ORIGINAL RESEARCH

Assessment of D-dimer levels in stroke patients

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ABSTRACT

Background: Due to increased morbidity and mortality by the complications associated with stroke also lead to high socioeconomic burden. The present study was conducted to study D-dimer levels in stroke patients. **Materials & Methods:** This study was carried out in the department of Medicine, in indoor patients of associated group of Hospitals attached to Dr. S N medical college, Jodhpur. All gave their written consent to participate in the study.Venous sampling for quantitative measurement of D-dimer was taken at the time of admission. Stroke severity was assessed on admission using the National Institutes of Health Stroke Scale (NIHSS, the NIHSS score with higher values reflect more severe neurological damage). **Results:** Out of 68 diabetic patients, 92.64% (63) were with raised D-dimer and 7.35% (5) were with normal D-dimer. The association of Diabetes mellitus with raised D-dimer levels was found significant in this study (p- 0.023). Out of 87 patients with raised D-dimer, 51.72% (45) were hypertensive and 48.27% (42) were non-hypertensive. And out of 13 patients with normal D-dimer, 15.38 % (2) were hypertensive and 84.61% (11) were non-hypertensive. The association of hypertension with raised D- dimer levels was found significant in this study (p-0.017). Out of the 87 patients who presented with raised levels of D-dimer 42.53% (37) reported with severe stroke with NIHSS score 21-42 followed by 29.88% (26) with moderate to severe stroke with NIHSS score 16-20, and 25.28% (22) had score in the range of 5-15 that is moderate score. In this study NIHSS score was higher with raised level of D-dimer. There was a significant correlation of NIHSS score with D-dimer level. The association of infarct size with D-dimer. In this study CT scan infarct size increases as level of D-dimer increase. There was a significant correlation of CT scan infarct size with level of D-Dimer. **Conclusion:** D-dimer values are increased in many conditions of thromboembolism including strokes and also in recent covid. This study highlights the increase in D-dimer levels in ischemic stroke. The rise was statistically significant with the increase severity judged by NIHSS score as well as size of stroke in NCCT-head. Therefore D-dimer values in stroke constitutes an important parameter in the evaluation of stroke specially its severity.

Key words: CT scan, D- dimer, NIHSS score

INTRODUCTION

The world health organisation defined 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.[1,2]

Due to increased morbidity and mortality by the complications associated with stroke also lead to high socioeconomic burden. About >80% of total stroke events are ischemic stroke.[3] Primary prevention strategies may be helpful in better prognosis of acute ischemic stroke by the early identification of people at risk**.** High blood pressure, uncontrolled diabetes, dyslipidaemia, smoking and alcoholism are the most important and significant risk factor associated with occurrence of stroke. All these risk factors are also related to poor prognosis after stroke.[4]

Some investigators have found that plasma D-dimer levels could independently predict poor functional outcomes in patients with acute ischemic stroke, while other investigators have reported conflicting results. Rapid diagnosis in patients with suspected acute ischemic stroke is critical for the patient's treatment and prognosis.[5] Radiological confirmation of the diagnosis of acute ischemic stroke is often delayed because computed tomography (CT) results may appear normal in the early stages or in patients with minor symptoms and magnetic resonance imaging (MRI) is not always available in the golden time of treatment.[6] Thus, many eligible cases are delayed in receiving intravenous thrombolysis treatment. Unfortunately, there has been little research on the

associations between plasma D-dimer level and stroke in the Indian patients.[7] The present study was conducted to study D-dimer levels in stroke patients.

MATERIALS & METHODS

This study was carried out in the department of Medicine, in indoor patients of associated group of Hospitals attached to Dr. S N medical college, Jodhpur. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Detailed history regarding smoking, alcoholism, diabetes mellitus, hypertension, Drug intake was taken. Vital signs, waist/Hip ratio, were noted. Blood sugar values and Fasting lipid profile sampling were taken.

