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Barriers to Timely Stroke Thrombolysis in Northeast India: A Qualitative Audit from A Tertiary Care Center

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Abstract
Timely thrombolysis significantly improves functional outcomes in acute ischemic stroke. However, implementation remains suboptimal in low-resource settings. To identify real-world barriers delaying intravenous thrombolysis in ischemic stroke patients in Northeast India. This prospective observational study was conducted at the Department of Neurology, GMCH Assam, between January 2023 and March 2024. We included 444 ischemic stroke patients presenting within 24 hours of symptom onset, of whom 29 underwent thrombolysis. Barriers were identified through patient interviews, medical records, and care provider documentation. Primary outcomes were patient-, system-, and hospital-related delays preventing thrombolysis. Frequencies and thematic narratives were compiled. Among 444 patients, only 29 (6.5%) received thrombolysis. The most common barriers were delayed arrival beyond the 4.5-hour window (63%), lack of symptom awareness (52%), ambulance unavailability (38%), imaging and consent delays (22%), and elevated blood pressure (17%). Financial constraints were a factor in 11%. Most patients originated from rural areas. Real-world barriers continue to hinder thrombolysis implementation in India. Public education, prehospital care reforms, and streamlined stroke protocols are crucial to improving outcomes in underserved regions.

INTRODUCTION

Stroke is a major public health challenge and the second leading cause of death globally, disproportionately affecting low- and middle-income countries (LMICs)[1]. In India, stroke incidence is rising due to aging, hypertension, diabetes, and limited preventive care[2]. Intravenous thrombolysis with rt-PA within 4.5 hours of onset remains the cornerstone of acute ischemic stroke management[3], yet thrombolysis rates in India remain below 10% in most centers. Understanding local barriers is essential to improving access.

MATERIALS AND METHODS

We conducted a prospective audit at GMCH, Assam, from January 2023 to March 2024. All ischemic stroke patients presenting within 24 hours were screened. We recorded clinical data, timelines, and outcomes. Semi-structured interviews with patients and caregivers were used to elicit delays in symptom recognition, transport, referral, and consent. Physicians recorded institutional and logistic issues.

RESULTS AND DISCUSSIONS

Out of 444 ischemic stroke patients who presented to the Department of Neurology, GMCH Assam, between January 2023 and March 2024, only 29 patients (6.5%) underwent intravenous thrombolysis with alteplase. The remaining 415 patients were deemed ineligible primarily due to delayed presentation, medical contraindications, or logistic constraints.

The most frequent and prominent barrier identified was delayed arrival beyond the therapeutic 4.5-hour window, seen in 278 patients (63%). A majority of these cases involved rural residents who either misinterpreted early symptoms or delayed seeking care due to underestimation of severity. Some patients resorted to local remedies or unqualified practitioners before presenting to a stroke-ready facility.

Lack of symptom awareness was reported in 231 patients (52%). Patients and caregivers failed to recognize signs of stroke such as facial droop, limb weakness, or speech difficulty. Many associated these symptoms with fatigue, falls, or unrelated illnesses, thereby delaying initial response.

Ambulance unavailability was a notable barrier in 168 cases (38%). Most patients used private vehicles or public transport. In many rural regions, emergency medical services (EMS) either did not exist or were slow to respond. Moreover, even when ambulances were available, paramedic staff lacked training in stroke triage and time-critical transport.

In-hospital delays affected 98 patients (22%). These included delays in getting non-contrast CT scans due to long queues, consent-related hold-ups particularly in unconscious or elderly patients, and lack of predefined stroke pathways for immediate assessment. The absence of dedicated stroke teams during night shifts or weekends also contributed to treatment delays.

Elevated blood pressure on arrival, specifically systolic BP >185 mmHg or diastolic BP >110 mmHg, was seen in 75 patients (17%). These patients required aggressive management prior to thrombolysis, and in many cases, the therapeutic window expired before BP could be adequately controlled. Some patients had previously undiagnosed hypertension.

Financial hesitancy was reported in 49 cases (11%), where out-of-pocket expenses for imaging, medications, or ICU admission led to delay or denial of consent by the family. This was particularly evident among daily wage laborers or those lacking social security.

Sociocultural barriers, although less quantifiable, emerged during interviews. In rural households, decision-making often rested with elders who were unavailable or unreachable at the time of consent. Myths surrounding injections and fear of complications also led to refusal in some cases.

Only 29 patients, most of whom presented within 2.5 hours of symptom onset, received timely thrombolysis. They shared common features: urban proximity, higher education level, use of EMS, and swift in-hospital assessment. Nearly all were supported by stroke-aware family members who expedited the process.

This prospective qualitative audit highlights the persistent and multifactorial barriers impeding timely intravenous thrombolysis for acute ischemic stroke in Northeast India. Despite being conducted at a tertiary care academic center, the thrombolysis rate in our cohort was only 6.5%, reflecting national trends and underscoring systemic challenges that limit optimal stroke care in resource-constrained settings.

