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Risk Factors for Prehospital Delays in Acute Stroke Patients in South India

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Abstract:- Prehospital delay in acute stroke is a critical factor influencing patient outcomes. This study, conducted in South India, aimed to identify and understand the risk factors associated with prehospital delay in patients with acute stroke. A total of 260 patients with acute stroke were included in this cross-sectional descriptive study, conducted between 2021 and 2022.

Various demographic, medical, and contextual factors were analyzed to determine their impact on prehospital delay. Factors such as age, marital status, education, occupation, living status, medical insurance, place of residence, type of stroke, and history of stroke were found to be statistically significant contributors to prehospital delay. Age groups between 41-70 years, being married, higher education, skilled or professional occupation, and living in nuclear families were associated with greater prehospital delays.

Additionally, factors related to the location and timing of stroke onset, such as whether the stroke occurred at home or outside, the day of the week, and the time of onset, were found to contribute significantly to prehospital delay. Stroke onset during weekdays and specific time intervals, as well as a longer distance and transportation time to the hospital, were linked to increased prehospital delay.

The study also explored the association between specific stroke symptoms and prehospital delay. Symptoms like slurred speech, dizziness, deviation of the face, and vomiting were associated with prehospital delay. Hemiplegia and headache, on the other hand, were not significant contributors to delay.

In conclusion, prehospital delay in acute stroke care is a multifaceted issue influenced by various factors. Addressing these factors through targeted education programs, improved healthcare infrastructure, and culturally sensitive healthcare can help reduce prehospital delays and improve stroke outcomes. Recognizing stroke symptoms and seeking timely medical attention are crucial for providing the best possible outcomes for stroke patients. This study provides valuable insights into the risk factors associated with prehospital delay in acute stroke, offering potential strategies for improvement in stroke care.

I. INTRODUCTION

A stroke is not a single disease, but rather a clinical condition. It is typified by an abrupt neurological deficit with a possible vascular cause. This is a common, debilitating illness that, at six months, affects one-third of patients and renders another third lifelong dependent on outside care.[1] The basic definition of stroke is an acute episode of localised neurologic impairment lasting longer than twenty-four hours. Stroke is second in the world's main causes of mortality and the top cause of disability.[/2] Although ischemic strokes occur more frequently, hemorrhagic strokes result in a higher death toll and DALYs (disability-adjusted life years) than ischemic strokes. Globally, there were 13.7 million new incident strokes in 2016. Ischemic strokes accounted for around 87 percent of these strokes, and a conservative estimate estimates that 10–20 percent of them were caused by LVO. Less than 5% of patients with acute ischemic stroke received intravenous thrombolysis during the eligible treatment window in 2016, and less than 100,000 mechanical thrombectomies were performed globally. Recent studies in clinical and experimental settings have illuminated the intricate function of the immune system in the pathophysiological changes that follow an acute stroke. Both brain ischaemia and tissue injury trigger the innate immune system's sensors, such as Toll-like receptors, and effectors, such as innate immune cells and the lectin route of complement activation. The inflammatory cascade becomes more severe as a result of this activation. Activation of the adaptive arm of the immune system following a stroke can lead to both cytoprotective effects and harmful antigen-specific autoreactive responses. This activation is mediated by lymphocyte populations that include T and B cells, regulatory T cells, and T cells. The higher prevalence of infections observed after an acute stroke may be attributed to the activation of long-distance feedback loops between the peripheral immune organs and the central nervous system (CNS), which are thought to contribute to stroke-induced immunodepression. The question of whether or not using antibiotics as a preventative measure can improve a patient's functional prognosis following a stroke is being investigated in ongoing clinical trials.*[4] It has been shown that commencing aspirin treatment (160–300 mg daily by mouth, nasogastric tube, or rectum) within the first 48 hours of the onset of acute ischemic stroke reduces the risk of death and disability later on. Neuroimaging is highly recommended prior to starting aspirin medication. Thrombolysis with alteplase administered within the first three hours following the onset of a stroke significantly improves the patient's chances of making a nearly full recovery when done by skilled medical personnel. As soon as feasible after

