Intensive Care Unit (PICU) Dr. Soetomo General Hospital

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Abstract

Dengue Hemorrhagic Fever (DHF) is an acute infectious disease caused by the dengue virus which is spread through the bite of female mosquitoes of the *Aedes Aegypti* and *Aedes Albopictus* species. DHF cases often attack children under 15 years of age and if not treated properly it will turn into Dengue Shock Syndrome (DSS). Supporting examinations are needed to diagnose and monitor the condition of DSS patients, one of which is a complete blood test. This study aims to determine the relationship between a complete blood profile and the parameters: platelet count, leukocyte count, hematocrit value, and hemoglobin level on the outcome of pediatric patients with DSS in the Pediatric Intensive Care Unit (PICU) at the Regional General Hospital (RSUD) Dr. Soetomo. This research is a descriptive analytical observational study with a cross sectional approach using medical record data from pediatric patients with DSS in the PICU of Dr. RSUD. Soetomo Surabaya for the 2015-2022 period. The sample consisted of 40 samples in accordance with the inclusion and exclusion criteria taken using total sampling technique. In this study, a significant relationship was found between age, hemoglobin and leukocytes and the mortality outcome of pediatric DSS patients. The values obtained were <0.05 (age), 0.048 (hemoglobin), and 0.048 (leukocytes). Apart from that, there is also a significant relationship between platelets and the outcome of treatment duration for pediatric DSS patients.

Keywords: DSS; Complete Blood Count; Mortality; Length of Stay; Shock Duration

1. Introduction

Dengue Hemorrhagic Fever (DHF) is a disease that is commonly found in tropical and sub-tropical areas, such as Southeast Asia, America and the Caribbean. This disease is spread through the bite of female mosquitoes of the Aedes Aegypti and Aedes Albopictus species which carry the dengue virus. This virus belongs to the *Flaviviridae* family and the *Flavivirus* genus [2]. DHF is an acute infectious disease characterized by sudden fever accompanied by bleeding manifestations and a tendency to shock and death. It is estimated that around 50-100 million cases of dengue infection occur each year, with the number of deaths reaching 24,000 cases worldwide [4]. DHF often attacks children under 15 years of age accompanied by bleeding which can cause shock, resulting in death in sufferers. Cases of dengue fever that are not handled properly can turn into Dengue Shock Syndrome (DSS) with clinical manifestations that show signs of emergency, such as impaired circulation in peripheral blood vessels as a result of plasma leakage, characterized by blood pressure dropping to zero and a rapid and weak pulse is not palpable [3].

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DHF which progresses to shock into DSS is a serious problem in children. It is not easy to know for certain which dengue fever patients will develop shock or experience shock repeatedly. This is because the clinical picture in DHF and DSS patients varies and the pathogenesis is not known with certainty. Recognition of symptoms and early signs in DHF and DSS patients is an important part that determines the success of patient therapy. Apart from anamnesis and physical examination, establishing a diagnosis of DHF and DSS also requires supporting examinations. One of these supporting examinations is a complete blood test. In previous research, it was found that there was a significant relationship between the number of platelets and leukocytes and the clinical degree of dengue infection in adult patients, where the lower the number of platelets, the more severe the clinical degree and the higher the number of leukocytes, the more severe the clinical degree [11].

A complete blood test can be performed to diagnose and monitor the patient's condition. There are several parameters that can be seen in a complete blood test, such as erythrocytes, leukocytes, platelets, hematocrit, and various other parameters [10]. In this study, the parameters used were platelet/platelet (PLT), leukocyte/white blood cell (WBC), hematocrit (Hct) and hemoglobin (Hb) levels.

2. Materials and methods

2.1. Ethical clearance

This study had received ethical clearance from Dr. Soetomo General Academic Hospital based on letter of exemption Ref. No: 1270/LOE/301.4.2/III/2023.

2.2. Methods

This research is a cross sectional study using medical record data from pediatric patients with DSS in the PICU Dr. Soetomo General Academic Hospital for the 2015-2022 period. The sample consisted of 40 samples in accordance with the inclusion and exclusion criteria taken using total sampling technique. The independent variable in this study was a complete blood count which included hemoglobin, hematocrit, leukocytes and platelets in pediatric DSS patients, while the dependent variable in this study was the outcome of pediatric DSS patients which included mortality, length of stay and duration of shock. Data analysis was carried out using the SPSS data processing application with the Pearson correlation test. This research was carried out from August 2022 to October 2023 and has gone through ethical clearance from Dr. Soetomo General Academic Hospital based on letter of exemption Ref. No: 1270/LOE/301.4.2/III/2023 where this research was declared feasible to carry out.

