

Evaluation of Red Cell Distribution Width(RDW) in patients with Acute Stroke

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Abstract

Introduction: Stroke is becoming an important cause of premature death and disability in developing countries like India, primarily because of demographic changes and increasing prevalence of the key modifiable risk factors. Red cell Distribution Width is an important hematological parameter which is now being found to associated with increased risk of stroke. **Objective:** To study the correlation between Red cell Distribution Width(RDW) and occurrence of acute stroke. **Materials and Methods:** This was an observational cross sectional study conducted at Shyam Shah Medical College Rewa, between April 2019 to June 2020. 150 patients with acute stroke were included in study along with 150 age matched controls. Red cell Distribution Width(RDW) was measured for cases as well as controls. Data were statistically analyzed. **Results:** Red Cell Distribution width was positively associated with occurrence of stroke, particularly ischemic stroke. It was not significantly associated with occurrence of hemorrhagic stroke. **Conclusion:** RDW can help in predicting the occurrence of stroke. Therefore it can work as a tool which can be used to identify individuals at high risk of stroke.

Keywords: Stroke, death

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Introduction

The World Health Organization defined stroke as a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours" Stroke is one of the leading causes of death and disability in developed as well as developing countries. Stroke is becoming an important cause of premature death and disability in low-income and middle-income countries like India, largely driven by demographic changes and enhanced by the increasing prevalence of the key modifiable risk factors. The mortality rate of stroke in the acute phase is as high as 20% and it remains higher for several years after the acute event in stroke patients than in the general population. Cerebral ischemia initiates a complex cascade of metabolic events, generating nitric oxide and free oxygen radicals. These free radicals and reactive oxygen species (ROS) mediate a great part of injuries appearing after a transitory ischemic attack or during permanent ischemia, modifying macromolecules especially DNA, initiating apoptosis and necrosis. Various hematological and biochemical parameters have emerged in recent times which are associated with increased occurrence of stroke. The Red Cell Distribution Width (RDW) is a parameter that reflects the heterogeneity of the red blood cell volume. RDW is elevated according to variation in red cell size (anisocytosis), ie, when elevated RDW is reported on complete blood count, marked anisocytosis (increased variation in red cell size) is expected on peripheral blood smear review. Much research has suggested that RDW is closely related to many vascular events, such as acute coronary syndrome, ischaemic cerebrovascular disease, peripheral artery disease, heart failure (HF), atrial fibrillation (AF) and hypertension. [1] RDW can be a potential marker to predict

occurrence of stroke in apparently healthy people. Therefore there is a need to evaluate the association of RDW with occurrence of acute stroke.

Material and methods

This was an observational study conducted from April 2019 to June 2020 in Shyam Shah Medical College and Sanjay Gandhi Memorial Hospital Rewa M.P. 150 cases of acute stroke primarily diagnosed with history and clinical examination, and further evaluated by available brain imaging modality (Computerised tomography or MRI) were included in the study. 150 controls were also included, who were age matched patients admitted for conditions other than stroke.

Inclusion Criteria: Patients admitted with symptoms suggestive of acute stroke within 24 hours of onset of stroke as evidenced by CT Scan or MRI.

Exclusion criteria: Patients below 18 years of age.

Hematological abnormalities like leukemia or other

myeloproliferative disorder

Patients of CKD due to any cause

Hematological conditions related to increased RDW

Data collection and methods: Patients selected after considering inclusion and exclusion criteria underwent detailed history taking followed by clinical examination. This was followed by hematological and biochemical assessment which included Complete Blood Count with RDW, and other baseline investigations. Similar assessment was done for individuals included in control group. Data thus obtained were recorded in a predesigned proforma.

Statistical Analysis: Data were entered on Microsoft Excel worksheet. Mean values were calculated for parameter under study. Comparison between mean values was done using independent sample T test. P value < 0.01 was considered significant. Statistical analysis was done on GraphPad Prism 8 software.

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Observations and results

Table 1: Age and sex distribution in stroke patients

Age (Years)	Male	Female	Total	Percent
21-30	2	2	4	2.7
31-40	9	6	15	10.0
41-50	22	8	30	20.0
51-60	24	17	41	27.3
61-70	21	21	42	28.0
71-80	6	6	12	8.0
81-90	1	3	4	2.7
91-100	1	1	2	1.3
Total	87	63	150	100.0

As evident from Table 1, among total 150 patients studied the incidence of stroke in the present study was more common in 5th and 6th decade and there was slight male (58%) preponderance compared to females (42%) making male-female ratio of 1.4:1 Average age of patients was 55.9 years. Male patients had average age 54.5 years while female patients had average age of 57.7 years.

Table 2: Incidence of Infarct & Hemorrhage

Type of stroke	Male		Female		Total	Percent
	No	%	No	%		
Infarct	54	51.9	50	48.1	104	69.3
Hemorrhage	28	60.9	18	39.1	46	30.7
Total	82		68		150	100.00

Table 2 shows the incidence of infarct was (69.3%) more common compared to hemorrhage (30.7%) . 51.9% of ischemic stroke occurred in males while 48.1% occurred in females. 60.9% of total hemorrhagic stroke occurred in males while 39.1% occurred in females.