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admission, the secondary prophylaxis, which includes blood pressure regulation, should start. Every patient should receive lifestyle counselling, which should include recommendations on how to give up smoking, limit alcohol and saturated fat intake, lose weight, and increase physical activity.(5) Roughly one in three individuals who subsequently underwent diffusion-weighted magnetic resonance imaging (DWMRI) had first visited their family physician. The likelihood of a four-fold increase in the delay in receiving prehospital care was associated with in-person visits to the family physician. Any initiative that seeks to reduce prehospital wait times should view the primary care physician and their team as important partners in the prehospital care pathway.(6) Robust, Combined Education Programmes Aimed at General Practitioners, the Public, and Medical and Paramedical Hospital Staff May Lead to Higher Stroke Treatment Rates.7, 8] Our study sought to determine the variables linked to prehospital delay in acute stroke patients, as well as to corroborate the previously investigated variables and uncover new ones.

II. METHODS AND MATERIALS

This descriptive cross-sectional study took place between 2021 and 2022 at Vijaya Hospital in Chennai, South India, a prominent referral center for diverse medical conditions. The hospital, a multispecialty tertiary care facility, particularly emphasizes thrombolysis in acute stroke cases within a 4.5-hour window. The neurology department admits around 400 new stroke patients annually, and the stroke ICU and neurology ward are well-equipped.

The study, with ethical clearance, involved the neurology intensive care unit and neurology units, encompassing a sample size of 260 patients with acute stroke. Inclusion criteria comprised individuals aged 19 and above with neurological symptoms, diagnosed with nontraumatic ischemic or hemorrhagic stroke through MRI or CT scan. Exclusions encompassed conditions like tumors, poisoning, trauma, in-hospital strokes, lesion-negative transient ischemic attacks, pre-treated thrombolysis, strokes from aneurysms or arteriovenous malformations, presentations beyond seven days from symptoms onset, and cases with unknown onset duration.

Patients, or their representatives, were informed and provided consent before enrollment, involving interviews lasting 20 to 30 minutes. Variables included prehospital time, defined as onset to hospital arrival, and prolonged prehospital delay (PHD) as over 4 hours and 30 minutes from symptom onset to hospital presentation. Factors examined comprised socio-demographic details, medical history, stroke manifestations, contextual factors (onset details, bystanders, arrival time, travel mode, distance), and cognitive-behavioral factors affecting delayed hospital arrival.

Statistical analysis involved summarizing categorical variables with frequency and percentage, while quantitative variables were represented using median and interquartile range. The arrival time was dichotomized into early (≤4 hours and 30 minutes) or late (>4 hours and 30 minutes). Univariate analysis, Chi-square, and Fisher's exact tests were conducted using SPSS 16 software to identify factors associated with PHD in acute stroke.

III. RESULTS

Table1: Demographic factors contributing to prehospital delay in univariate analysis (n-200)

	Variables	Frequency	n%	Prehospital delay (PHD)		P value
				Yes	No	
1.	**Age (in years)**					0.003*
	20-30 31-40 41-50 51-60 61-70	37 21 63 56 23	(18.50) (10.50) (31.50) (28.00) 11.50	14 17 45 38 16	23 04 18 18 07	
2.	**Sex** Male Female	56 144	28 72	92 38	52 18	0.597
3.	**Marital status**					0.000*
	Married Unmarried	161 33	83.50 16.50	119 11	48 22	
4.	**Education**					0.000*
	No education Primary Hr. secondary Graduate postgraduate	36 47 32 55 30	18 23.5 16 27.5 15	36 47 16 27 04	0 0 16 28 26	

