

ORIGINAL RESEARCH

EVALUATION OF D-DIMER LEVELS IN STROKE PATIENTS

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ABSTRACT

Background: To evaluate D-dimer levels in stroke patients.

Methods: Seventy- six patients of stroke of both genders were enrolled and the measurement of D-dimer at the time of admission was done.

Results: Out of 76 patients, males were 42 (55.2%) and females were 34 (44.8%). The most common type identified was anterior circulation ischemia (ACI) in 54 (71%) followed by posterior circulation ischemia (PCI) in 15 (19.3%) and intracerebral hemorrhage (ICH) in 7 (9.7%). The difference was significant ($P < 0.05$). 20 patients had normal and 56 patients had raised D- dimer level. The age group <40 years had 5 and 12, 40-60 years had 6 and 18 and >60 years had 9 and 26 patients had normal and raised D- dimer level respectively. NIHSS- Score was minor in 10 and 2, moderate in 5 and 7, moderate- severe in 3 and 16 and severe in 2 and 31. The history of alcoholism was present in 4 and 20, smoking in 8 and 31 in patients with normal and raised D-dimer level respectively.

Conclusion: The plasma D-dimer levels increased with the increasing severity of stroke. Hence, D-dimer values in stroke constitute an important parameter in the evaluation of stroke especially its severity.

Keywords: Anterior circulation ischemia, D-dimer, Stroke

INTRODUCTION

A stroke, also known as a cerebrovascular accident (CVA), occurs when there is a sudden interruption in the blood supply to the brain, resulting in the death of brain cells. This interruption can be caused by a blockage (ischemic stroke) or the rupture of a blood vessel (hemorrhagic stroke). Strokes are serious medical emergencies that require immediate attention and intervention.¹

Ischemic stroke is more common and occurs when a blood clot or plaque blocks a blood vessel supplying blood to the brain.² This can happen within the blood vessels of the brain (thrombotic stroke) or elsewhere in the body, with the clot traveling to the brain (embolic stroke). Hemorrhagic stroke occurs when a blood vessel in the brain ruptures, causing bleeding into the surrounding tissue. Hemorrhagic strokes can be caused by conditions such as high blood pressure, aneurysms, or vascular malformations.³ The symptoms of a stroke can vary, but common signs include sudden numbness or weakness in the face, arm, or leg (especially on one side of the body), confusion, trouble speaking or understanding speech, difficulty walking, dizziness, and severe headache.⁴

The most significant risk factors for the occurrence of stroke are high blood pressure, uncontrolled diabetes, dyslipidemia, smoking, and alcoholism. The poor prognosis following a stroke is also associated with all of these risk factors.⁵ As the cross-linked fibrin network is broken down by plasmin, a soluble fibrin degradation final product called D-dimer is produced. Because blood thrombosis and fibrin degradation raise the level of plasma D-dimer, plasma D-dimer may be a biological marker of hemostatic problems and thrombosis.⁶ In cases of acute ischemic stroke, elevated plasma D-dimer levels are reportedly a factor in stroke progression, infarction volume, and incidence; however, in cases of hemorrhagic stroke, they are not thought to be a risk factor.^{7,8} We performed this study to evaluate D-dimer levels in stroke patients.

MATERIALS & METHOD

After considering the utility of the study and obtaining approval from the ethical research & review committee, we enrolled seventy- six patients of stroke of both genders. Patients’ consent was obtained before starting the study.

Data such as name, age, gender etc. was recorded. The history regarding smoking, alcoholism etc. were obtained. A 5 ml venous blood was obtained for measurement of D-dimer at the time of admission. The D-dimer values less than 500 ng/ml was considered normal and values equal or more than 500 ng/ml were taken as raised D-dimer level. For the evaluation of stroke severity, the National Institutes of Health Stroke Scale (NIHSS) on admission was used. The NIHSS score with higher values reflects more severe neurological damage. All patients underwent NCCT-HEAD to determine the size of the lesion (mm). The results were compiled and subjected for statistical analysis using the Mann- Whitney U test. P value less than 0.05 was set as significant.

