

Study of Association Between Red Blood Cell Parameters And Ischemic Stroke Mortality

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Abstract:

Background: There are myriad of factors which influence the ischemic stroke outcome. This study evaluated association between Red Blood Cell parameters & ischemic stroke mortality.

Materials and Methods: In this observational prospective study, 94 patients of ischemic stroke were evaluated. Patients who fulfilled the inclusion criteria were evaluated in the study for a period of one year from December 2019 to December 2020, after taking ethical clearance from institutional ethical committee. Stroke evaluation was done with clinical, biochemical & radiological methods. Data analysis was done using independent 't' test and Chi square tests in SPSS IBM version 21.0

Results: A total of 94 subjects (67% men and 33% women) with the mean age of 56±9.3 years were assessed. Statistical test was applied to find any association of outcomes of ischemic stroke and RBC indices. It was observed that lower values of HCT, MCV, MCH, MCHC were associated with poor outcome in form of death.

Conclusion: Lower values of MCV, HCT, MCH, MCHC were associated with mortality in ischemic stroke patients, but how these associations may be influenced by extraneous factors that were not considered here should be investigated in the future.

Key Word: Ischemic stroke, Red Blood Cell parameters, MCV, HCT, MCH, MCHC.

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I. Introduction

Stroke, a growing epidemic, is an important cause of mortality and disability worldwide¹. It remains the third leading cause of death and leading cause of severe disability in the United States, Europe and portions of Asia in young¹. Many studies have highlighted the prognostic importance of various laboratory parameters like blood sugar, total leukocyte count, and erythrocyte sedimentation rate (ESR) in stroke patients, but how red blood cells affect stroke risk has not been fully elucidated. In the present study, the association between the different RBC indices in ischemic stroke patients were assessed.

II. Material And Methods

This prospective comparative study was carried out on patients of Department of Medicine at Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur, Madhya Pradesh, India from December 2019 to December 2020. A total 94 adult subjects (both male and females) of aged ≥ 18 years were taken for this study.

Study Design: Prospective open label observational study.

Study Location: This was a tertiary care teaching Hospital based study done in Department of Medicine. at Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur, Madhya Pradesh, India.

Study Duration: December 2019 to December 2020.

Sample size: 94 patients.

Sample size calculation: By considering expected prevalence as 3% from previous literature with margin of error 4%, the sample size of 72 was obtained. Further, considering a factor of drop outs with assumed percentage of 20% and confidence level of 95%, a sample size of 86 was achieved. Total sample size recruited was 94.

Subjects & selection method: Patients fulfilling inclusion criteria and willing to participate in the study were included. As the study participants were the patients presenting with ischemic stroke at department of Medicine, and their samples were collected. Informed written consent was taken from the Guardian/attender who were willing to participate in the study.

Inclusion criteria:

1. Patients with evidence of ischemic stroke in Plain CT brain.
2. Patients with age \geq 18 year, both sexes.

Exclusion criteria:

1. Patients with systemic condition that affect MCV for e.g., Hypothyroidism, Rheumatoid arthritis, Cancer.
2. Patient on medications that affect MCV, e.g., Allopurinol, Hydroxyurea, etc.

Procedure methodology

After obtaining written informed consent in local vernacular language, the patients who were fulfilling the inclusion criteria were included in the study. History of onset, progression, duration of various symptoms was noted. Past history for any co morbid conditions, personal history regarding smoking and alcohol use and treatment history were elicited in addition to general physical examination with charting of the vitals and laboratory investigation like Complete hemogram, liver function tests, Renal function tests. All the records were recorded by using structured schedule (case report form) and entered in Microsoft Excel Sheet. All biochemical assays were carried out by the same team of laboratory technicians using the same method, throughout the study period.

Statistical analysis

The data collection sheet was checked for completeness and correctness before entering into the worksheet. All the data collected were entered in to a spread sheet on Micro Soft Office Excel Sheet and later transferred to SPSS IBM version 21.0 for analysis. The qualitative variables are described in the form of proportions and quantitative variables are described in the terms of mean, median, range and standard deviation. Required univariate and bivariate analysis was done Data was checked for normality before applying appropriate tests of significance. Significance of difference in means was calculated using independent ‘t’ test and Chi square tests. Significance of p value was taken as $p < 0.05$.

III. Result

Table no.1 shows that out of 94 patients majority of patients fall in 45-65 year age group (72.34%, n= 68) followed by patients that were above the age of 65 year (18.08%, n=17). Only 9 patients were less than 45 year of age (9.57%, n=9). The age of study participant ranged from 30 – 73 years with mean \pm SD age of 56 ± 9.3 years.