Table 3 : RDW(%) in patients with stroke compared with controls

RDW	Mean(%)	SD(%)	P value 0.003
Cases(n=150)	14.42	1.64	
Controls(n=150)	13.78	1.38	

RDW in the stroke patients ranged from 10.09 % to 18.31 % and in control subjects ranged from 9.86 % to 17.75 %. As evident by Table 3, the mean RDW in stroke patients was found to be 14.42 % with standard deviation 1.64 %, while mean RDW in controls was found to be 13.78 % with standard deviation of 1.38 % .The difference was found to be statistically significant with p<0.01.

Table 4 :RDW(%) in patients with ischemic stroke compared to controls

RDW	Mean(%)	SD(%)	P value 0.001
Cases(n=104)	14.58	1.77	
Controls(n=150)	13.78	1.38	

As seen in Table 4, RDW in patients with ischemic stroke had a mean value of 14.58% with standard deviation of 1.77 % compared with control subjects who had mean RDW of 13.78% with standard deviation of 1.38%. The difference was statistically significant with p<0.01.

Table 5:RDW(%) in patients with hemorrhagic stroke compared to controls

RDW	Mean(%)	SD(%)	P value 0.280
Cases(n=46)	14.06	1.25	
Controls(n=150)	13.78	1.38	

As seen in Table 5, RDW in patients with hemorrhagic stroke had a mean value of 14.06% with standard deviation of 1.25 % compared with control subjects who had mean RDW of 13.78% with standard deviation of 1.38%. This difference was not found to be statistically significant as p value was >0.01.

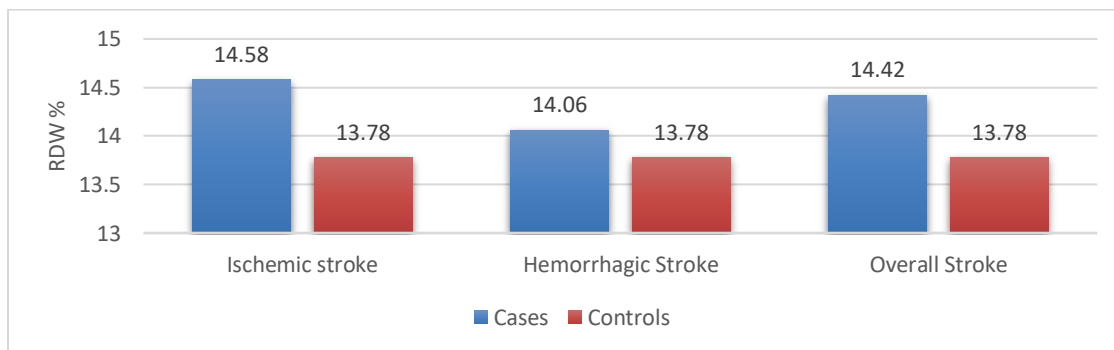


Fig 1: RDW in stroke patients compared with controls

Discussion

Our study showed that mean RDW in stroke patients was higher (14.42±1.64%) compared to controls (13.78±1.38%). This difference was statistically significant. A cohort study conducted by Ani et al (2009) [2] found that mean RDW was significantly higher among persons with stroke compared to individuals without stroke (13.7 % vs 13.2%, $p < 0.001$). This was similar to results obtained by us. A metaanalysis conducted by Li et al (2020) [3] included 6 studies concluded that RDW level in patients with stroke was significantly higher than in those without stroke ($p < 0.001$).

Ischemic Stroke-In our study patients with ischemic stroke had mean RDW of 14.58±1.77%, which was significantly higher than RDW of controls which was 13.78±1.38% ($p < 0.01$). Our results were comparable to those obtained in a case control study by Moreno et al (2013) [4] where patients with ischemic stroke had mean RDW of 14.48±1.76 compared to controls with mean RDW 13.91±1.43. ($p < 0.01$) A population based cohort study by Soderholm et al (2015) [5] concluded that RDW in the highest quartile was associated with increased incidence of total stroke and cerebral infarction. A metaanalysis by Feng et al (2017) [6] concluded that increased RDW value is likely associated with ischaemic cerebrovascular disease, carotid artery atherosclerosis and cerebral embolism.

Hemorrhagic stroke-In our study mean RDW in patients with hemorrhagic stroke was found to be higher (14.06±1.25) as compared to controls (RDW 13.78±1.38). However this difference was not found to be statistically significant. Soderholm et al (2015) [5] in their cohort study concluded that there is no significant association between RDW and incidence of intracerebral or sub arachnoid hemorrhage. This is similar to our result. However, a study conducted by Altintas et al (2017) [7] showed that there is significant relationship between RDW and hematoma growth in patients with hypertensive ICH, which indirectly indicates RDW may be associated with occurrence of hemorrhagic stroke. In a study by Wang et al (2019) [8] it was shown that RDW is associated with hemorrhagic transformation in acute ischemic stroke patients, pointing towards a possible association of RDW with ICH.

Conclusion

Red Cell Distribution Width was positively associated with occurrence of stroke, particularly ischemic stroke. It was not significantly associated with occurrence of hemorrhagic stroke. Stroke is one of the leading causes of death and disability worldwide.

Conflict of Interest: Nil

Source of support: Nil

RDW can help in predicting the occurrence of stroke. Therefore it can work as a tool which can be used to identify individuals at high risk of stroke. Such individuals can be offered lifestyle modification and other interventions which can help in primary prevention of stroke.

Limitations

1. This study was done on a relatively smaller sample size. Larger sample size would have ensured greater applicability of results to general population.
2. This was an observational cross sectional study. A prospective follow up study would be more helpful in drawing definite conclusions.

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