Effect of Red Blood Cell Distribution Width on The Mortality f Patients With Ischemic Stroke

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Abstract

Objective: To investigate a possible correlation between elevated levels of red blood cell distribution width (RDW) and the mortality of ischemic stroke.

Patients and methods: Seventy patients admitted to Merjan Medical City in Babylon; suffering from ischemic stroke were enrolled in this study which lasted from February to June 2014. The study contain 40 males and 30 females, their ages ranged from 36-97 years with a mean age of 69.26±14.870 years. The patients were divided into two groups: those who survive the disease and those who died; in order to assess the impact of RDW values on the severity and mortality of the disease. Blood samples were taken from the patients to estimate RDW.

Results: The study results showed a statistically significant difference between the two groups of patients regarding the values of RDW and the age distribution, on the other hand, there were no statistically significant differences between the two groups of patients regarding sex distribution and history of diabetes, hypertension and previous stroke attack.

Conclusion: Red blood cell distribution width is an independent predictor of mortality in patients with ischemic stroke. Higher RDW values correspond to higher mortality.

Keywords: Red blood cell distribution width, stroke, mortality.

تأثير نطاق توزيع خلايا الدم الحمراء على معدل وفيات مرضى السكتة الدماغية الاسكيمية

الخلاصة

الهدف: استقصاء العلاقة الممكنة بين المعدلات المرتفعة لنطاق توزيع خلايا الدم الحمراء ومعدل وفيات السكتة الدماغية الاسكيمية.

المرضى وطرق العمل: سبعون مريضاً أدخلوا إلى مدينة مرجان الطبية في بابل؛ يعانون من السكتة الدماغية الاسكيمية تضمنتهم هذه الدراسة والتي استمرت من شباط إلى حزيران ٢٠١٤. تضمنت الدراسة ٤٠ ذكراً و ٣٠ أنثى، تراوحت أعمارهم بين ٣٦–٩٧ سنة وبمعدل عمري هو ٦٩,٢٦±١٤,٨٧٠ سنة. قسم المرضى إلى مجموعتين: أولئك الذين بقوا على قيد الحياة وأولئك الذين توفوا؛ لأجل تقييم تأثير المستويات المرتفعة لنطاق توزيع خلايا الدم الحمراء على شدة ومعدل وفيات المرض. جمعت عينات دم من المرضى لقياس نطاق توزيع خلايا الدم الحمراء.

النتائج: أظهرت الدراسة فرقاً احصائياً معنوياً بين مجموعتي المرضى فيما يخص قيم نطاق توزيع خلايا الدم الحمراء والتوزيع العمري، من جانب آخر، لم يكن هنالك فروق احصائية معنوية بين مجموعتي المرضى فيما يخص توزيع الجنس والتاريخ المرضي لمرض السكري، ارتفاع ضغط الدم والإصابة السابقة بالسكتة الدماغية.

الاستنتاج: نطاق توزيع خلايا الدم الحمراء عامل متنبئ مستقل لمعدل وفيات مرضى السكتة الدماغية الاسكيمية. المستويات المرتفعة لنطاق توزيع خلايا الدم الحمراء تنسجم مع مستويات مرتفعة لمعدل وفيات المرض.

الكلمات الدالة: نطاق توزيع خلايا الدم الحمراء، السكتة الدماغية، معدل الوفيات.

Introduction

All over the world, stroke is the first most common cause of permanent disability, the second most common cause of dementia and the third most common cause of the mortality. Ischemic strokes account for the 87% of the stroke cases (1).

Red blood cell distribution width (RDW) is the coefficient of variation of the mean corpuscular volume(MCV) and therefore higher RDW values reflect greater heterogeneity in anisocytosis ,which is usually caused by perturbation in erythrocyte maturation or degradation(2). RDW is also elevated in patients with anemia or thalassemia and after a blood transfusion or in the presence of iron deficiency (2). Although the exact physiologic mechanisms that underlie the association of RDW with survival are unknown, systemic factors that alter erythrocyte homeostasis, such as inflammation and oxidative stress(oxidative stress shortens red blood cell survival), likely play a role. Inflammation might contribute to increased RDW levels by not only impairing iron metabolism but also by inhibiting the production of or response to erythropoietin or by shortening red blood cell survival. In recent years there have been studies referring to RDW variation in patients with heart failure, with acute coronary syndromes and various non-cardiological conditions including stroke (3).

This study aims to investigate a possible correlation between elevated levels of RDW and the mortality of ischemic stroke.

Patients and Methods

Seventy patients admitted to Merjan Medical City in Babylon; suffering from ischemic stroke were enrolled in this study which lasted from February to June 2014. The study contain 40 males and 30 females, their ages ranged from 36-97 years with a mean age of 69.26±14.870 years. The diagnosis of ischemic stroke was confirmed by cranial CT scan which was done at the first day of the disease attack. Study data were collected from the patients including age and sex, history of diabetes, hypertension and previous attack of stroke, and blood samples to test for RDW. Those blood samples were taken by the use of EDTA tubes and were processed in an automated hematological analysis system (Ruby analyzer, Abbott Diagnostic, USA).

