

Relationship Among Platelet Number, Mean Platelet Volume, C-Reactive Protein, and Mortality in Patients with Ischemic Stroke

Ayhan Doner , Mahmut Arda Cinarlik 

Department of Emergency, Health of Sciences University, Okmeydani Training and Research Hospital, Istanbul, Turkey

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Abstract

Aim: This study aimed to analyze the relationship among platelet number, mean platelet volume (MPV), C-reactive protein (CRP), and mortality in patients with ischemic stroke who admitted to Okmeydani Training and Research Hospital Emergency Department with cerebrovascular disease between January and July 2016. The most commonly encountered neurological disease is cerebrovascular disease. Of the cerebrovascular diseases, ischemic stroke has a major importance due to its high mortality and morbidity. It is the third leading cause of death in the world.

Materials and Methods: This study is a retrospective study that includes 322 patients who admitted to our emergency department with cerebrovascular disease between January and July 2016. Patient information system was searched covering the study period. Information such as age, sex, platelet number, MPV, and CRP levels at first admission were recorded in the study form. Quantitative data were reported as average±standard deviation; categorical data. Quantitative data were reported as average±standard deviation; categorical data were reported as number or percentage. SPSS 10.0 for Windows was used for statistical analysis. A value of $p < 0.05$ was accepted as statistically significant.

Results: Upon our analysis, we detected significant relationship among the higher age, higher CRP levels, and mortality in patients with ischemic stroke.

Conclusion: In our study, we detected significant relationship among the higher age, higher CRP levels, and mortality in patients with ischemic stroke similar to the studies in the relevant literature.

Keywords: Stroke, platelet number, mean platelet volume, CRP, mortality

Introduction

Stroke is defined by the World Health Organization as a clinical syndrome consisting of rapidly developing clinical signs of focal disturbance of cerebral function due to disturbed cerebral blood flow, lasting more than 24 hours with no apparent cause other than a vascular origin. Ischemic stroke is the most common type of stroke in the world (1, 2); 80 to 85% of stroke cases have ischemic origin and 10 to 15% of them are hemorrhagic (1).

Acute stroke is still the third most common cause of mortality and morbidity after heart diseases and malignancy (2, 3). Furthermore, it causes economic and physiosocial outcomes that affects individuals, families, and communities. For these particular reasons, prevention and treatment of stroke is an important public health problem.

Risk factors for ischemic cerebrovascular diseases, such as diabetes mellitus, hypertension, atrial fibrillation, smoking, and coronary

ORCID IDs of the authors: A.D. 0000-0003-2645-8215; M.A.Ç. 0000-0002-7559-0194.



Corresponding Author: Mahmut Arda Cinarlik e-mail: ardacinarlik@gmail.com

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heart disease, are well defined by lots of international multi-centered studies (4). Although the risk factors for acute ischemic stroke have been extensively studied, there is no definitive study related to the increased risk when these factors are present together. When we examined the patients with ischemic stroke, a majority of patients was observed to have multiple chronic diseases and higher age.

In recent years, C-reactive protein (CRP) has become established as a risk factor for cerebrovascular diseases. Increased levels of CRP are relevant to poor prognosis, and it has been suggested that measurement of CRP, in addition to traditional risk factors, may improve our ability to predict ischemic stroke outcome.

In this study, we aimed to analyze the relationship among platelet number, mean platelet volume (MPV), CRP, and mortality in patients with ischemic stroke who admitted to Okmeydani Training and Research Hospital Emergency Department with cerebrovascular disease between January and July 2016.

Materials and Methods

Patients admitted to Okmeydani Training and Research Hospital Emergency Department between January and July 2016 who had one of the I63, I64, I65, I66, I67, I68, I69, and G46 diagnosis codes inside the ICD-10 medical coding system were included in this retrospective study. Approval was obtained from the Institutional Ethics Board before starting the study.

Hospital electronic medical record system and hospital archive files were used to obtain information about patients' records. All patients older than 16 years who were diagnosed and coded to ICD-10 system with ischemic stroke were included in the study.

