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EVALUATION OF D-DIMER IN ISCHEMIC STROKE PATIENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: The rising incidence of stroke-associated morbidity and mortality significantly contributes to the socioeconomic challenges faced by communities. This investigation aimed to analyze the levels of D-dimer in individuals diagnosed with ischaemic stroke.

Methodology: The research was executed on participants who consented in writing before inclusion. Quantitative D-dimer levels were measured through venous sampling upon hospital admission. The severity of stroke was evaluated using the National Institutes of Health Stroke Scale (NIHSS), wherein a higher NIHSS score indicates greater neurological impairment.

Findings: A significant correlation was found between the NIHSS score and D-dimer levels, suggesting that higher D-dimer levels are associated with more severe stroke outcomes. Furthermore, the study observed a significant relationship between the size of the cerebral infarct observed in CT scans and D-dimer levels, with larger infarcts correlating with higher D-dimer levels. A significant correlation was observed between elevated D-dimer levels and Diabetes mellitus and Hypertension.

Conclusion: Elevated D-dimer levels, indicative of thromboembolic events, were significantly associated with ischemic stroke severity, as evaluated by NIHSS scores and infarct size on NCCT-head imaging. Thus, D-dimer measurements serve as a critical parameter in assessing the severity of stroke, underscoring the importance of this biomarker in the clinical evaluation of stroke patients.

Keywords: Ischaemic stroke, D Dimer, Diabetes, Hypertension.

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INTRODUCTION

The World Health Organization identifies a stroke as a clinical syndrome marked by the sudden emergence of clinical symptoms and/or signs indicative of a focal, and occasionally global, neurological deficit. This condition persists for over 24 hours or results in death, without any discernible cause other than vascular origins. The complications arising from strokes contribute to increased morbidity and mortality, imposing a significant socioeconomic impact. Ischemic strokes account for more than 80% of all stroke incidents. Implementing primary prevention measures could enhance the prognosis for acute ischemic stroke through early detection of individuals at risk. Key risk factors include hypertension, unmanaged diabetes, dyslipidemia, tobacco use, and excessive alcohol consumption, which not only elevate the likelihood of a stroke occurrence but also worsen outcomes post-stroke [1-4].

Research has shown that levels of plasma D-dimer may serve as an independent indicator of adverse functional outcomes in patients experiencing an acute ischemic stroke, although findings have been mixed. Prompt diagnosis in individuals suspected of acute ischemic stroke is imperative for determining the appropriate course of treatment and outcome. Often, the diagnosis of acute ischemic stroke is delayed due to the initial normal appearance of computed tomography (CT) scans in the early phases or in cases with minor symptoms, and magnetic resonance imaging (MRI) may not be readily accessible during the optimal treatment window. Consequently, this results in delays in administering intravenous thrombolysis to qualified patients [5,6].

Notably, there is a scarcity of research focusing on the correlation between plasma D-dimer levels and stroke occurrences in Indian populations [7]. This study was designed to examine the D-dimer levels among patients who have suffered a stroke.

MATERIALS AND METHODS

The investigation was conducted on participants who provided consent for their involvement in the study. Personal and demographic details such as name, age, and gender were meticulously recorded. An extensive patient history covering smoking habits, alcohol consumption, the presence of diabetes mellitus, hypertension, and any medication usage was compiled. Additionally, vital signs and waist-to-hip ratios were documented. Laboratory tests including blood glucose levels and fasting lipid profiles were performed.

For the quantitative analysis of D-dimer levels, venous blood samples were collected upon patient admission. D-dimer levels below 500 ng/ml were categorized as normal, while levels of 500 ng/ml or above were considered elevated. The severity of stroke was determined at the time of admission using the National Institutes of Health Stroke Scale (NIHSS), where higher scores indicate a greater degree of neurological impairment. The dimensions of the cerebral lesion were

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assessed using Non-Contrast Computed Tomography (NCCT-HEAD) and reported in millimeters.

On the initial day of the study, the statistical power was determined.The collected data were then analyzed statistically, with a p-value of less than 0.05 denoting statistical significance.

RESULTS

Table 1 illustrates that 82.11% of patients experienced acute cerebral infarction (ACI), 12.20% had primary cerebral hemorrhage (PCH), and 5.69% suffered from intracerebral hemorrhage (ICH).

Table 2 reveals that among 107 cases with elevated D-dimer levels, the majority of patients fell into the age group of 51-60 years, followed by those in the 41-50 years age range. A positive correlation between age and D-dimer levels was observed (p=0.003).

Table 3 demonstrates that elevated D-dimer levels were significantly associated with smoking, diabetes mellitus, and hypertension in ischemic stroke patients.

Figure 1 depicts that the NIHSS score was higher in patients with elevated D-dimer levels. A significant correlation between the NIHSS score and D-dimer levels was observed (p value<0.001).

