Original Article

Factors Influencing Delay in Treatment-Seeking Among Adults with Acute Ischemic Stroke: A Retrospective Case-Control Study at Selected Private Hospital, Coimbatore, Tamil Nadu

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Abstract

Background: Acute ischemic stroke (AIS) is a leading cause of death and long-term disability worldwide. Timely intervention, particularly thrombolysis within the 4.5-hour therapeutic window, can significantly improve outcomes. In India, however, pre-hospital delays frequently prevent patients from receiving time-sensitive treatment.

Objective: To examine demographic, clinical, cognitive, and social factors associated with delays in seeking treatment among adults diagnosed with AIS.

Methods: A retrospective case-control study was conducted among 105 AIS patients admitted to private hospital, Coimbatore. Patients were categorized into within-window (<4.5 hours; n = 39) and after-window (>4.5 hours; n = 66) groups. Data were collected using structured questionnaires, the Duke Social Support and Stress Scale (DUSOCS), and the NIH Stroke Scale (NIHSS). Statistical analysis included Chi-square tests and logistic regression; significance was set at $p \leq 0.05$.

Results: The mean time to hospital arrival was 7 hours 47 minutes (SD = 5 h 33 m), with 62.9% presenting after the 4.5-hour window. Delayed presentation was significantly associated with poor stroke knowledge ($p = 0.01$), low perceived seriousness of symptoms ($p < 0.001$), inadequate non-family support ($p < 0.001$), and coexisting hypertension and diabetes ($p = 0.005$). Patients presenting after the window had higher rates of moderate-to-severe strokes (NIHSS: 50%) compared to those presenting within the window (2.6%).

Conclusion: Delays in treatment were primarily attributable to inadequate symptom recognition, underestimation of severity, limited social support, and transport barriers. Public awareness initiatives, strengthened emergency medical services, and enhanced community support systems are essential to reducing pre-hospital delays in AIS care.

Keywords: Acute ischemic stroke, treatment delay, social support, symptom perception, India

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Introduction

Stroke is the second leading cause of death globally and a major cause of long-term disability (Revathi et al., 2023)[3]. Ischemic strokes account for the majority of cases, with acute ischemic stroke (AIS) resulting from cerebral artery occlusion. Early reperfusion therapy, particularly thrombolysis with tissue plasminogen activator (tPA), has been proven to reduce disability when administered within the 4.5-hour golden window from symptom onset (Joseph, Divakaran, Mathew, & Menon, 2024) [5].

In India, stroke burden is increasing due to aging populations, hypertension, diabetes, and sedentary lifestyles (Revathi et al., 2023) [3]. Despite improved diagnostic and therapeutic resources in tertiary care hospitals, many patients present too late to benefit from thrombolysis [4]. Factors such as low awareness of stroke symptoms, delays in recognizing severity, limited access to emergency medical services (EMS), and inadequate social support have been reported as significant contributors to delay (Aruyan, Chaiyasit, &Kanchanarin, 2024) [1]. "Factors such as low awareness of stroke symptoms, delays in recognizing severity, limited access to emergency medical services (EMS), and inadequate social support have been reported as significant contributors to delay. [2]

Need for the study: Despite several Indian studies describing pre-hospital delay in stroke, most have focused on public or government hospitals and have not examined the combined influence of cognitive factors, comorbidities, and social support within the private-hospital setting of Tamil Nadu [19]. This limited evidence leaves an important knowledge gap regarding how these variables interact in private tertiary care centres, where care pathways and patient profiles may differ from those in public facilities[17]. To address this gap and guide context-specific interventions, the present study aimed to identify factors influencing treatment-seeking delay among adults with acute ischemic stroke (AIS) admitted to a tertiary private hospital in Tamil Nadu, India, to inform targeted strategies for timely stroke management. [18]

Research gap: Few data from private tertiary hospitals examining cognitive, social, and clinical factors together. Findings will inform tailored interventions to reduce pre-hospital delay in similar private-care settings.

Methods

Study Design and Setting

This retrospective case-control study was conducted at selected private hospital, Coimbatore, a tertiary care facility with specialized neuro-intervention services.

Participants

A total of 105 adult patients diagnosed with AIS via CT cerebral angiography were included.

- Within-window group: arrival ≤ 4.5 hours (n = 39)
- After-window group: arrival > 4.5 hours (n = 66)

Inclusion criteria: Adults aged ≥18 years with confirmed AIS, able to participate in interviews or provide reliable case records.