TABLE 1: Age wise distribution of subjects.

Age group (yrs)	Total Number (%)
<45	9 (9.57 %)
45-65	68 (72.34 %)
>65	17 (18.08 %)

Table no 2 shows that majority of patients encountered in the present study were males (n=63, 67%) followed by females (n=31, 33%).

Table 2: Gender wise distribution of subjects.

GENDER	FREQUENCY	PERCENT
MALE	63	67
FEMALE	31	33
TOTAL	94	100

Table no. 3 shows that out of 94 patients, 11 got expired during hospital stay.

Table 3: Distribution of the study participants with clinical outcome.

S.No.	Clinical outcome	N (%)
1	Death	11 (11.7%)
2	Alive	83 (88.3%)

Table no. 4 shows that mean RBC was 4.4 ± 0.26 lakh per cubic mm among survivors and 4.5 ± 0.32 lakh per cubic mm among expired. The mean values of HCT, MCV, MCH, MCHC were $39.2 \pm 1.2\%$, 85.7 ± 3.4 fL, 30.2 ± 1.2 pg, 32.3 ± 0.79 g/dL among survivors and $36.9 \pm 2.0\%$, 80.8 ± 0.5 fL, 28 ± 2.0 pg, 31.0 ± 0.00 g/dL among expired. Independent t test was applied to find any association of outcomes of stroke and RBC indices such as MCV, HCT, MCH, MCHC and RBC. It was observed that lower values of MCV, HCT, MCH and MCHC were associated with mortality among ischemic stroke patients. (p value < 0.001).

Table 4 Distribution of mortality in relation to different RBC indices.

S. No.	Variables	Mean(SD)	t value	Mean Difference	95%CI	p value
1.	MCV (fL)					
	Recovery	85.7(± 3.4)	4.607	4.09	2.79-7.03	< 0.001
Death	80.8(± 0.5)					
2.	HCT (%)					
	Recovery	39.2(± 1.2)	5.33	2.3	0.4- 3.1	< 0.001
Death	36.9(± 2.0)					
3.	MCH (pg)					
	Recovery	30.2(± 1.2)	5.69	2.25	1.46- 3.03	< 0.001
Death	28(± 2.0)					
4.	MCHC (g/dL)					
	Recovery	32.3(± 0.79)	5.46	1.3	0.88- 1.8	< 0.001
Death	31.0(± 0.00)					
5.	RBC (million/mm³)					
	Recovery	4.4(± 0.26)	1.34	0.117	0.05- 0.292	0.184
Death	4.5(± 0.32)					

IV. Discussion

Many studies have highlighted the prognostic importance of various laboratory parameters like blood sugar, total leukocyte count, and erythrocyte sedimentation rate (ESR) in stroke patients^{2,3}. But, how red blood cells affect stroke risk has not been fully elucidated. One case-control study conducted in 2001 identified an association between MCV and peripheral arterial disease in male subjects⁴. MCV may also predict left atrial stasis in patients with non-valvular atrial fibrillation⁵. Based on these findings, elevated MCV may play a significant role in ischemic vascular disease^{6,7}. Solak Y et al⁸ showed that the MCV was inversely correlated with flow-mediated dilatation, indicating that the MCV is associated with endothelial function. Therefore, an elevated MCV may reflect the severity of atherosclerosis.

In this study, association between different Red Blood Cell parameters and mortality in ischemic stroke patients was assessed. In current study the age of study participant ranged from 30 – 73 years with mean \pm SD age of 56 ± 9.3 years, which is similar to study done by Sylaja et al⁹ and in contrast to study done by

Fonarow GC et al¹⁰. Majority of patients encountered in the present study were males (n=63, 67%) followed by females (n=31, 33%), which is similar to study findings by Palm et al¹¹ and Sylaja et al⁹ and in contrast to the finding of the study done by Fonarow GC et al¹⁰.

In our study, mortality due to ischemic stroke was 11.7 %, similar results were found in study done by Bath et al¹², while Sylaja et al⁹ reported 7.9% mortality in ischemic stroke patients. It was observed that lower values of HCT, MCV, MCH, MCHC were associated with poor outcome (P value <.001) in form of death. It is in contrast to study done by Sharif S et al¹³, Hatamian et al¹⁴ and Wuth et al¹⁵,

V. Conclusion

In current study, lower values of MCV, HCT, MCH, MCHC were associated with mortality in ischemic stroke patients, but this study has its limitation of small number of patients, so further studies are needed for generalization of results.

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