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Original Research Article

Study to Determine the Prognosis of Acute Ischemic Stroke and Compare Mean Hematological Parameters Based on the Prognosis of Acute Ischemic Stroke

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Abstract

Aim: The aim of the present study was to determine the prognosis of acute ischemic stroke and compare mean hematological parameters based on the prognosis of acute ischemic stroke.

Methods: This Descriptive case series was conducted in the Department of Pathology for one year.100 patients fulfilling the selection criteria were selected.

Results: The Mean±SD for the quantitative variables Hemoglobin, total leukocyte count, platelet, mean platelet volume, ESR & CRP are 10.5±2.8, 14.6±12.0, 144.6±92.8, 16.4±10.5, 43.4±36.4 & 18.6±22.5 respectively. There was an association between the Outcome (rather expired or discharged) of the patients with the variables like Hemoglobin, TCL, Platelet, MPV, ESR & CRP as all p-values were significant. Mean Discharged group was greater than mean Expired group in Hemoglobin & Platelet, mean Expired group is greater than mean Discharged group in TLC, MPV, ESR & CRP. Levene's Test for Equality of Variances had p-values for Hemoglobin, TLC, Platelet, MPV, ESR & CRP in Expired & Discharged group showed all significant p- values as these were less than 0.05 & concludes that the variances of Expired group & Discharged group were significantly different.

Conclusion: We concluded that a significant change was found in hematological parameters in ischemic stroke patients. In light of our results that depicted the difference in the readings of the values for each parameter like hemoglobin, erythrocyte sedimentation rate, platelets count, mean platelet volume, C-reactive protein, and leukocyte count we suggest that these hematological parameters can be used as a tool to take the measures necessary for the prevention of future damage by stroke.

Keywords: Stroke, Hematological Parameters, and Prognosis

Introduction

Stroke is known as the second most common cause of mortality and the third most common cause of morbidity all over the world. [1,2] In 2013, about 10 million individuals had a stroke. [3] Through the years, the incidence of stroke has decreased in developed countries and increased in developing countries.4 Besides death, stroke has always been known as one of the most debilitating health conditions known to affect patients physically, mentally, and emotionally. [5-7] Because of this concern, patients always ask about the prognosis and possibility of symptoms of withdrawal after strokes, and also physicians have always tried to minimize the consequences of stroke.

Rehabilitating and trying to return the patients' functional status to the functional state before the stroke has been always one of the main policies in treating patients with stroke. Thus, prognosis assessment has been always of significant importance. [8] Many factors have been proposed to be involved in the prognosis of stroke. Stroke subtype, patient age, the severity of the stroke, and infarct location are factors influencing the prognosis of stroke. [9-11] Ischemic stroke (IS) is one of the leading causes of disability and death around world. [12-14] Prognostic assessment is crucial for treatment selection. [15] However, prognostic assessment is really a challenge for clinicians. Although accumulated prognostic factors have been widely validated by previous studies, these factors have some limitations, such as high observer variability and cost. [16]

Besides, these factors, when used alone or in combination, cannot predict the prognosis of IS

patients adequately. [16] Therefore, it is of great value to explore more factors with low cost and variability. During past years, some studies have revealed that routine hematological parameters (eg, red blood cell distribution width [RDW] [17,18] and neutrophil to lymphocyte ratio [NLR] [19,20] are associated with prognosis of IS. Predicting outcomes in stroke remains an unanswered question. Most studies focus on conventional risk factors, clinical conditions, and radiological parameters.

The aim of the present study was to determine the prognosis of acute ischemic stroke and compare mean hematological parameters based on the prognosis of acute ischemic stroke.

Materials and Methods

This Descriptive case series was conducted in the Department of Pathology, Government Medical College and Hospital, Bettiah, West Champaran, Bihar, India for one year .100 patients fulfilling the selection criteria were selected.

Inclusion Criteria

- Patient with acute ischemic stroke presenting within 72 hrs of the onset of symptoms of stroke was included.