Patients with diagnosis of hemorrhagic stroke were excluded. Moreover, patients younger than 16 years and whose medical follow-up records after being discharged from the hospital were unavailable were excluded.

Under these certain criteria, the patients were grouped according to their age, sex, platelet numbers, MPV values, and CRP levels.

Statistical analysis

Statistical analysis was performed by using Statistical Package for the Social Sciences (IBM Corp.; Armonk, NY, USA) 22 for Windows. The normality of distribution was assessed with Shapiro-Wilk test. To compare groups, the Mann-Whitney U test was used for analysis of non-parametric continuous variables. The Pearson correlation test was used for the detection of correlation between quantitative variables. Chi-square test was used for the detection of correlation between qualitative variables. The cutoff values of parameters were identified using the analysis of receiver operating characteristic (ROC) curves for the differentiation of groups. For all statistical tests performed, $p < 0.05$ was considered to be statistically significant.

Table 1. Relationship among age, C-reactive protein, platelet number, mean platelet volume, sex, and ischemic stroke

		Min-Max	Median	Mean±SD/n %	
Age		16.0- 104.0	70	68.0±14.4	
Age	16-30			5	1.1%
	31-45			34	7.6%
	46-60			74	16.5%
	61-75			183	40.8%
	76-90			146	32.6%
	>90			6	1.3%
Sex	Female			209	46.7%
	Male			239	53.3%
PLT		27.0-887.0	238	252.9±87.4	
PLT	Low			25	5.6%
	Normal			393	87.7%
	High			31	6.8%
MPV		8.7-13.4	10.4	10.5±1.0	
MPV	Normal			440	98.2%
	High			7	1.5%
CRP		0.2- 377.9	6.8	18.4±36.8	
CRP	Normal			203	45.2%
	High			245	54.7%

PLT: platelet; MPV: mean platelet volume; CRP: C-reactive protein

Results

For the study period, we retrospectively analyzed data for patients aged 16 years or older 322 patients were admitted to our emergency department with acute ischemic stroke and included to our study according in the inclusion criteria. Of these 322 patients, 140 (43.5%) patients were women and 182 (56.5%) were men. The median age value was 70 years, and the mean age value was 66.6 ± 15.1 years. The median platelet number was 288,000; for 87%, 5.6%, and

7.4% of patients, platelet numbers were recorded as normal, low, and high, respectively. The MPV values were recorded as normal in 97.5% of patients and high in 2.5% of them. The CRP levels were recorded as high in 50.6% of patients and normal in 49.4% of them (Table 1).

Patients ended up with exitus were significantly older than alive patients ($p < 0.05$). The median age value of the alive patients was 67 years, and the exitus group was 77.5 years. There was no significant

Table 2. Relationship among age, sex, and mortality

		Alive		Exitus		p		
		Mean \pm SD / n %	Median	Mean \pm SD/n %	Median			
Age		67.3 \pm 14.4		70.0	76.3 \pm 10.9		77.5	0.000 _m
Age	16-30	5	1.2%		0	0.0%		
	31-45	33	8.0%		1	2.9%		
	56-60	73	17.6%		1	2.9%		
	61-75	175	42.3%		8	23.5%		
	76-90	124	30.0%		22	64.7%		
	>90	4	1.0%		2	5.9%		
Sex	Female	195	47.1%		14	41.2%		0.506 ^{X²}
	Male	219	52.9%		20	58.8%		

Table 3. Relationship between platelet number and mortality

		Alive		Exitus		p		
		Mean \pm SD/n-%	Median	Mean \pm SD /n-%	Median			
PLT		252.9 \pm 78.5		241.0	252.5 \pm 139.6		214.0	0.108 _m
PLT	Low	22	5.4%		3	8.8%		
	Normal	364	87.9%		29	85.3%		
	High	29	6.9%		2	5.9%		

PLT: platelet

Table 4. Relationship between mean platelet volume and mortality

		Alive		Exitus		p		
		Mean \pm SD/n-%	Median	Mean \pm SD /n-%	Median			
MPV		10.5 \pm 1.0		10.4	10.7 \pm 1.0		10.5	0.276 _m
MPV	Normal	409	98.8%		31	91.2%		
	High	5	1.2%		2	5.9%		