Several days after the attack of disease; the patients were divided into two groups: those who survive the disease and those who died; in order to assess the impact of RDW values on the severity and mortality of the disease.

Statistical analysis:

The two groups of stroke patients were analyzed by the use of independent-samples t-test for the numerical variables which were expressed as mean ± standard deviation; and chi-square test for the categorical variables which were expressed as numbers and percentages. Both tests were done by the aid of SPSS 15.0 software (SPSS Inc., Chicago, IL, USA). $P<0.05$ was considered statistically significant.

Results

The study results showed a statistically significant difference between the two groups of patients regarding the values of RDW and the age distribution; as shown in tables (1) and (2).

Table (1) Values of red cell distribution width for ischemic stroke patients

Groups	RDW (%) Mean ± SD	P-value
Group 1 (Alive patients) (n=40)	13.510±1.4386	0.004
Group 2 (Dead patients) (n=30)	14.987±2.6727	

* RDW: Red cell distribution width.
* SD: Standard deviation.

Table (2) Age distribution for ischemic stroke patients

Groups	Age (Years) Mean ± SD	P-value
Group 1 (Alive patients) (n=40)	64.75±14.939	0.003
Group 2 (Dead patients) (n=30)	75.27±12.673	

* SD: Standard deviation.

Concerning the other parameters of the study (sex distribution and history of diabetes, hypertension and previous stroke attack), there were no statistically significant differences between the two groups of patients regarding them, as shown in tables (3), (4), (5) and (6).

Table (3) Sex distribution for ischemic stroke patients

Groups	Sex		Total	P-value
	Males No. (%)	Females No. (%)		
Group 1 (Alive patients) (n=40)	24 (60.0)	16 (40.0)	40 (100)	0.631
Group 2 (Dead patients) (n=30)	16 (53.3)	14 (46.7)	30 (100)	

Table (4) History of diabetes mellitus in ischemic stroke patients

Groups	Diabetes mellitus		Total	P-value
	Present No. (%)	Absent No. (%)		
Group 1 (Alive patients) (n=40)	18 (45.0)	22 (55.0)	40 (100)	0.139
Group 2 (Dead patients) (n=30)	8 (26.7)	22 (73.3)	30 (100)	

Table (5) History of hypertension in ischemic stroke patients

Groups	Hypertension		Total	P-value
	Present No. (%)	Absent No. (%)		
Group 1 (Alive patients) (n=40)	24 (60.0)	16 (40.0)	40 (100)	0.598
Group 2 (Dead patients) (n=30)	18 (60.0)	12 (40.0)	30 (100)	

Table (6) History of previous attack of stroke in ischemic stroke patients

Groups	Previous stroke attack		Total	P-value
	Yes No. (%)	No No. (%)		
Group 1 (Alive patients) (n=40)	12 (30.0)	28 (70.0)	40 (100)	0.084
Group 2 (Dead patients) (n=30)	16 (53.3)	14 (46.7)	30 (100)	

Discussion

Recent studies have showed an association between higher RDW and increased risk of death and cerebrovascular disease events in middle-aged and older adults (4).

In this study, it was clear that the values of RDW were significantly higher in the deceased group of ischemic stroke patients compared to the survived group, suggesting that RDW is probably a significant predictor of stroke mortality. This finding is of particular interest because RDW is a measure of the variation of red blood cell volume and is routinely reported as part of standard complete blood count measures.

This result is consistent with what was stated by Ramírez-Moreno *et al*. (5) that higher levels of RDW were associated with increased risk of stroke mortality and RDW is a powerful predictor of stroke.

Agreement to this result is showed also in the statement of Worcester (6) that the findings of his analysis suggest that red blood cell distribution width may be a useful prognostic tool in stroke patients. Among the possible explanations for the association between RDW and stroke mortality seen in this study are rapid red blood cell demise occurring in the context of an underlying inflammatory state or underlying hemopoietic pathologies secondary to nutritional deficiency that may lead to worse cardiovascular outcomes. A mechanistic role of red cell size variations on deformability and embolic phenomenon is another possible explanation.

The second group of patients in this study was older than the first one, meaning that there is a positive impact of age on the severity and/or the mortality of ischemic stroke. This result was supported by the finding of Hu *et al*. (7) who stated that prospective studies have identified risk factors for stroke and stroke mortality,

including advancing age, hypertension, diabetes, smoking, and atrial fibrillation. Also an agreement is found in the statement of Nakayama *et al*. (8) in that age has been identified as a significant prognostic factor for stroke severity in a number of studies which have reported an associations between age and poor stroke outcome.

Sex distribution and history of diabetes, hypertension and previous attack of stroke where insignificantly changed between the two groups of patients in this study, possibly due to the small study sample; different demographic, environmental or other unknown factors that can't be achieved in this study.

Conclusion

Red blood cell distribution width appears to be a significant predictor of stroke severity and mortality, and considering that it is an inexpensive test, further research with larger sample size is certainly needed to investigate the potential mechanistic role of RDW in stroke occurrence.

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