Exclusion criteria: Exclusion criteria included a history of prior stroke, significant cognitive impairment (as documented in the medical record or identified during screening), or a stroke diagnosed incidentally during hospitalization for another primary condition. Because this was a retrospective case-control study using medical records, informed consent was obtained from all living participants or their legally authorized representatives when patients were unable to provide consent for the use of their data.

Instruments

1. Demographic and Clinical Proforma – Age, sex, education, income, occupation, comorbidities.
2. **Cognitive Factors Questionnaire** – This investigator-designed questionnaire assessed (a) knowledge of stroke warning signs and risk factors, (b) recognition of symptom onset,

and (c) perceived seriousness of symptoms. Item generation was informed by existing stroke-awareness instruments and guidelines, including the World Health Organization stroke education framework and the American Stroke Association's FAST campaign.[16,18]

3. Compliance Assessment – Adherence to medication/self-care for chronic conditions. [8,12]
4. Duke Social Support and Stress Scale (DUSOCS) – Measures family and non-family support.[9]
5. NIH Stroke Scale (NIHSS) – Categorizes stroke severity.[10]

Data Analysis

Data were analyzed using SPSS v20. Descriptive statistics summarized demographic and clinical characteristics. Chi-square tests examined associations between variables and treatment delay. Logistic regression identified s ignificant predictors. Statistical significance was set at $p \leq 0.05$.

Results

Extent of Delay

Table 1 & Figure 1 :presents treatment-seeking times. Over 60% arrived beyond the 4.5-hour window, with a mean arrival time of nearly 8 hours.

Table 1. and figure 1 Treatment-Seeking Time among Patients with Acute Ischemic Stroke

Time from Symptom Onset to Hospital Arrival	Frequency (n)	Percentage (%)
< 4 hours (within window)	39	37.1
4–12 hours	48	45.7
12–24 hours	16	15.2
> 24 hours	2	1.9
Total	105	100

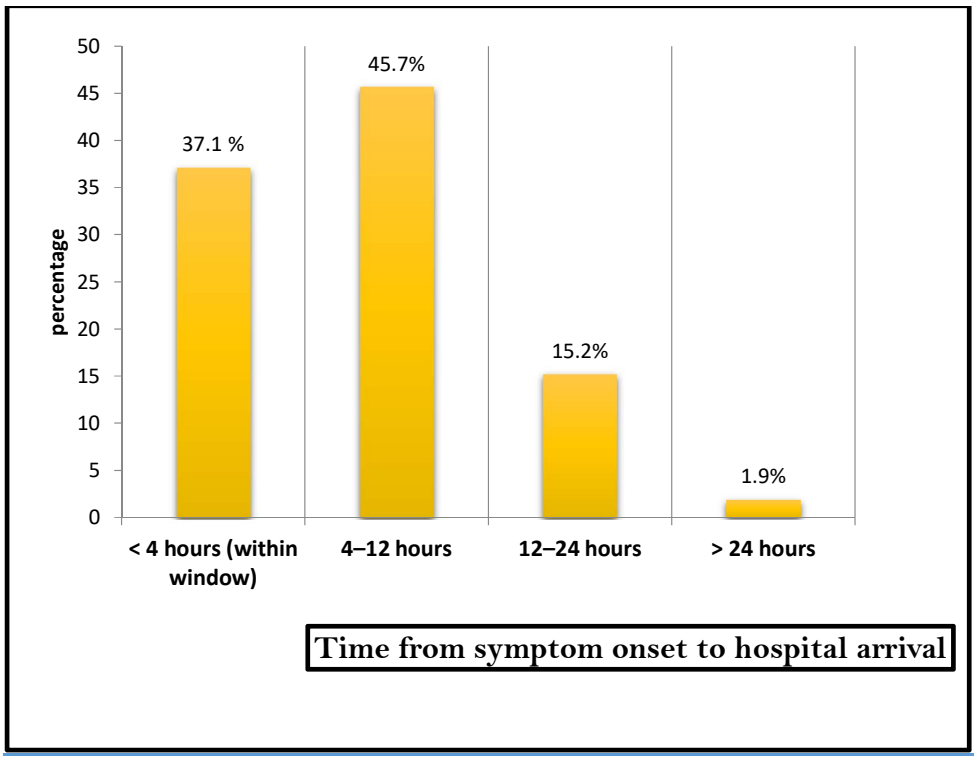

Figure 1: (treatment-seeking times)

Cognitive Factors

Table 2 Figure 2 shows that patients with low knowledge of stroke symptoms were significantly more likely to present late.