Venous sampling for quantitative measurement of D-dimer was taken at the time of admission. Values less than 500ng/ml was considered normal and values equal or more than 500ng/ml were taken as raised D-dimer level.Stroke severity was assessed on admission using the National Institutes of Health Stroke Scale (NIHSS, the NIHSS score with higher values reflect more severe neurological damage). On day one, power was calculated.Size of lesion was provided by NCCT-HEAD in mm.Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I: Distribution of patients

Stroke	Male		Female		Total	
	N	%	N	%	N	%
ACI	59	71.95	23	28.05	82	82.00
ICH	6	100.00	0	0.00	6	6.00
PCI	7	58.33	5	41.67	12	12.00
Total	72	72.00	28	28.00	100	100.00

Table I shows that 82% patients had ACI, 12% had PCI and 6% had ICH.

Table II: D-dimer levels in different age groups

Age groups	Normal d-dimer	(%)	Raised d-dimer	(%)	P-value
<40 years	3	23.07%	7	8.04%	0.004
41-50 years	1	7.69%	27	31.03%	
51- 60 years	3	23.07%	31	35.63%	
61- 70 years	6	46.15%	9	10.34%	
71- 80 years	0	0%	11	12.64%	
> 80 years	0	0%	2	2.29%	
Total	13	100%	87	100%	

Table II shows that out of 87 cases of raised D-dimer level, most of the patients were in age group of 51-60 years with 35.63% (35) followed by 41-50 years with 31.03% (27). There was a positive correlation between the age and D-dimer was seen (p=0.004).

Table III: Distribution of patients according to d-dimer levels

Study subject	Normal d-dimer	Raised d-dimer	Total
Number of patients	13	87	100
Percentage (%)	13%	87 %	100%

Table III shows that the patients were distributed based on their D-dimer level as with normal or raised D-dimer level. Out of 100 patients, 13(13%) had normal D-dimer level while 87 (87%) participants had raised level of D-dimer.

Table IV: Association between d-dimer and smoking

SMOKING	NORMAL D-DIMER	%	RAISED D-DIMER	%	P VALUE
YES	5	38.46%	64	73.56%	0.020
NO	8	61.53%	23	26.43%	
TOTAL	13	100%	87	100%	

Table IV shows that in 64 (73.5%) smokers, D- Dimer level was raised.

Table V: Association between d-dimer levels and dm (diabetes mellitus)

	D-dimer (ng/ml)	Total	P value

Diabetes mellitus		Normal	Raised		
Non-Diabetic	No of cases	8	24	32	0.023
	Percentage (%)	25%	75%	100.0%	
Diabetic	No of cases	5	63	68	
	Percentage (%)	7.35%	92.64%	100.0%	

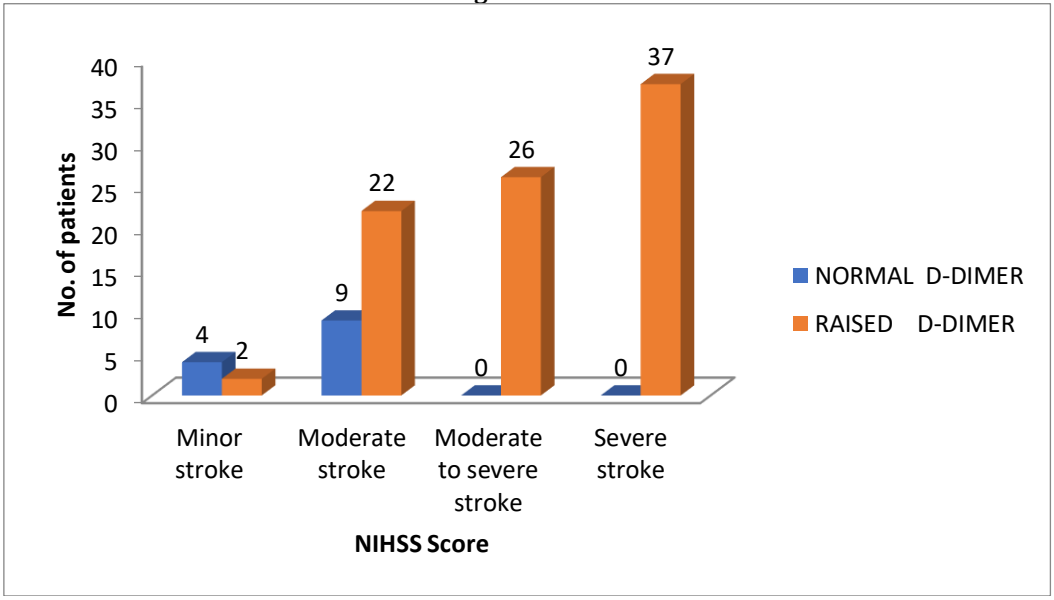
Table V shows that out of 68 diabetic patients, 92.64% (63) were with raised D-dimer and 7.35% (5) were with normal D-dimer. The association of Diabetes mellitus with raised D-dimer levels was found significant in this study (p- 0.023).