RESULTS

Table I Patients distribution

Total- 76		
Gender	Males	Females
Number (%)	42 (55.2%)	34 (44.8%)

Out of 76 patients, males were 42 (55.2%) and females were 34 (44.8%) (Table I).

Table II Type of stroke

Type of stroke	Number (%)	P value
Anterior circulation ischemia (ACI)	54 (71%)	0.01
posterior circulation ischemia (PCI)	15 (19.3%)	
Intracerebral hemorrhage (ICH)	7 (9.7%)	

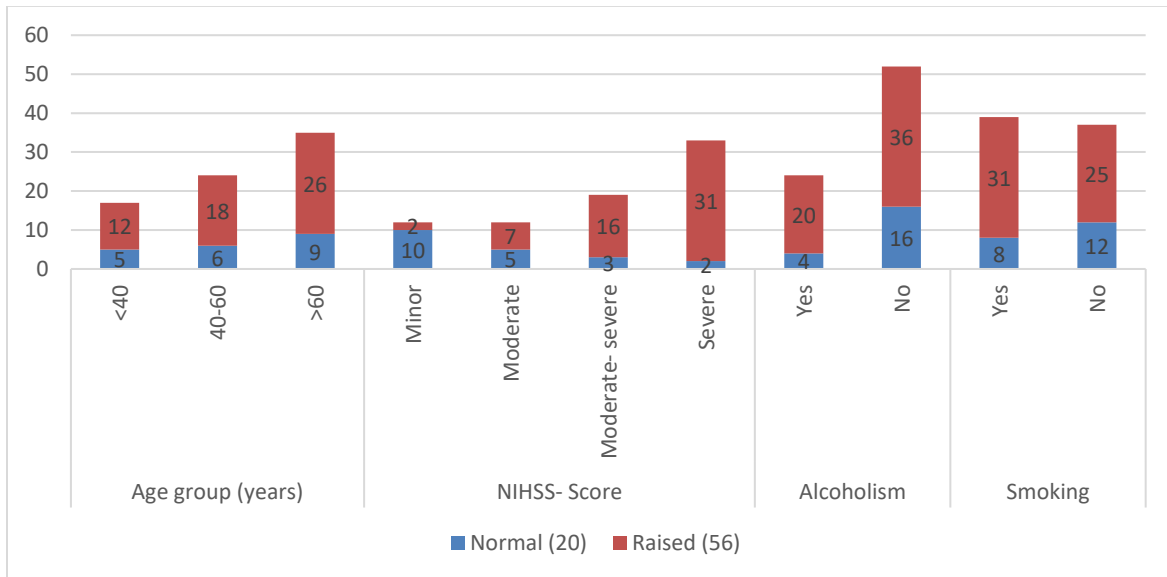
The most common type identified was anterior circulation ischemia (ACI) in 54 (71%) followed by posterior circulation ischemia (PCI) in 15 (19.3%) and intracerebral hemorrhage (ICH) in 7 (9.7%). The difference was significant (P< 0.05) (Table II).

Table III Assessment of D-Dimer levels

Parameters	Variables	Normal (20)	Raised (56)	P value
Age group (years)	<40	5	12	0.05
	40-60	6	18	

	>60	9	26	
NIHSS- Score	Minor	10	2	0.01
	Moderate	5	7	
	Moderate- severe	3	16	
	Severe	2	31	
Alcoholism	Yes	4	20	0.03
	No	16	36	
Smoking	Yes	8	31	0.04
	No	12	25	

It was found that 20 patients had normal and 56 patients had raised D- dimer level. The age group <40 years had 5 and 12, 40-60 years had 6 and 18 and >60 years had 9 and 26 patients had normal and raised D- dimer level respectively. NIHSS- Score was minor in 10 and 2, moderate in 5 and 7, moderate- severe in 3 and 16 and severe in 2 and 31. The history of alcoholism was present in 4 and 20, smoking in 8 and 31 in patients with normal and raised D- dimer level respectively (Table III, graph I).