2.3. Data Analysis

In this study, data analysis was carried out in a cross sectional study by analyzing medical records to view pediatric patients with DSS in the PICU Dr. Soetomo General Academic Hospital for the 2015-2022 period.

3. Results

3.1. Relationship of Variables with Mortality Outcome

Table 1 Relationship of Variables with Mortality Outcome

Variable	**Mortality Outcome**		***p-Value***
	Died	Recovered	
Gender			
Man	14 (70%)	6 (30%)	0.520
Woman	12 (60%)	8 (40%)	
Age (years)	7.00 (3.00)	12.00 (3.50)	<0.05
BMI (kg/m^2)	16.21 (8.52)	24.00 (6.28)	0.059
HB (g/dL)	11.45 (3.13)	14.65 (4.25)	0.048
HCT (%)	34.05 (14.25)	44.00 (13.85)	0.106

WBC (x10^3/µL)	17355.00 (16970.00)	8890.00 (6302.50)	0.048
PLT (x10^3/µL)	20200.00 ± 17818.84	54500.00 ± 56742.10	0.163

3.2. Relationship of Variables with Length of Stay Outcome

Table 2 Relationship of Variables with Length of Stay Outcome

Variable	**Length of Stay Outcome**		***p-Value***
	≤ 3 days	> 3 days	
Gender			
Man	11 (55%)	9 (45%)	0.728
Woman	12 (60%)	8 (40%)	
Age (years)	8.00 (0.00)	9.00 (0.00)	0.603
BMI (kg/m^2)	24.73 (0.00)	16.07 (0.00)	0.267
HB (g/dL)	13.80 (0.00)	9.70 (0.00)	0.181
HCT (%)	44.20 (0.00)	29.50 (0.00)	0.151
WBC (x10^3/µL)	22230.00 (0.00)	6160.00 (0.00)	0.363
PLT (x10^3/µL)	12333.33 ± 1527.53	17666.67 ± 9291.57	0.043

3.3. Relationship of Variables with Shock Duration Outcome

Table 3 Relationship of Variables with Shock Duration Outcome

Variable	**Shock Duration Outcome**		***p-Value***
	≤ 24 hours	> 24 hours	
Gender			
Man	8 (100%)	0 (0%)	0.089
Woman	4 (67%)	2 (33%)	
Age (years)	9.00 (5.00)	6.00 (0.00)	0.318
BMI (kg/m^2)	20.00 (8.66)	15.08 (0.00)	0.124
HB (g/dL)	11.70 (4.10)	14.90 (0.00)	0.561
HCT (%)	33.50 (14.70)	42.00 (0.00)	0.786
WBC (x10^3/µL)	13120.00 (14280.00)	20920.00 (0.00)	0.200
PLT (x10^3/µL)	31090.90 ± 39006.29	26000.00 ± 17349.35	0.576

4. Discussion

There is a significant relationship between the amount of hemoglobin and the mortality outcome of pediatric DSS patients. However, there was no significant relationship between the amount of hemoglobin and the outcome of length of stay and duration of shock in pediatric DSS patients. There are several studies concluding that there is no significant relationship between hemoglobin levels and the clinical grade of DHF which is related to patient outcomes [8]. This happens because the hemoglobin value increases to a severe degree, namely at degrees 3 and 4. The higher the

hemoglobin value, the higher/severer the clinical degree. This is caused by plasma leakage due to increased vascular permeability which is a clinical manifestation of DHF/DSS [7].

There is a significant relationship between the number of leukocytes and the mortality outcome of pediatric DSS patients. However, there was no significant relationship between the number of leukocytes and the outcome of length of stay and duration of shock in pediatric DSS patients. This is because DSS patients often experience extensive plasma leakage, so that activated leukocytes can migrate from the bloodstream to inflammatory tissue during very extensive plasma leakage [9]. Leukocyte counts are considered important for determining prognosis in the early phases of infection. The role of leukocytes in cases of dengue infection is to form the body's immunity and stimulate the production of inflammatory mediators [5].

There is a significant relationship between platelet count and the outcome of length of stay in pediatric DSS patients. However, there was no significant relationship between platelet count and mortality outcomes and duration of shock in pediatric DSS patients. Thrombocytopenia (platelet count <100,000/mm^3) is one of the requirements for hospitalization in dengue fever patients and is one of the determining factors for shock in dengue fever patients. The lower the platelet count, the worse the clinical grade or degree of severity. The severity of dengue fever will then influence the patient's length of stay, i.e. patients with severe clinical degrees are at risk of being hospitalized for longer and are likely to go into shock [1].