Table VI: Associations between d-dimer levels and hypertension

Hypertension	Normal d-dimer	(%)	Raised d-dimer	(%)	P value
YES	2	15.38%	45	51.72%	0.017*
NO	11	84.61%	42	48.27%	
TOTAL	13	100%	87	100%	

Table VI shows that out of 87 patients with raised D-dimer, 51.72% (45) were hypertensive and 48.27% (42) were non-hypertensive. And out of 13 patients with normal D-dimer, 15.38 %(2) were hypertensive and 84.61%(11) were non-hypertensive. The association of hypertension with raised D-dimer levels was found significant in this study (p-0.017).

Graph I: Distribution of d-dimer levels according to NIHSS score



Graph Ishows that out of the 87 patients who presented with raised levels of D-dimer 42.53% (37) reported with severe stroke with NIHSS score 21-42 followed by 29.88% (26) with moderate to severe stroke with NIHSS score 16-20, and 25.28% (22) had score in the range of 5-15 that is moderate score. In this study NIHSS score was higher with raised level of D-dimer. There was a significant correlation of NIHSS score with D-dimer level (p value<0.0001).

Table VII: Association between d-dimer and infarct size (mm)

Association with infarct size	Mean	Standard. Deviation	N	r value	P value
D-DIMER	1293.63	1012.9	100	0.875	0.015
CT SCAN SIZE OF INFARCT (in mm)	974.64	1325.4	100		

Table VII shows the association of infarct size with D-dimer. In this study CT scan infarct size increases as level of D-dimer increase. There was a significant correlation of CT scan infarct size with level of D-DIMER (p-value <0.0001).

DISCUSSION

Stroke is the world's third leading cause of mortality, with high incidence of severe morbidity in surviving victims.[8,9] Rapid evaluation of stroke becomes necessary as to plan early thrombolysis as soon as possible within golden hours of evolution, use of

specific brain biomarkers may play a crucial role in the management of stroke.[10]This study was conducted on 100 patients admitted in department of medicine at associated group of hospitals attached to Dr. S. N. medical college Jodhpur, which were randomly selected over a period of 1 year after applying inclusion and exclusion criteria. This study was planned to see the role of D-dimer and its association with severity and prognostic outcome in acute stroke by using NIHSS score. Clinical history was taken in detail, complete general physical and systemic examination was done, taking comorbidities and risk factors into consideration. D-dimer and NCCT-head were done in all such patients.

In our study we found that maximum number of cases of stroke were of anterior circulation (82), followed by posterior circulation (12) and few cases were of intracranial hemorrhage. Park YW et al[11] evaluated that mean D-dimer level at admission was 626.6 µg/L (range, 77-4,752 µg/L) and the mean level measured after seven days of treatment was 238.3 µg/L (range, 50-924 µg/L). 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 (p=0.044). 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 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 as a valuable marker for predicting infarction volume in acute ischemic strokes and treatment response.

We found that out of 87 cases of raised D-dimer level, most of the patients were in age group of 51-60 years with 35.63% (35) followed by 41-50 years with 31.03% (27). Patients were distributed based on their D-dimer level as with normal or raised D-dimer level. Out of 100 patients, 13 (13%) had normal D-dimer level while 87 (87%) participants had raised level of D-dimer. We found that out of 68 diabetic patients, 92.64% (63) were with raised D-dimer and 7.35% (5) were with normal D-dimer. The association of Diabetes mellitus with raised D-dimer levels was found significant in this study (p- 0.023). Out of 87 patients with raised D-dimer, 51.72% (45) were hypertensive and 48.27% (42) were non-hypertensive. And out of 13 patients with normal D-dimer, 15.38 % (2) were hypertensive and 84.61% (11) were non-hypertensive. The association of hypertension with raised D- dimer levels was found significant in this study (p-0.017).