5.	**Occupation**					0.000*
	Unskilled	18	09	18	0	
	Agricultural farmers	08	04	8	0	
	Skilled	32	16	7	25	
	Professional	47	23.5	25	22	
	Business	34	17	22	12	
	Unemployed (retired and homemaker)	28	14	28	0	
6.	**Living Status**					0.000*
	Nuclear	61	30.50	29	32	
	Joint	101	19	101	0	
	Living alone	38	50.50	0	38	
7.	**Medical insurance**					0.000*
	Yes	158	79	88	70	
	No	42	21	42	0	
8.	**Place of residence**					0.000*
	Rural	102	51	102	0	
	Urban	70	35	0	70	
	Suburban	28	14	28	0	
9.	**Type of stroke**					0.001*
	Ischemic	89	44.5	69	20	
	Haemorrhagic	111	55.5	61	50	
10.	**History of stroke**					0.026*
	First time	160	80	98	62	
	Recurrent	40	20	32	08	

In the univariate analysis assessing demographic factors contributing to prehospital delay, several variables were scrutinized, including Age, Sex, Marital status, Education, Occupation, Living status, Medical insurance, Place of residence, Type of stroke, and History of stroke. Noteworthy findings emerged across different age groups, with statistically significant prehospital delays identified in individuals aged 20-30, 31-40, 41-50, 51-60, and 61-70 years. Marital status revealed a predominant percentage of married individuals at 83.50%. Educational disparities were evident, with statistically significant variations among primary-educated, secondary-educated, graduate, post-graduate, and uneducated groups. Occupational differences were also notable, encompassing unskilled, agricultural farmers, skilled, professional, business, and unemployed categories, all exhibiting statistical significance. The majority of the population possessed medical insurance (79%), while rural residence (51%) and urban residence (35%) demonstrated statistically significant distinctions. The distribution between ischemic and hemorrhagic strokes was statistically significant, with 44.5% and 55.5%, respectively. Additionally, the occurrence of stroke as a first-time event was prevalent in 80% of patients, and recurrent cases constituted 20%, with statistical significance identified in these values.

Table2: **Distribution of SF-36 scores by sex of study subjects**

Variables	**Frequency**	**(n%)**	**Prehospital delay (PHD)**		**P value**
			Yes	**No**	
Location of stroke onset					
Home	138	69	85	53	0.132
Outside	62	31	45	17	
Onset day					
Monday	77	38.50	11	14	
Tuesday	25	12.50	15	0	
Wednesday	15	7.50	27	5	0.000*
Thursday	32	16	01	13	
Friday	14	7	11	1	
Saturday	12	6			
Sunday					
Stroke onset					
While awake	159	79.50	106	53	0.330
While sleeping	41	20.50	24	17	
Stroke onset time					
3 am-11 am	77	38.50	62	15	

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11 am-7 pm	82	41	44	38	0.001*
7 pm-3 am	41	20.50	24	17	
Hospital arrival time					
3 am-11 am	87	43.5	68	19	
11 am-7 pm	32	16.00	21	11	0.001*
7 pm-3 am	81	40.50	41	40	
Distance to study hospital					
≤80 km	28	14	28	0	
81-120 km	102	51	102	0	0.000*
>120 km	70	35	0	70	
Transportation time					
Up to 3 h	28	14	28	0	
3.1-6 h	102	51	102	0	0.000*
>6 h	70	35	0	70	

The breakdown of SF-36 scores based on the gender of study subjects included various variables such as location, onset day, stroke onset circumstances, hospital arrival time, distance to the study hospital, and transportation. Notable findings in the distribution of stroke onset locations revealed that 69% occurred at home, while 31% took place outside. The timing of stroke onset indicated that 79.50% occurred while the individual was awake, with 20.50% occurring during sleep. The distribution across different time intervals showed that 38.50% of strokes occurred between 3 am and 11 am, 41% between 11 am and 7 pm, and 40.50% between 7 pm and 3 am. Regarding hospital arrival times after symptoms, 43.5% were recorded between 3 am and 11 am, 16% between 11 am and 7 pm, and 40.50% between 7 pm and 3 am, all of which were statistically significant. The distance to the study hospital revealed that 14% were less than 80 km, 51% were between 81-120 km, and 35% were greater than 120 km, with all of these being statistically significant. In terms of transportation time, 14% took up to 3 hours, 51% between 3.1-6 hours, and 35% more than 6 hours, all of which were statistically significant.