Graph I Assessment of D-Dimer levels

DISCUSSION

The World Health Organization defines stroke as a clinical syndrome characterized by rapidly developing clinical symptoms and/or signs of focal neurological deficit and at times global loss of cerebral function, lasting for more than 24 hours or leading to death with no apparent causes other than of vascular origin.^{9,10} The therapy of stroke may greatly benefit from the use of specific brain biomarkers.^{11,12} Rapid examination of stroke becomes important to arrange early thrombolysis as soon as possible within the golden hours of evolution.^{13,14,15} We performed this study to assess D-dimer levels in stroke patients.

Our results showed that out of 76 patients, males were 42 (55.2%) and females were 34 (44.8%). Park YW et al¹⁶ found that the mean D-dimer level at admission was 626.6 µg/L. The mean level measured after seven days of treatment was 238.3 µg/L (range, 50-924 µg/L). The mean D-dimer

level at admission was 215.3 µg/L in patients with focal infarctions, 385.7 µg/L in patients with multiple embolic infarctions, 566.2 µg/L in those with 1-19 cc infarctions, 668.8 µg/L in 20-49 cc infarctions, 702.5 µg/L in 50-199 cc infarctions, and 844.0 µg/L in >200 cc infarctions. On the 7th day of treatment, the D-dimer levels had fallen to 201.0 µg/L, 293.2 µg/L, 272.0 µg/L, 232.8 µg/L, 336.6 µg/L, and 180.0 µg/L, respectively (p=0.530). They had shown that D-dimer level significantly increases after the onset of an acute ischemic stroke and that the D-dimer level correlates positively with acute ischemic volume. D-dimer can be considered a valuable marker for predicting infarction volume in acute ischemic strokes and treatment response.

Our results showed the most common type identified was anterior circulation ischemia (ACI) in 54 (71%) followed by posterior circulation ischemia (PCI) in 15 (19.3%) and intracerebral hemorrhage (ICH) in 7 (9.7%). Zhang et al¹⁷ showed that elevated D-dimer levels were associated with recurrence on 5-day diffusion-weighted imaging (OR = 2.28, 95% CI = 1.32–3.95), 30-day mRS \geq 3 (OR = 1.59, 95% CI = 1.37–1.85), 30-day mortality (OR = 1.92, 95% CI = 1.27–2.90) and 90-day mRS \geq 3 (OR = 1.61, 95% CI = 1.05–2.46). They concluded, for patients with AIS, higher D-dimer level within 24 hours from stroke onset was associated with recurrence on 5-day diffusion-weighted imaging, mortality at 30 days, and poor functional outcome at both 30 days and 90 days.

It was found that 20 patients had normal and 56 patients had raised D-dimer levels. The age group <40 years had 5 and 12, 40-60 years had 6 and 18, and >60 years had 9, and 26 patients had normal and raised D-dimer levels respectively. NIHSS score was minor in 10 and 2, moderate in 5 and 7, moderate-severe in 3 and 16, and severe in 2 and 31. The history of alcoholism was present in 4 and 20, smoking in 8 and 31 in patients with normal and raised D-dimer levels respectively. Zi et al¹⁸ investigated the association between plasma D-dimer level at admission and AIS. The plasma D-dimer levels were measured using a particle-enhanced, immunoturbidimetric assay on admission in 240 patients. Plasma median D-dimer levels were significantly higher in AIS patients as compared to healthy controls (0.88; interquartile range [IQR], 0.28–2.11 mg/L and 0.31; IQR, 0.17–0.74 mg/L). D-dimer levels increased with increasing severity of stroke as defined by the NIHSS score (r=0.179, p=0.005) and infarct volume (r=0.425, p=0.000). Those positive trends still existed even after correcting for possible confounding factors (P=0.012, 0.000; respectively). Based on the Receiver operating characteristic (ROC) curve, the optimal cut-off value of plasma D-dimer levels as an indicator for diagnosis of cardioembolic strokes was projected to be 0.91 mg/L, which yielded a sensitivity of 83.7% and a specificity of 81.5%, the area under the curve was 0.862.

CONCLUSION

The plasma D-dimer levels increased with the increasing severity of stroke. Hence, D-dimer values in stroke constitute an important parameter in the evaluation of stroke especially its severity.

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