We found that out of the 87 patients who presented with raised levels of D-dimer 42.53% (37) reported with severe stroke with NIHSS score 21-42 followed by 29.88% (26) with moderate to severe stroke with NIHSS score 16-20, and 25.28% (22) had score in the range of 5-15 that is moderate score. In this study NIHSS score was higher with raised level of D-dimer. There was a significant correlation of NIHSS score with D-dimer level. The association of infarct size with D-dimer. In this study CT scan infarct size increases as level of D-dimer increase. There was a significant correlation of CT scan infarct size with level of D-DIMER.Yao T et al[12] observed that poor outcome was present in 302 (34.4%) of the 877 patients that were included in the study (mean age, 64 years; male, 68.5%). After adjustment for potential confounding variables, higher plasma D-dimer level on admission was associated with poor outcome. According to receiver operating characteristic (ROC) analysis, the best discriminating factor for poor outcome was a plasma D-dimer level ≥ 0.315 mg/L (area under the ROC curve 0.657; sensitivity 83.8%; specificity 41.4%). Elevated plasma D-dimer levels on admission are significantly associated with poor outcome after admission for AIS, suggesting the potential role of plasma D-dimer level as a predictive marker for short-term poor outcome in patients with AIS.

The limitation the study is small sample size.

CONCLUSION

Authors found that D-dimer values are increased in many conditions of thromboembolism including strokes and also in recent covid. This study highlights the increase in D-dimer levels in ischemic stroke. The rise was statistically significant with the increase severity judged by NIHSS score as well as size of stroke in NCCT-head. Therefore D-dimer values in stroke constitutes an important parameter in the evaluation of stroke specially its severity.

REFERENCES

1. Osman Moussa AL, Gad Kawasthi H, Fathy Mohammad S, Sobh Mohammed K, Imam Mohammad Loai.: Assessment of ischemic stroke subtypes using D-dimer. AAMJ. 2013; 10(4):295-312.
2. Wen-JieZi and JieShuai: Plasma D-Dimer Levels Are Associated with Stroke Subtypes and Infarction Volume in Patients with Acute Ischemic Stroke. PLoS One. 2014; 9(1):e86465.
3. Zhang J, Liu L, Tao J, Song Y, Fan Y, et al. (2019) Prognostic role of early D-dimer level in patients with acute ischemic stroke. PLOS ONE 14(2): e0211458.
4. Haapaniemi E, Tatlisumak T, Is D-dimer helpful in evaluating stroke patients? A systematic review. ActaNeurolScand 2009, 119(3):141-150.
5. Adams HP, Bendixen BH, Kappelle LJ, Biller J, Love BB (1993) Classification of subtype of acute ischemic stroke. Definitions for use in a multicentre clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. Stroke 24: 35–41. [PubMed] [Google Scholar]
6. Montaner J, Perea-Gainza, Delgado P, et al (2008): Etiological diagnosis of ischemic stroke subtypes with plasma biomarkers. Stroke, 39:2280 -87.
7. Hinkle J and Guanci M. (2007): Acute ischemic stroke review. J Neuro sciNurs, 39(5):285-93.

8. Rigini M, Goehring C, Bounameaux H, et al., (2000): Effects of age on the performance of common diagnostic tests for pulmonary embolism. Am J Med, 109:357-61.
9. Kataoka S, Hirose G, Hori A, et al., (2000): Activation of thrombosis and fibrinolysis following brain infarction. J NeurolSci, 181:82-8.
10. Li F, Zhang G, Zhao W. (2003): Coagulation and fibrinolytic activity in patients with acute cerebral infarction. Chin Med J (Engl), 116:475-7.
11. Park YW, Koh EJ, Choi HY. Correlation between Serum D-Dimer Level and Volume in Acute Ischemic Stroke. J Korean Neurosurg Soc. 2011;50(2):89-94. doi:10.3340/jkns.2011.50.2.89.
12. Yao T, Bo-Lin Tian, Gang Li, Qin Cui, Cui-fang Wang, Qi Zhang, Bo Peng, Yan Gao, Yan-QiangZhan, Dan Hu, Lu Xu and Gao-Hua Wang: Elevated plasma D-dimer levels are associated with short-term poor outcome in patients with acute ischemic stroke: a prospective, observational study. BMC Neurology 2019;19:175.