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An Overview of Erithocyt Index among Stroke Patients In Kraton Regional Hospital, Pekalongan

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ABSTRACT

Background & Objective: Stroke is a serious health condition that requires immediate treatment. It occurs when blood supply to the brain is interrupted due to blockage or rupture of blood vessels in the brain, resulting in cell death in certain areas of the brain. This study aims to determine the erythrocyte indices (MCV, MCH, MCHC) in stroke patients. **Method:** The study design was descriptive, with a sample size of 24 participants. Total sampling was used for sample selection. The study was conducted at the inpatient ward of Kraton District General Hospital, Pekalongan Regency, from January to February 2025. Data analysis was performed using descriptive and analytical methods, presented in tables and narrated. **Result:** The study results showed that MCV levels were normal (80.00 µL/mL – 100.00 µL/mL) in all 24 samples (100%), with an average value of 85.32 µL/mL. The majority of MCH levels showed normal results (27.00 pg – 31.00 pg) in 18 samples (75%), 3 samples (12.5%) with low values, and 3 (12.5%) samples with high values, with an average value of 34.32 pg. The majority of MCHC levels showed normal results (30.00–35.00 g/dL) in 15 samples (62.5%), 9 samples had high values, and there were no low results, with an average value of 29.2 g/dL. **Conclusion:** The conclusion of this study is that the average results of MCV, MCH, and MCHC in the respondents were normal.

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Introduction

A stroke is a disease that disrupts brain function. If left untreated, it can lead to death. A stroke is characterized by a decline in brain function, which occurs due to blockages, narrowing, or rupture of blood vessels and the cessation of blood flow to the brain for 24 hours or more, or resulting in death. Stroke is the third leading cause

of death worldwide after coronary heart disease and cancer, both in developed and developing countries. One in ten deaths is caused by stroke. The prevalence of stroke in Indonesia increases with age, peaking at ages ≥75 years (43.1% and 67.0%). The prevalence is higher among the non-working population (18%). The highest incidence of stroke diagnosed by healthcare professionals is among those aged 75 years and older (43.1%), while the lowest incidence is among those aged 15–24 years (0.2%). Stroke prevalence also varies by gender, with men being more affected (7.1%) than women (6.8%). Based on place of residence, the prevalence of stroke is higher in urban areas (8.2%) than in rural areas. According to the results of the 2023 Indonesian Health Survey (SKI), the prevalence of stroke in Indonesia is 8.3 per 1,000 population.

The major risk factors for stroke include smoking, hypertension, hypercholesterolemia, diabetes mellitus, elevated red blood cell count, vascular disorders, obesity, lack of physical activity, and alcohol consumption. Blood viscosity/thickness in stroke patients can be assessed based on hematological blood test results, including elevated hemoglobin levels, hematocrit values, and red blood cell counts compared to normal values obtained in the laboratory. Red blood cell indices, including MCV, MCH, and MCHC, are derived from hemoglobin, hematocrit, and red blood cell count test results. Research on erythrocyte indices in patients with ischemic and hemorrhagic strokes highlights the importance of understanding the role of hemoglobin, hematocrit, and erythrocytes in the clinical condition of stroke. The study results show that, specifically in ischemic strokes, 5 patients had low MCV values, while in hemorrhagic strokes, 1 patient exhibited the same. These findings indicate that monitoring erythrocyte indices can provide valuable insights into the management and prevention of stroke, as well as strengthen the relationship between hematological conditions and the severity of stroke. Based on these conditions, it is important to understand the erythrocyte indices in stroke patients.

Objective

The objective of this study is to determine the profile of erythrocyte indices (MCV, MCH, MCHC) in stroke patients.

Method

The type of research conducted in this study was descriptive, with a sample population of 24. Sampling was conducted using the total sampling method. This study was conducted at the inpatient facility of Kraton Regional General Hospital in Pekalongan Regency in January-February 2025. Data analysis was conducted descriptively and analytically, presented in tables and then narrated.

Results

The results of the study indicate that MCV levels were normal (80.00 um^3 – 100.00 um^3) in 24 samples (100%) with an average value of 85.32 um^3. The majority of MCH levels showed normal results (27.00 pg – 31.00 pg) in 18 samples (75%), 3 samples (12.5%) with low values, and 3 (12.5%) samples with high values, with an average value of 34.32 pg. The majority of MCHC levels showed normal results (30.00–35.00 g/dL) in 15 samples (62.5%), 9 samples had high values, and there were no low results, with an average value of 29.2 g/dL. The conclusion of this study is that the average results of MCV, MCH, and MCHC in the respondents were normal.

