

The Relationship Between Platelet, Mean Platelet Volume, C-Reactive Protein and Mortality in Ischemic Stroke Patients

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Abstract

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

Materials and Methods: This study is a retrospective study and covers 322 patients who admitted to our emergency department with cerebrovascular disease between January 2016 and July 2016.

Results: Patient information system was searched as covering the study period. Information of age, sex, platelet, mean platelet volume and C-reactive protein levels at first admission were recorded. Obtained data were recorded in study form. With our analysis we detected meaningful relation between the higher age, higher C-reactive protein levels and mortality in ischemic stroke patients. Study was performed with 322 patients in Okmeydanı Training and Research Hospital between January 2016 and July 2016. Quantitative data was reported as average \pm standard deviation, categorical data was reported as number or percentage. In all statistical analysis $p < 0.05$ was accepted as statistically meaningful difference. SPSS 10.0 for Windows was used for statistical analysis.

Conclusion: In our study, we detected meaningful relation between the higher age, higher C-reactive protein levels and mortality in ischemic stroke patients similar to the literature.

Keywords: Stroke, platelet, 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 whole world (1,2). Eighty-eighty five percent of stroke cases are with ischemic origin and 10-15% of them are hemorrhagic (1).

Acute stroke is still the 3rd most common reason of mortality and morbidity after heart diseases and malignancy (2,3). Furthermore,

it causes economic and psychosocial outcomes that affects individuals, families and communities. For this particular reasons, prevention and treatment of stroke is an important public health problem.

Risk factors of ischemic cerebral vascular diseases like diabetes mellitus, hypertension, atrial fibrillation, smoking, coronary artery diseases are well defined by too many international multicentric researches (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 look at patients with ischemic stroke, majority is observed to have multiple chronic diseases and advanced age.



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In recent years, C-reactive protein (CRP) has become established as a risk factor for cerebrovascular disease. Increased levels of CRP 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 between platelet, mean platelet volume, C-reactive protein and mortality in ischemic stroke patients who admitted to Okmeydanı Training and Research Hospital Emergency Department with cerebrovascular disease between January 2016 and July 2016.

Materials and Methods

Patients admitted to Okmeydanı Training and Research Hospital emergency department between January 2016 and July 2016 who has one of the I63, I64, I65, I66, I67, I68, I69 and G46 diagnoses codes according to 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 was used to get information about patients' records. All patients older than 16 years of age and diagnosed and coded to ICD-10 system with ischemic stroke are included to study.

Patients with diagnoses of hemorrhagic infarct were excluded. Also patients with under age of 16 and whose medical follow up records were unable to observe after discharging from hospital were excluded.

Under these certain criterias, included patients were grouped according to their age, sex, platelet values, mean platelet volume values and CRP values.

Statistical Analysis

Statistical analysis was performed by using SPSS 22 for Windows (IBM Corp). The normality of distribution was assessed with Shapiro Wilks 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 cut-off 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.

Results

For the time period of our study retrospectively analyzed data, between the age of 16 and 104, 322 patients were admitted to

our emergency department with diagnosis of acute ischemic stroke and included to our study according to inclusion criterias.

One hundred forty (43.5%) of our patients were female and 182 (56.5%) of them were male. Median age value calculated as 70 and mean value was 66.6 ± 15.1 . Median platelet value was 288.000 and 87% of patients' platelet results were recorded as normal, 5.6% as low and 7.4% as high. Mean platelet volume recorded as normal with 97.5% of all patients and as high with 2.5% of them. 50.6% of CRP value were high and 49.4% of them were normal (Table 1).

Patients ended up with exitus were significantly older than alive patients group ($p < 0.05$). Median age value of alive patients group was 67 and exitus patients group was 77.5.

There were no significant relationship between exitus and alive patients group according to their gender. Forty three point eight percent of alive patients group were female and 56.3% of them were male. Forty one point two percent 41.2% of exitus patients group were female and 58.8% of them were male (Table 2).

There is no significant difference of platelet and mean platelet volume values between exitus and alive patients groups (Table 3, 4).

Exitus patients group had significantly higher values of C-reactive protein than alive patients group ($p < 0.05$). Alive group had a median CRP values of 5.5 and exitus group had 14.7. Seventy three point five percent of exitus patients C-reactive protein values were recorded as high (Table 5).

Discussion

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

A study made by Bonita et al. (10) showed that mortality rates of stroke are higher in males than females and females had better prognosis than males. A study made by Redfors et al., (11) pointed that male patients are significantly more likely to have stroke than females. Besides these studies McCullough et al. (12) found that older female stroke patients had higher mortality and morbidity than males due to decreased hormone levels. 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.

Table 1. Relationship between age, C-reactive protein, platelet, mean platelet volume, gender and ischemic stroke

		Minimum-Maximum		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%
Gender	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%

CRP: C-reactive protein, PLT: Platelet, MPV: Mean platelet volume, SD: Standard deviation

Table 2. Relationship between age, gender and mortality

		Alive		Exitus		p			
		Mean ± SD/n-%	Median	Mean ± SD/n-%	Median				
Age		67.3	± 14.4	70.0	76.3	± 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%			
Gender	Female	195	47.1%		14	41.2%		0.506	X ²
	Male	219	52.9%		20	58.8%			

SD: Standard deviation

Table 3. Relationship between platelet and mortality

		Alive		Exitus		p			
		Mean ± SD/n-%	Median	Mean ± SD/n-%	Median				
PLT		252.9	± 78.5	241,0	252.5	± 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, SD: Standard deviation

Table 4. Relationship between mean platelet volume and mortality

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

SD: Standard deviation, MPV: Mean platelet volume

Table 5. Relationship between C-reactive protein and mortality

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

SD: Standard deviation, CRP: C-reactive protein

According to a study made by Korsakova et al., (13) 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 analyzed that C-reactive protein values of exitus patients group were significantly ($p < 0.05$) higher than alive patients group like the study made by Irene et al. (14) and considered C-reactive protein levels as a deterministic factor of prognosis. Furthermore, our results of study were similar with the study made by Arıkanoglu and Yücel (15) and analyzed the relationship between mortality and C-reactive protein levels in ischemic stroke patients.

Although Arevalo-Lorido et al. (16) 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 of time periods might effect the results.

In our study, we found no relationship between platelet levels and mortality. This result conflicts with the study made by Furlan and FANG (17) 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. Difficulty to have clinical follow up records of patients have limited our study.

Conclusion

Our study showed significant relationship between age and incidence of ischemic stroke and mortality.

There is no relationship between platelet and mean platelet volume levels and mortality.

It is important that we found significant relationship between C-reactive protein levels and mortality similar to literature, due to contributions to common approach on ischemic stroke patients. But in our study analyzed results of mean platelet volume and platelet levels were conflicted with similar studies. Further studies need to be made analyzing relationship between mortality and platelet and mean platelet volume levels.

We strongly suggest that patients admitted to emergency department and diagnosed as ischemic stroke and who have higher values of C-reactive protein and age, should be evaluated carefully and consider transferring to proper stroke centre due to higher rates of mortality according to these factors.

Ethics

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Istanbul 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.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Concept: A.D., M.A.Ç., Design: A.D., M.A.Ç., Data Collection or Processing: A.D., M.A.Ç., Analysis or Interpretation: A.D., M.A.Ç., Literature Search: A.D., M.A.Ç., Writing: A.D., M.A.Ç.

Conflict of Interest: No conflict of interest was declared by the authors.

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