Table 3: Association between stroke symptoms and prehospital delay in univariate analysis

Variables	**Frequency(n%)**	**Prehospital delay (PHD)**		**P value**
		Yes	No	
Symptoms				
Hemiparesis	32(16)	30	2	
Slurred speech	54(27)	31	23	
Dizziness	14(7)	14	0	
Deviation of the face	18(9)	14	4	
Vomiting	9(4.50)	6	3	**0.000***
Consciousness disturbances	11(5.50)	3	8	
Hemiplegia	8(4)	0	8	
Head ache	7(3.50)	0	7	
Aphasia	11(5.50)	3	8	
Visual disturbances	6(3)	6	0	
Fall	16(8)	10	6	
Seizure	14(7)	10	4	

The association between stroke symptoms and prehospital day in univariate analysis the symptoms was collected. Hemiparesis in 16% and prehospital in 30 patients, Slurred speech 27% and 31 patients were pre-delayed, Dizziness 7% and 14 patients in pre-hospital delay, Deviation of the face 9% and 14 patients, Vomiting 4.50% and prehospital delay in 6 patients, Consciousness 5.50% and pre-hospital delay in 3 days, Hemiplegia 4%, Headache 3.50%, Aphasia 5.50% prehospital delay in 3 patients, Visual disturbances 3% and prehospital delay in 6 days, Fall 8% and pre hospital delay in 10 patients, Seizure 7% and prehospital delay in 10 patients and all these values were statistically significant.

IV. DISCUSSION

Prehospital delay in the context of acute stroke pertains to the time lapse between the initiation of stroke symptoms and the patient's arrival at the hospital, a critical factor influencing stroke outcomes. Insufficient awareness of stroke symptoms among the public is a primary contributor to prehospital delay. Transportation-related challenges, particularly for individuals residing in remote areas or having limited access to transport, can significantly prolong the time it takes for them to reach the hospital. Additionally, patient-related factors, including age, gender, and race/ethnicity, may also play a role in prehospital delay.

In our study, while variables such as location of stroke onset did not exhibit statistical significance in contributing to prehospital delay, other factors like stroke onset time, distance to the study hospital, and transportation time were significant contributors. Symptoms, excluding hemiplegia and headache, were associated with delays in reaching the hospital. Findings from Eun Seog Hong et al. indicated that prehospital delays were linked to worsening symptoms, symptom onset at home, and self-arrival at the emergency department. Atrial fibrillation risk patients tended to arrive at the emergency department sooner.

Notably, our study identified that subjects experiencing stroke onset between 3 am and 11 am had a higher prehospital delay (43.5%). This aligns with a Taiwanese prospective study of 196 patients, suggesting that prolonged prehospital delay is often due to the interval between symptom onset and the decision to seek medical attention. Age-wise, individuals between 41-50 (31.50%), 51-60 (28%), and 61-70 (11.50%) demonstrated more prehospital delay than other age groups, consistent with Ku-Chou Chang's study where advanced age delayed the decision to seek medical help.

In terms of gender, our study showed more female subjects (72%) than males (28%), differing from Hyung Ju Kim MD's study, which reported a higher male proportion (60.3%). In conclusion, addressing the complex issue of prehospital delay in acute stroke requires targeted educational programs, improvements in healthcare infrastructure, and culturally sensitive healthcare provision. Swift recognition and treatment of stroke symptoms are imperative for optimizing outcomes for stroke victims.

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