TABLE 1. Erythrocyte Index Values in Stroke Patients Based on MCV Levels (N=24)

No.	Sample Code	MCV level	Description
1.	Kh	87.70 um^3	Normal
2.	Nn	81.70 um^3	Normal
3.	Az	83.80 um^3	Normal
4.	Mh	80.80 um^3	Normal
5.	Nr	82.70 um^3	Normal
6.	Sp	82.00 um^3	Normal
7.	Ti	87.20 um^3	Normal
8.	Kh	82.90 um^3	Normal
9.	Ih	82.70 um^3	Normal
10.	Mq	82.60 um^3	Normal
11.	Mt	83.10 um^3	Normal
12.	Sr	88.70 um^3	Normal
13.	Rh	83.10 um^3	Normal
14.	Td	87.20 um^3	Normal
15.	Lk	85.00 um^3	Normal
16.	Aw	88.30 um^3	Normal
17.	Kl	88.30 um^3	Normal
18.	Sl	83.50 um^3	Normal
19.	Cs	88.80 um^3	Normal
20.	Si	92.90 um^3	Normal
21.	Ma	88.70 um^3	Normal
22.	Ms	83.20 um^3	Normal
23.	Uh	82.50 um^3	Normal
24.	Hu	90.30 um^3	Normal
	Minimum	80.8 um^3	
	Maximum	92,9 um^3	
	Mean	85,321 um^3	

TABLE 2. Distribution of Erythrocyte Index Values in Stroke Patients Based on MCV Levels

No.	MCV Level Categories	Frequency	Percentage (%)
1.	Low	0	0
2.	Normal	24	100
3.	High	0	0

The results of this study indicate that all MCV levels were normal (80.00 um^3 – 100.00 um^3) in 24 samples (100%) with an average of 85.32 um^3.

TABLE 3. Erythrocyte Index Values in Stroke Patients Based on MCH Levels (N=24)

No.	Sample Code	MCH level	Description
1.	Kh	31.40 pg	High
2.	Nn	29.30 pg	Normal
3.	Az	28.70 pg	Normal
4.	M	26.80 pg	Normal
5.	Nr	29.20 pg	Normal
6.	Sp	29.30 pg	Normal
7.	Ti	29.90 pg	Normal
8.	Kh	27.80 pg	Normal
9.	Ih	30.70 pg	Normal
10.	Mq	29.30 pg	Normal

11.	Mt	28.40 pg	Normal
12.	Sr	28.10 pg	Normal
13.	Rh	29.10 pg	Normal
14.	Td	31.10 pg	High
15.	Lk	30.20 pg	Normal
16.	Aw	30.70 pg	Normal
17.	Kl	26.60 pg	Low
18.	Sl	26.30 pg	Low
19.	Cs	28.80 pg	Normal
20.	Si	30.50 pg	Normal
21.	Ma	31.30 pg	High
22.	Ms	28.20 pg	Normal
23.	Uh	28.50 pg	Normal
24.	Hu	30.60 pg	Normal
	Minimum	26,3 pg	
	Maximum	31,4 pg	
	Mean	34,329 pg	

TABLE 4. Distribution of Erythrocyte Index Values in Stroke Patients Based on MCH Levels (N=24)

No.	MCH Level Categories	Frequency	Percentage (%)
1.	Low	3	12,5
2.	Normal	18	75
3.	High	3	12,5

The results of this study indicate that the majority of MCH levels were normal (27.00 pg – 31.00 pg) in 18 samples (75%) with an average of 34.32 pg.