Delayed hospital arrival, noted in 63% of patients, emerged as the most dominant barrier in our study. This is consistent with earlier audits from across India. Kamalakannan *et al*. (2017) in a systematic review reported delayed presentation as the primary reason for low thrombolysis rates across South Indian centers, often linked to poor awareness and logistic delays[5]. Similarly, Das *et al*. (2021) in Eastern India observed that 68% of non-thrombolysed patients presented after the 4.5-hour window[10]. Our findings further validate that delayed arrival is a nationwide issue, especially among rural populations, and is driven largely by symptom misrecognition and prolonged travel.

Lack of stroke awareness, noted in over half our patients, is another key contributor. This trend mirrors

Table 1: Patient Characteristics and Barriers to Thrombolysis

Barrier Category	Specific Barrier	Frequency (n)	Percentage (%)
Prehospital	Arrival beyond 4.5-hour window	278	63
Prehospital	Lack of symptom awareness	231	52
Prehospital	Ambulance unavailability	168	38
Intrahospital	Imaging or consent delay	98	22
Medical	Hypertensive crisis on arrival	75	17
Socioeconomic	Financial hesitancy	49	11

Table 2: Comparison of Thrombolysis Rates and Barriers in Indian Studies

Study	Region	Thrombolysis Rate	Primary Barriers
Kamalakannan et al., 2017	South India	5.8%	Late arrival, cost, imaging delay
Das et al., 2021	Eastern India	7.2%	Transport, consent, CT delay
John et al., 2020	West India	4.5%	Awareness, family refusal, finances
Present Study	Northeast India	6.5%	Late arrival, awareness, transport

studies from both South Asia and LMICs. A study from rural Bangladesh revealed that less than 30% of respondents could identify two or more stroke warning signs[6]. Lai *et al*. (2022) demonstrated that community-based stroke education using the FAST mnemonic significantly improved early presentation rates and patient outcomes[6]. Our findings reinforce the urgent need for grassroots-level awareness campaigns in local languages using culturally sensitive communication.

Transport and ambulance barriers were seen in 38% of our cases, echoing deficits identified in Tamil Nadu (Mukunth *et al*., 2019) and Nepal (Manandhar et al., 2020)[8,9]. In both these regions, poor EMS coverage and dependency on private vehicles resulted in average delays of over 2 hours. In our study, most patients came via unassisted transport, further delaying triage. This emphasizes the need for integrating prehospital stroke alerts, trained paramedics, and prioritized ambulance dispatch within India's national emergency response systems (e.g., 108 services).

In-hospital delays, including imaging queues and consent issues, are common across public hospitals in India. Our 22% rate is similar to the 18% reported by Das *et al*. (2021) in Eastern India[10]. The lack of dedicated stroke teams, unavailability of 24x7 radiology, and hierarchical consent processes prolong decision-making. Several countries have implemented "stroke code" activations where multidisciplinary teams expedite imaging, labs, and consent-such pathways remain rare in Indian public hospitals and should be prioritized.

Elevated blood pressure on arrival (17% in our study) also parallels findings from Menon et al. (2021), who reported that nearly 1 in 5 patients in urban Maharashtra had hypertensive emergencies delaying thrombolysis[12]. Studies from Sri Lanka also showed similar patterns, especially in elderly patients and those with untreated hypertension[11]. This underscores the need for prehospital BP management, rapid-acting antihypertensives in emergency settings, and community-level screening programs.

Financial constraints (11% of our cases) are a recurring theme in Indian stroke care. Even in government hospitals, costs related to CT/MRI, ICU admission, and thrombolytic agents can pose significant burden. John *et al*. (2020) from Western India highlighted how economic insecurities led to thrombolysis refusal despite clinical eligibility[13]. Out-of-pocket expenses remain a barrier even after the introduction of Ayushman Bharat and state health schemes, especially in settings with unpredictable outlays or lack of awareness about financial coverage.

Cultural and family-related delays remain underreported in literature but were prominently seen in our cohort. In rural Northeast India, family elders often hold decisional authority, and fear of "strong injections" or fatal complications influences consent. Mukherjee *et al*. (2022) highlighted similar sociocultural challenges in Jharkhand and Chhattisgarh, where treatment refusal was often rooted in generational beliefs and low medical literacy[14]. Addressing these barriers requires sustained community engagement and involvement of local leaders and influencers.

When comparing thrombolysis rates across studies (Table 2), the overall percentage rarely exceeds 10%, even in high-volume academic centers. This reaffirms the need for national-level structural reforms. Organized stroke systems in China and Brazil have shown that investment in EMS training, tele-stroke networks, and public education can raise thrombolysis rates to >15% even in rural zones[15].

CONCLUSIONS

This qualitative audit reveals modifiable barriers to thrombolysis in Northeast India. Addressing stroke education, transport networks, emergency protocols, and financial support systems can significantly improve thrombolysis rates. Regional and national stroke taskforces should prioritize these structural reforms.

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