Table 2. Knowledge Level about Acute Ischemic Stroke by Treatment Window

Knowledge Level	Within Window (<4 h) n (%)	After Window (>4 h) n (%)	χ^2	p-value
Low	11 (28.2)	40 (60.6)	18.71	0.01 **
Moderate	15 (38.5)	23 (34.9)		
High	13 (33.3)	3 (4.5)		

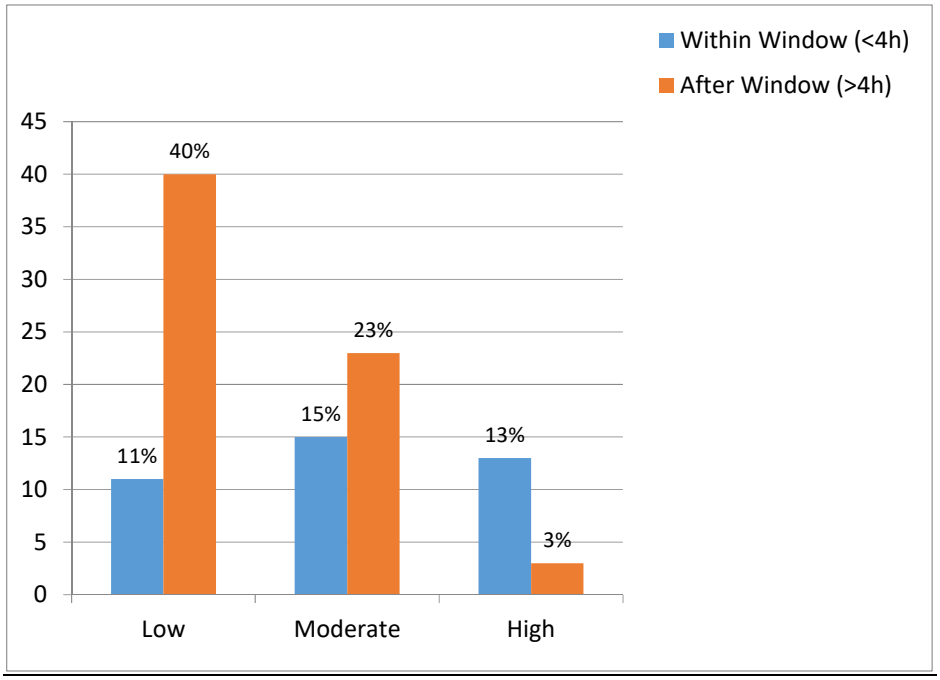

Figure 2: (knowledge level)

Perceived Seriousness

Perception of mild severity was much more common in the delayed group (Table 3 & Figure 3).

Table 3. Perceived Seriousness of Symptoms by Treatment Window

Perceived Seriousness	Within Window (<4 h) n (%)	After Window (>4 h) n (%)	χ^2	p-value
Mildly serious	0 (0.0)	17 (25.8)	27.17	<0.001 ***
Moderately serious	8 (20.5)	18 (27.3)		
Very serious	14 (35.9)	23 (34.9)		
Extremely serious	15 (38.5)	3 (4.5)		

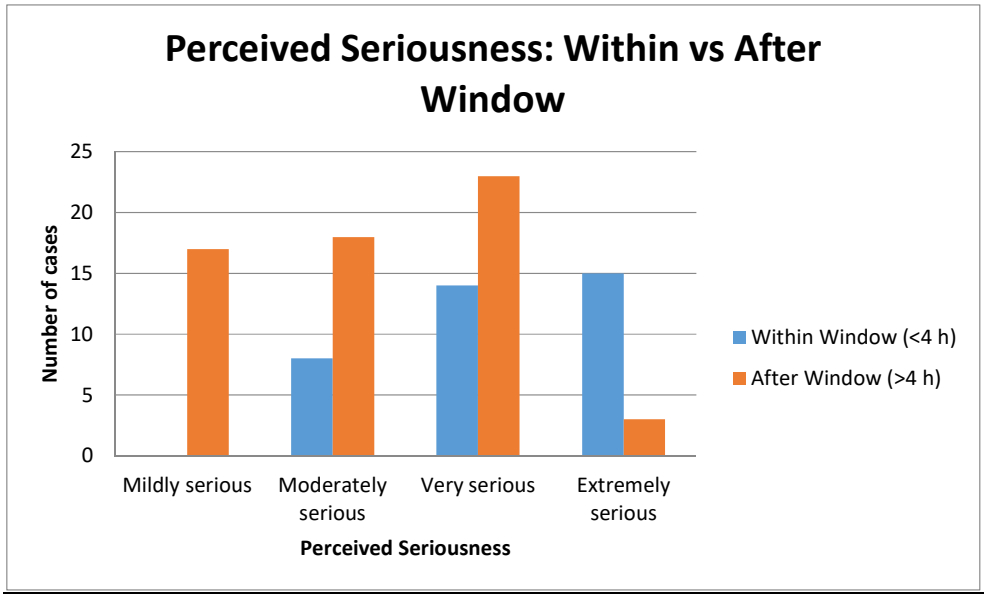

Figure 3: (seriousness of symptoms)

Stroke Severity

NIHSS scores indicated more severe strokes among those who arrived late (Table 4).