There was no significant relationship between the hematocrit number and the outcome of mortality, length of stay, and duration of shock in pediatric DSS patients. This happens because hematocrit is an indication for dengue fever patients to undergo hospitalization. Hematocrit that increases by more than 20% of normal is an indicator of plasma leakage which results in reduced plasma volume and large numbers of red blood cells in the blood vessels, resulting in hypovolemic shock, circulatory failure, and worsening the degree of dengue fever [6].

5. Conclusion

There is a significant relationship between hemoglobin and leukocytes with the mortality outcome of pediatric DSS patients. Apart from that, there is also a significant relationship between platelets with the outcome of length of stay for pediatric DSS patients.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflicts of interest concerning this article.

Statement of ethical approval

This study had received ethical clearance from Dr. Soetomo General Academic Hospital based on letter of exemption Ref. No: 1270/LOE/301.4.2/III/2023.

References

[1] Cahyani S, Rizkianti T, Susantiningsih T. The Relationship Between Platelet Count, Hematocrit Value, and Neutrophil-Lymphocyte Ratio on the Length of Hospitalization for Child Patients with DHF at Budhi Asih Regional Hospital in January-September 2019. National Seminar on Medical Research 2020, (Vol. 1, No. 1). (accessed December 25, 2023)

[2] Candra A. Dengue Hemorrhagic Fever: Epidemiology, Pathogenesis, and Risk Factors for Transmission. ASPIRATOR-Journal of Vector-borne Disease Studies 2010, 2(2). (accessed December 25, 2023).

[3] Fathurrahman M, Wahyuni T. Analysis of Nursing Clinical Practices for Patients with Dengue Shock Syndrome in the PICU Room at Abdul Wahab Sjahranie Hospital, Samarinda. 2015 (accessed December 21, 2023).

[4] Ginting V. Differences Between Clinical and Laboratory Features of Dengue Hemorrhagic Fever and Dengue Shock Syndrome in Children at PKU Muhammadiyah Hospital in the January 2010-December 2010 Period. 2012 (accessed December 21, 2023).

[5] Ichsan J. Comparison of Leukocyte Counts in Children Suffering from DHF With and Without Shock at Dr. H. Chasan Boesoirie General Hospital, Ternate in the January-December 2020 Period. JUMANTIK (Jurnal Ilmiah Penelitian Kesehatan) 2022, 7(4), 344-350.

[6] Idris R, Tjeng WS, Sudarso S. Correlation Between the Results of Leukocyte, Platelet, and Hematocrit Examinations with the Clinical Degree of Dengue Fever in Pediatric Patients at Abdul Wahab Sjahranie Hospital, Samarinda. Sari Pediatri 2017, 19(1), 41-5. (accessed December 25, 2023)

[7] Jayani, I., Susmiati, S., & Kurniawati, C. Correlation of Hemodynamic Status with the Degree of Dengue Hemorrhagic Fever in Children. Nursing Sciences Journal 2018, 2(1), 125-139. (accessed December 25, 2023)

[8] Mayasari, R., Sitorus, H., Salim, M., Oktavia, S., Supranelfy, Y., & Wurisastuti, T. Characteristics of Dengue Hemorrhagic Fever Patients in the Inpatient Installation of Prabumulih City Regional Hospital for the January–May 2016 Period. Health Research and Development Media 2019, 29.1: 39-50. (accessed December 25, 2023)

[9] Nugroho H, Buchori M. The Relationship between Risk Factors and the Occurrence of Dengue Shock Syndrome (SSD) in Children at Abdul Wahab Sjahranie Samarinda Hospital for the 2018-2020 Period. Verdure: Health Science Journal 2021, 3(1), 34-44. (accessed December 25, 2023)

[10] Sastri NLPP, Lestari AAW. Description of Complete Blood Examination Results in Patients with Suspected Dengue Virus Infection at Surya Husadha Hospital Denpasar for the February-July 2014 Period. E-Jurnal Medika Udayana 2016, 7.5 : 1-5. (accessed December 25, 2023)

[11] Valentino B, Riyanto B, Ariani MD. Correlation Between Complete Blood Examination Results and Clinical Degree of Dengue Infection in Adult Patients at Dr. Kariadi General Hospital, Semarang. 2012. (accessed December 25, 2023)