Exclusion Criteria Used Was:

- Patients were admitted 72 hours after the onset of symptoms of a stroke
- Patients with stroke due to trauma, tumor, infection, infarction, or bleeding
- Patients with known thyroid disease
- Patients with known hematological disorder

Approval from the Institutional Research committee and informed consent was obtained. Data regarding demographic information (name and age) and hospital registration numbers were obtained. Then blood sample from each patient was obtained under aseptic measures by using a 3 cc syringe containing EDTA. After mixing the sample on the rotator the complete blood picture was obtained with the help of an automated blood counter, i.e., sysmex or mindray. ESR was measured with the help of the westergren method. A sample for CRP was taken in gel tube and is then analyzed by means of an agglutination technique. Reports were assessed by the researcher herself and all the information was recorded in the study proforma. The collected data was entered and analyzed through SPSS version 22.0.Mean & Standard deviation was calculated for quantitative variables i.e; Hemoglobin, total leukocyte count, platelet, mean platelet volume, ESR & CRP. Frequency, percentage & Pie graph for qualitative variable Outcome.

Spearman'srho Correlation for association between Outcome with Hemoglobin, TLC, Platelet, MPV, ESR & CRP.Means comparison between Expired group & Discharged group with Hemoglobin, TLC, Platelet, MPV, ESR & CRP using Independent sample's t-test. A p-value of < 0.05 was taken as statistically significant.

Results

Table 1: Mean & Standard Deviation of quantitative variables

Variables	Mean	Standard Deviation
Hemoglobin (g/dl)	10.5	2.8
Total Leukocyte Count (TLC) x 10^9/L	14.6	12.0
Platelet x 109/L	144.6	92.8
Mean Platelet Volume (fl)	16.4	10.5
ESR Mm/hr	43.4	36.4
CRP mg/l	18.6	22.5

The Mean±SD for the quantitative variables Hemoglobin, total leukocyte count, platelet, mean platelet volume, ESR & CRP are 10.5±2.8, 14.6±12.0, 144.6±92.8, 16.4±10.5, 43.4±36.4 & 18.6±22.5 respectively.

Table 2: Spearman's Rho Correlation Association of Outcome with Hemoglobin, TCL, Platelet, MPV, ESR & CRP

Variables	P-value	Spearman's Rho Coefficient
Hemoglobin (g/dl)	0.015	0.224
Total Leukocyte Count (TCL) x 10^9/L	0.025	-0.205
Platelet x 109/L	0.028	0.195
Mean Platelet Volume (fl)	0.000	-0.323
ESR Mm/hr	0.027	-0.193
CRP mg/l	0.014	-0.216

There was an association between the Outcome (rather expired or discharged) of the patients with the variables like Hemoglobin, TCL, Platelet, MPV, ESR & CRP as all p-values were significant.

Table 3: Means comparison with Discharged & Expired groups

Variables	Outcomes	Mean	Standard Deviation
Hemoglobin (g/dl)	Expired Discharged	8.52 12.03	3.24 2.28
Total Leukocyte Count (TCL) x10^9/L	Expired Discharged	16.34 12.58	12.68 5.90
Platelet x 109/L	Expired Discharged	127.23 162.28	98.62 84.66
Mean Platelet Volume (fl)	Expired Discharged	18.84 12.88	12.38 5.95
ESR Mm/hr	Expired Discharged	48.92 35.12	38.12 30.32
CRP mg/l	Expired Discharged	26.44 10.82	28.42 16.12

Mean Discharged group was greater than mean Expired group in Hemoglobin & Platelet, mean Expired group is greater than mean Discharged group in TLC, MPV, ESR & CRP.

Table 4: Independent Samples Test

Equal variances assumed / not assumed	Levene's Test forEquality of Variances		t-test for Equality of Means						
	F	Sig.	t	Df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Upper	Lower
Hemoglobin (g/dl)									
Equal variances assumed	11.937	.001	-2.940	128	.004	-1.4598	.4965	-2.4422	-.4773
Equal variances not assumed			-2.988	120.015	.003	-1.4598	.4886	-2.4271	-.4924
Total Leukocyte Count X 109/L									
Equal variances assumed	15.826	.000	3.112	128	.002	5.8464	1.8788	2.1289	9.5640
Equal variances not assumed			3.212	93.383	.002	5.8464	1.8203	2.2320	9.4609
Platelet X 109 /L									
Equal variances assumed	6.439	.012	-2.093	128	.038	-34.054	16.274	-66.254	-1.853
Equal variances not assumed			-2.106	127.702	.037	-34.054	16.168	-66.045	-2.063
Mean Platelet Volume (fl)									
Equal variances assumed	25.477	.000	4.082	128	.000	7.060	1.729	3.638	10.482
Equal variances not assumed			4.204	97.830	.000	7.060	1.679	3.727	10.393
ESR Mm/hr									
Equal variances assumed	8.833	.004	2.558	128	.012	15.815	6.183	3.581	28.049
Equal variances not assumed			2.588	124.807	.011	15.815	6.112	3.719	27.911
CRP mg/l									
Equal variances assumed	40.462	.000	3.712	128	.000	14.608	3.935	6.821	22.394
Equal variances not assumed			3.805	106.183	.000	14.608	3.839	6.997	22.218

Levene's Test for Equality of Variances had p-values for Hemoglobin, TLC, Platelet, MPV, ESR & CRP in Expired & Discharged group showed all significant p- values as these were less than 0.05 & concludes that the variances of Expired group & Discharged group were significantly different.