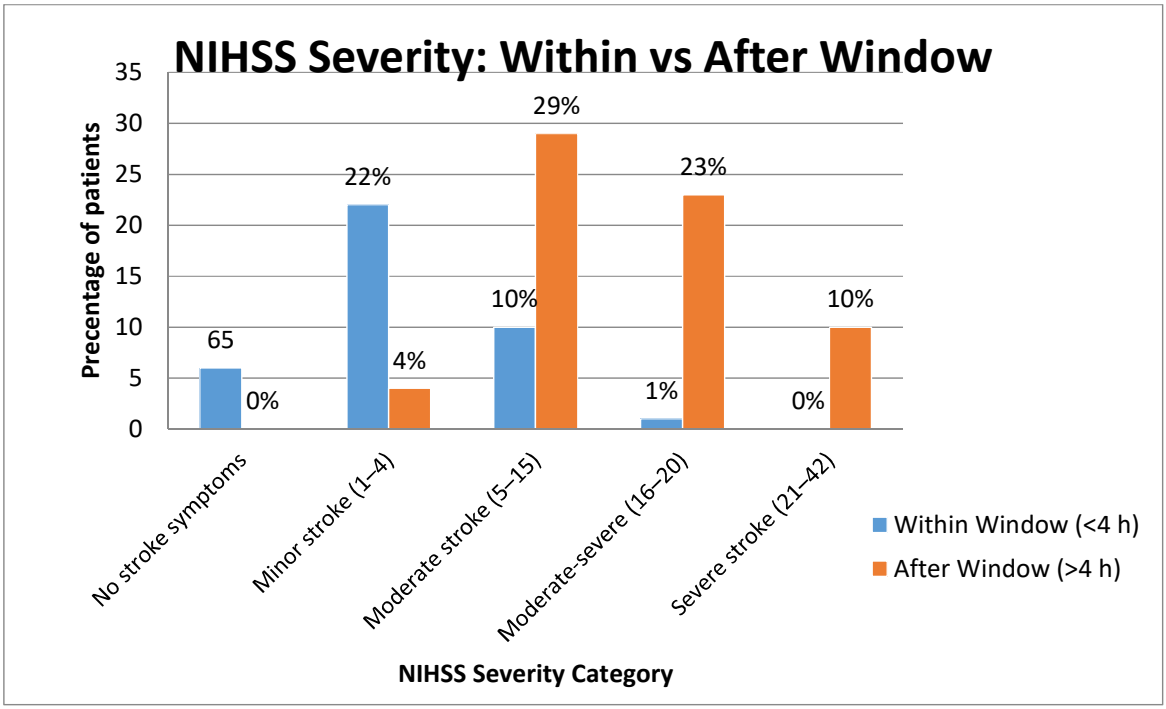

Figure 4: (severity by treatment window)

Table 4 & Figure 4 : NIHSS Stroke Severity by Treatment Window

NIHSS Severity Category	Within Window (<4 h) n (%)	After Window (>4 h) n (%)	χ^2	p-value
No stroke symptoms	6 (15.4)	0 (0.0)	54.55	<0.001 ***
Minor stroke (1–4)	22 (56.4)	4 (6.1)		
Moderate stroke (5–15)	10 (25.6)	29 (43.9)		
Moderate-severe (16–20)	1 (2.6)	23 (34.9)		
Severe stroke (21–42)	0 (0.0)	10 (15.2)		

Social Support

Non-family support was notably inadequate in the delayed group (Table 5& figure 5).