Table 1: Gender distribution of ischaemic stroke patients

Stroke	Male		Female		Total	
	n	%	n	%	n	%
PCI	9	7.32	6	4.88	15	12.20
ICH	7	5.69	0	0.00	7	5.69
ACI	73	59.35	28	22.76	101	82.11
Total	89	72.36	34	27.64	123	100.00

Table 2: Age wise distribution of D-dimer levels in ischaemic stroke patients

Age groups	Normal d-dimer	%	Increased d-dimer	%	p Value
<40 years	4	3.25	9	7.32	<0.05
41-50 years	1	0.81	33	26.83	
51-60 years	4	3.25	38	30.89	
61-70 years	7	5.69	11	8.94	
71-80 years	0	0.00	14	11.38	
> 80 years	0	0.00	2	1.63	
Total	16	13.01	107	86.99	

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Table 3: Association of Smoking, Diabetes Mellitus and Hypertension with D-dimer

Variable	Normal d-dimer	%	Increased d-dimer	%	p Value
Somking, Yes	6	4.88	79	64.23	<0.05
Smoking, No	10	8.13	28	22.76	
DM Present	9	7.32	76	61.79	<0.05
DM Absent	7	5.69	31	25.20	
Hypertension Present	2	1.63	55	44.72	<0.05
Hypertension Absent	14	11.38	52	42.28	

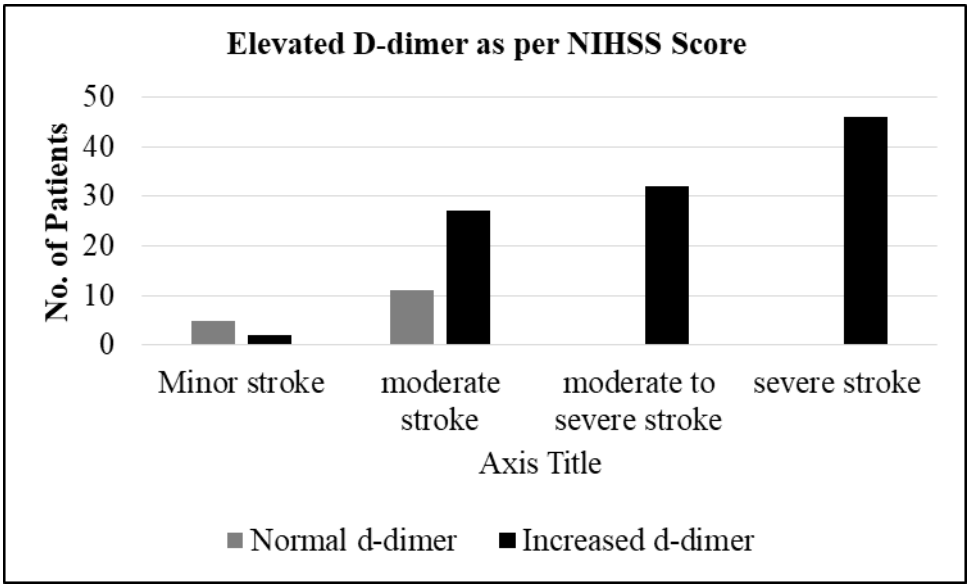

Figure 1: Distribution of elevated d-dimer levels as per NIHSS score

DISCUSSION

Stroke ranks as the third leading cause of death worldwide, significantly contributing to severe long-term disability among survivors. The imperative for swift stroke evaluation stems from the urgent need to initiate thrombolytic therapy within the critical early hours following symptom onset, where the employment of specific cerebral biomarkers could significantly influence stroke management [8-10]. This research aimed to explore the role of D-dimer levels in relation to the severity and prognosis of acute stroke, assessed via the NIHSS (National Institutes of Health Stroke Scale) score.

The findings of our study indicated a predominance of stroke cases affecting the anterior circulation, with a lesser incidence in the posterior circulation and a minimal occurrence of intracranial hemorrhage. According to Park YW et al. [11], the average D-dimer level upon hospital admission was observed at 626.6 µg/L (with a range from 77 to 4,752 µg/L), which decreased to an average of 238.3 µg/L (range 50 to 924 µg/L) following seven days of treatment.

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Initial D-dimer levels were recorded at 215.3 µg/L in patients with focal infarctions, 385.7 µg/L in those with multiple embolic infarctions, and progressively higher in patients with larger infarct sizes, demonstrating a significant increase post-acute ischemic stroke onset, and a positive correlation with the volume of acute ischemia. This suggests that D-dimer levels could serve as an effective marker for estimating infarct size in acute ischemic strokes and monitoring treatment efficacy.

Our analysis revealed that the majority of patients exhibiting elevated D-dimer levels were aged between 51-60 years, followed by those in the 41-50 year age bracket. The study involved 123 patients, predominantly showing increased D-dimer levels, with a significant number of these patients also suffering from diabetes mellitus. A notable association between elevated D-dimer levels and both diabetes mellitus and hypertension was established.

Furthermore, our study found a significant correlation between higher NIHSS scores and increased D-dimer levels, indicating the impact of D-dimer on stroke severity. The correlation extended to CT scan-detected infarct size, which escalated with rising D-dimer levels, underscoring the significant relationship between D-dimer levels and the extent of cerebral infarction. Yao T et al. [12] reported a 34.4% occurrence of poor outcomes in their study cohort, highlighting that higher D-dimer levels at admission were predictive of unfavorable outcomes. The ROC analysis identified a D-dimer level ≥ 0.315 mg/L as a critical predictor of poor prognosis, with significant sensitivity and specificity rates, thereby underscoring the potential of plasma D-dimer levels as a prognostic marker for acute ischemic stroke (AIS) patients. SImilar findings were reported by previous studies [13,14].

A notable limitation of this study was its small sample size, which may impact the generalizability of the findings.

CONCLUSION

This study particularly emphasizes the increase in D-dimer levels specifically in ischemic strokes. The elevation in D-dimer levels was statistically significant, correlating with the severity of stroke as assessed by the NIHSS score and the size of the stroke lesion observed in NCCT-head scans. Consequently, D-dimer values in stroke patients represent a crucial parameter for evaluating stroke severity, aiding in the clinical assessment and management of this condition.

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