Discussion

Stroke is the second most common cause of death and is a major cause of serious morbidity and mortality worlwide. [21] It is now the need of the hour to have a reasonable assessment of the burden of diseases like Stroke as evaluated by the highly influential Global Burden of Disease (GBD) publications. [22] The most important feature of ischemia is impeded perfusion to the brain due to poor blood flow. The chance of having infarction increases if more than 95% of cerebral blood flow(CBF) in the affected tissue area falls to less than 25% of its normal value as revealed by the literature review. However, the chance infarction is just 5% if CBF in the affected tissue area is above 50% of its normal value. [23]

The Mean±SD for the quantitative variables Hemoglobin, total leukocyte count, platelet, mean platelet volume, ESR & CRP are 10.5±2.8, 14.6±12.0, 144.6±92.8, 16.4±10.5, 43.4±36.4 & 18.6±22.5 respectively. There was an association between the Outcome (rather expired or discharged) of the patients with the variables like Hemoglobin, TCL, Platelet, MPV, ESR & CRP as all p-values were significant. It was seen that the patients that expired within 72 hours of stroke had their mean hemoglobin levels at a much lower level as compared to the normal range of hemoglobin. Whereas the mean hemoglobin levels for the patients that were discharged had their hemoglobin

levels close to the normal range. It was seen that for both groups, hemoglobin concentration was found to be lower than normal. The association between lower levels of hemoglobin and stroke is unknown. However, there is a possible explanation for its role in carrying and supplying oxygen. Hemoglobin is known to carry 98 percent of blood oxygen. Since the brain with a stroke is under the influence of trauma, this might hinder its ability to increase the extraction of available oxygen. However, the increased mortality rate can be explained through different mechanisms. [24] First, with the decrease in hemoglobin levels, oxygen-carrying capacity is also lowered, hence intensifying ischemia. This can cause hypoxia within the penumbral lesions of patients with ischemic stroke. [25] Secondly, lower levels of hemoglobin may lead to hyperdynamic circulation which is known to modulate the expression of adhesion molecules on vascular endothelial cells by upregulating their production. This can cause an inflammatory response responsible for thrombus formulation. [26]

Mean Discharged group was greater than mean Expired group in Hemoglobin & Platelet, mean Expired group is greater than mean Discharged group in TLC, MPV, ESR & CRP. Levene's Test for Equality of Variances had p-values for Hemoglobin, TLC, Platelet, MPV, ESR & CRP in Expired & Discharged group showed all significant p- values as these were less than 0.05 & concludes that the variances of Expired group & Discharged group were significantly different. The previous study revealed that RDW is positively correlated with inflammatory markers, [27] such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR). In a recent study, a positive correlation between NLR, CRP and ESR was also observed in general populations visited hospital for healthy checking. [28]

ESR is a commonly known inexpensive laboratory test that is used for the assessment of acute response. An increase in fibrinogen concentration is indicated, with an increase in the erythrocyte sedimentation rate at the time of acute stroke, which is responsible for the reduction in cerebral blood flow. [29] It has been reported in previous studies that an increase in leukocytes and ESR are associated with the worst outcomes in ischemic stroke patients. [30] An increase in white blood cell or leukocyte counts right after the ischemic stroke indicates a strong prognosis for in-hospital mortality. [31] Song et. Al [32] (2010) found that there was a significantly positive relation between CRP levels and poor outcomes of ischemic stroke. Like this, Rajeshwar et al [33] (2012) did a comparative study and found that high CRP levels are associated with poor outcomes in ischemic stroke patients.

Conclusion

We concluded that a significant change was found in hematological parameters in ischemic stroke patients. In light of our results that depicted the difference in the readings of the values for each parameter like hemoglobin, erythrocyte sedimentation rate, platelets count, mean platelet volume, C-reactive protein, and leukocyte count we suggest that these hematological parameters can be used as a tool to take the measures necessary for the prevention of future damage by stroke.

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