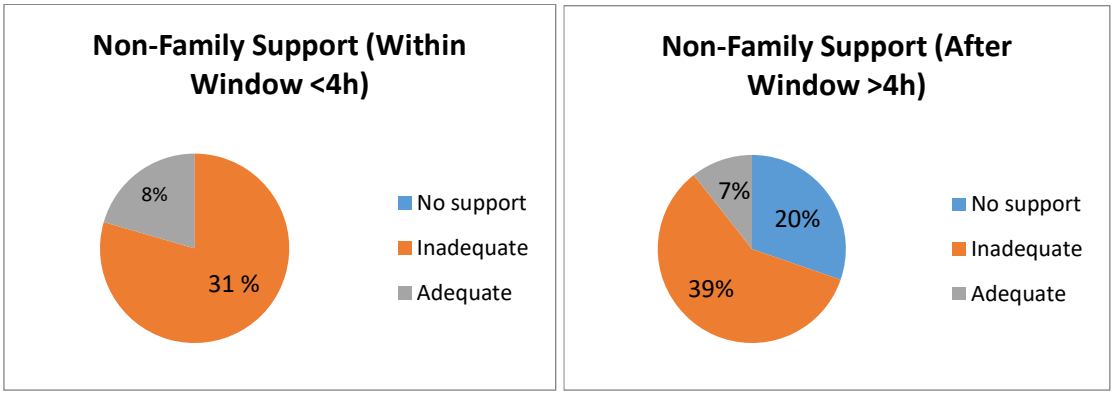

Figure 5: family support level

Table 5. Non-Family Support Levels by Treatment Window

Non-Family Support Level	Within Window (<4 h) n (%)	After Window (>4 h) n (%)	χ^2	p-value
No support	0 (0.0)	20 (30.3)	15.03	<0.001 ***
Inadequate	31 (79.5)	39 (59.1)		
Adequate	8 (20.5)	7 (10.6)		

Discussion

This study found that nearly two-thirds of AIS patients arrived after the recommended therapeutic window for thrombolysis. Consistent with recent studies from India, low stroke knowledge and misinterpretation of symptoms were major contributors to delay [6]

The strong association between inadequate non-family support and delayed presentation underscores the importance of social networks in emergency response [20]. Coexisting hypertension and diabetes were also linked to delays, possibly because patients and caregivers misattributed acute neurological symptoms to chronic conditions. Similar patterns have been reported in Southeast

Asia,[1] and are consistent with findings from other regions of India, where low social support and poor recognition of stroke warning signs independently predicted late arrival. [3,4,5] Studies from Pakistan and Kerala further highlight socioeconomic constraints, family decision-making dynamics, and limited emergency medical service utilization as key contributors to pre-hospital delay.[11,7] Collectively, these observations reinforce that treatment-seeking delay is multifactorial and transcends geographic boundaries, requiring multifaceted community- and system-level interventions. [4]

These findings highlight the need for targeted stroke education, improved EMS coverage, and community-based support systems to ensure timely access to care.[13]

Conclusion

Most AIS patients in this study presented beyond the optimal window for reperfusion therapy. Addressing the identified cognitive, social, and logistical barriers could substantially improve timely hospital arrival and clinical outcomes.[14]

Implications

- **Community Education:** Nurses can lead stroke-awareness programs in villages, workplaces, and outpatient clinics to teach the FAST (Face, Arm, Speech, Time) signs and the need for rapid hospital transport.
- **Strengthening EMS Links:** Nurse Educators and administrators can work with emergency services to develop quick-referral protocols and provide training in prehospital stroke triage.
- **Family and Social Support:** Community health nurses can identify patients at risk (elderly, those living alone) and build support networks to ensure timely help during emergencies.
- **Policy Input:** Nurse leaders can advocate for better ambulance coverage and stroke-care pathways in rural and peri-urban areas, using evidence from this study to guide health-policy decisions.

Limitations

- Conducted in one private tertiary hospital in Tamil Nadu, so results may not represent government hospitals or rural communities.
- Retrospective design relied on hospital records and patient recall, which may contain missing or inaccurate details.
- Modest sample size limits detection of less common factors affecting delay.

Future Research

- **Multicenter Prospective Studies:** Include both private and public hospitals to compare treatment-seeking behavior across settings.
- **Qualitative Studies:** Explore patient, family, and community perceptions of stroke symptoms and barriers to early hospital arrival.
- **Intervention Trials:** Test nurse-led education programs, tele-EMS coordination, and community support models to see if they shorten prehospital delay.
- **Follow-up Outcomes:** Assess how timely arrival influenced recovery, rehabilitation needs, and long-term quality of life.

Recommendations

1. Public education on FAST (Face, Arm, Speech, Time) for stroke recognition.
2. Strengthening EMS for rapid transport in both urban and rural areas.
3. Primary care training for immediate referral of suspected stroke.
4. Community engagement to foster supportive networks for at-risk individuals.

Conflict of Interest: None declared.

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