MPV: mean platelet volume

Table 5. Relationship between C-reactive protein and mortality

		Alive		Exitus		p		
		Mean \pm SD/n-%	Median	Mean \pm SD /n-%	Median			
CRP		16.6 \pm 31.0		5.5	32.0 \pm 65.3		14.7	0.008 _m
CRP	Normal	194	46.8%		9	26.5%		
	High	220	53.1%		25	73.5%		

CRP: C-reactive protein

relationship between exitus and alive patients groups according to their sex. In the alive patients group, 43.7% were women and the remaining 56.3% were men; in the exitus group, 41.2% were women and 58.8% were men (Table 2).

There was no significant difference in the platelet number and MPV values between exitus and alive patients groups (Tables 3 and 4).

The CRP levels of patients were recorded as significantly higher in the exitus patients compared to those in the alive patients group ($p < 0.05$). The median CRP value was recorded as 5.5 and 14.7 for the patients in the alive group and exitus group, respectively; 73.5% of patients in the exitus group had high CRP values (Table 5).

Discussion

Age is the most important risk factor for ischemic stroke among all. Risk of stroke increases as the patients get older. The incidence of stroke increases twice for every decade after the age of 55 years. In several studies, the mean age value of patients with stroke was analyzed. It was reported as 70 ± 11 years by Yoneda et al. (5), 65.3 ± 8.2 years by Reganon et al. (6), 64 ± 3 years by Williams et al. (7), 63.5 ± 13.6 years by Hakbilir et al. (8), and 68.6 ± 14.6 years by Gürger et al. (9). Our study supported these numbers with the mean age value of 66.6 ± 15.1 years.

A study made by Redfords et al. (10), pointed that male patients are significantly more likely to have stroke than females. In our study we had %56.5 of male and %43.5 of female patients coherent with literature. It had no significant difference between gender in our study.

According to a study made by Korsakova et al. (11), age is a particular risk factor for long term survival after stroke. In our study exitus patients group were significantly ($p < 0.05$) older than alive patients group similar to study mentioned above.

We saw that C-Reactive Protein values of exitus group were significantly ($p < 0.05$) higher than alive patients group like the study made by Irene et al. and considered C-Reactive Protein levels as a deterministic factor of prognosis (12). Furthermore, our results were similar with the study made by Arikanoglu et al. (13) and analyzed the relationship between mortality and C-Reactive Protein levels in ischemic stroke patients.

Although Arevalo-Lolido et al. (14) found that Mean Platelet Volume levels are related with mortality in ischemic stroke patients, in our study we found no significant relationship between mortality and Mean Platelet Volume levels. But we have to notice that in study mentioned above mortality analyzed in a period of 12 months but we only analyzed mortality occurred in 3 months after discharging from hospital. So differences in the length of follow-up might effect the results.

In our study, we found no relationship between platelet numbers and mortality. This result conflicts with the study made by Furlan et al. (15) that shows significant relationship between Platelet levels and mortality in ischemic stroke patients.

Study limitations

The limitations of this study were in common with other prognosis- and mortality-based studies. Moreover, difficulty to have clinical follow-up records of patients have limited our study.

Conclusion

Our study showed significant relationships among age, incidence of ischemic stroke, and mortality. There is no relationship among platelet numbers, MPV levels, and mortality.

It is important that we found significant relationship between CRP levels and mortality similar to other studies in the literature. However, we found contradictory results regarding MPV and platelet numbers compared to the results of previous studies. Further studies are warranted to analyze the relationship among mortality, platelet, and mean platelet number volume values.

We strongly suggest that patients diagnosed with ischemic stroke at emergency department, and have higher values of CRP and higher age, should be evaluated carefully and be considered for transfer to a proper stroke center due to higher rates of mortality according to these factors.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of İstanbul Okmeydanı Training and Research Hospital (25.10.2016, Decision no: 531).

Informed Consent: Informed consent is not necessary due to the retrospective nature of this study.

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