TABLE 5. Erythrocyte Index Values in Stroke Patients Based on MCHC Levels (N=24)

No.	Sample Code	MCHC Level	Description
1.	Kh	35.80 g/dl	High
2.	Nn	35.90 g/dl	High
3.	Az	34.30 g/dl	Normal
4.	Mh	33.20 g/dl	Normal
5.	Nr	35.30 g/dl	High
6.	Sp	35.70 g/dl	High
7.	Ti	34.30 g/dl	Normal
8.	Kh	33.50 g/dl	Normal
9.	Ih	37.10 g/dl	High
10.	Mq	35.40 g/dl	High
11.	Mt	34.20 g/dl	Normal
12.	Sr	33.50 g/dl	Normal
13.	Rh	35.00 g/dl	Normal
14.	Td	35.70 g/dl	High
15.	Lk	35.50 g/dl	High
16.	Aw	34.80 g/dl	Normal
17.	Kl	30.30 g/dl	Normal
18.	Sl	31.60 g/dl	Normal
19.	Cs	32.40 g/dl	Normal
20.	Si	32.80 g/dl	Normal
21.	Ma	35.30 g/dl	High
22.	Ms	33.80 g/dl	Normal
23.	Uh	34.60 g/dl	Normal

24.	Hu	33.90 g/dl	Normal
	Minimum	30,3 g/dl	
	Maximum	37,1 g/dl	
	Mean	29,2 g/dl	

TABLE 6. Distribution of Erythrocyte Index Values in Stroke Patients Based on MCHC Levels (N=24)

No.	Category MCHC Level	Frequency	Percentage (%)
1.	Low	0	0
2.	Normal	15	62,5
3.	High	9	37,5

The results of this study indicate that the majority of MCHC levels were normal (30.00-35.00 g/dL) in 15 samples (62.5%) with an average of 29.2 g/dL.

Discussion

The results of this study indicate that the majority of MCHC levels are normal (30-35 g/dL). Lower MCHC levels are associated with mortality in ischemic stroke patients. There are reports that an increase in red blood cells (RBC) above normal levels can thicken the blood and increase the likelihood of clot formation, as well as increase the risk of stroke because this contributes to cerebrovascular blood viscosity. This may explain the high RBC index levels observed in stroke patients in this study; increased RBC index levels have been reported as risk factors for ischemic stroke, cardiovascular disease, and venous thromboembolism. There were significant differences in platelet counts, with stroke patients having higher values. This aligns with reports that elevated platelet levels may indicate increased platelet aggregation and activity in the early phase of stroke, and platelet count may serve as a predictor of stroke occurrence.

A study involving 15,154 hypertensive patients divided them into two groups based on MCHC values: the hypochromic group (MCHC ≤ 33 g/dL) and the non-hypochromic group (MCHC > 33 g/dL). The results showed that patients with low MCHC had a higher risk of death, both for all-cause mortality and cardiovascular mortality. In the analysis after propensity score matching (PSM), the hypochromic group had a hazard ratio (HR) of 1.26 (95% CI: 1.11–1.43) for all-cause mortality and 1.42 (95% CI: 1.12–1.80) for cardiovascular mortality, compared to the non-hypochromic group. Although the primary focus of this study was on hypertensive patients in general, the authors also noted that low MCHC levels have previously been reported as an independent risk factor for acute myocardial infarction and stroke. Thus, low MCHC levels not only reflect anemia but may also reflect iron imbalance, inflammation, and red blood cell dysfunction, all of which contribute to poor prognosis in vascular conditions such as stroke. Overall, low MCHC levels can be considered an important hematological indicator in evaluating mortality risk in patients with cardiovascular and cerebrovascular disorders, including stroke.

Conclusion

MCV levels showed normal results (80.00 um^3 – 100.00 um^3) in 24 samples (100%) with an average of 85.32 um^3. The majority of MCH levels showed normal results (27.00 pg – 31.00 pg) in 18 samples (75%), 3 samples (12.5%) with low values, and 3 samples (12.5%) with high values, with an average of 34.32 pg. The majority of MCHC

levels showed normal results (30.00–35.00 g/dL) in 15 samples (62.5%), 9 samples (37.5%) were high, and there were no low results, with an average value of 29.2 g/dL.

High MCV levels can increase the risk of death from ischemic heart disease and ischemic stroke. Low levels of Hb, RBC, Hct, MCV, MCH, and MCHC were observed in most ischemic stroke patients, exacerbating cerebral ischemia. Patients who have experienced an ischemic stroke often have low MCH levels, while those with high MCH levels are more likely to experience major cardiovascular events (MACE). After a stroke, low MCHC levels are also associated with a higher risk of mortality. On the other hand, elevated RBC levels above normal increase the risk of stroke and blood viscosity. The conclusion of this study is that the average MCV, MCH, and MCHC levels in the respondents were normal.

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