

A PROSPECTIVE STUDY ON THE RISK FACTORS, TOAST CLASSIFICATION, AND MANAGEMENT OF ACUTE ISCHEMIC STROKE IN A TERTIARY CARE CENTER

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ABSTRACT

Objectives: Stroke contributes to being the fourth and third highest major cause of mortalities in India and in the global scenario, respectively. The Trial of ORG 10172 in acute stroke treatment (TOAST) system of classification is essential for determining the underlying cause, easier diagnosis, and improved treatment prognosis in acute ischemic stroke (AIS). This study was planned to classify the types of AIS and assess the treatment plans accordingly for overall improvement.

Methods: A prospective, observational study was conducted for a time period of 6 months. A total of 100 patients were selected for the study. Data included demographic information, medical and family history, TOAST classification, and management.

Results: The evaluation of 100 patients revealed that stroke prevalence is higher in males than females, with the predominant age group being 61–70 years. Significant association was found with hypertension, diabetes, alcoholism, and smoking. Furthermore, this study found that large artery atherosclerosis was the most common type of AIS among the patients.

Conclusion: This study highlights the importance of identifying and managing presumable risks through past medical history, classifying and treating the underlying cause and region of AIS for better prognosis.

Keywords: Trial of ORG 10172 in acute stroke treatment, Acute ischemic stroke, Tissue plasminogen activator.

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INTRODUCTION

Stroke, also referred to as a cardiovascular accident, is defined by the World Health Organization as an abrupt disturbance of brain function due to a vascular event. It is of two types: ischemic and hemorrhagic [1]. Stroke is the third and fourth highest contributor to mortality globally and in India, respectively [2-4], with 7.3 million deaths and more than 160 million lost disability-adjusted life years [5]. The prevalence of stroke has increased post-COVID-19 [6]. The most common kind of stroke is acute ischemic stroke (AIS). Prolonged neurological symptoms result from a blockage in a blood artery that supplies the brain. Transient ischemic attacks are generally similar in nature but resolve in a day without causing permanent damage [7,8]. The risk factors of stroke can be broadly divided into two groups, Modifiable (high blood pressure, diabetes, high cholesterol, smoking, obesity, excessive alcohol consumption, and unhealthy diet) and non-modifiable (age, sex, genetics, and ethnicity-South Asians, African Americans) [9] Modifiable factors are critical targets for prevention as they contribute to vascular damage and increased stroke risk [10].

To aid easier diagnosis, treatment, and prognosis, Ischemic strokes are categorized according to their etiology using the Trial of ORG 10172 in acute stroke treatment (TOAST) categorization system [11] into five types. Large artery atherosclerosis (LAA), where occlusion of major arteries (e.g., carotid, vertebral) or substantial atherosclerotic constriction (>50%) results in large cortical or subcortical infarcts (>1.5 cm). These strokes are frequently caused by thromboembolism due to plaque accumulation. Cardio-embolic stroke results by emboli originating in the heart, such as atrial fibrillation, myocardial infarction, or valve dysfunction. Lacunar stroke or small vessel occlusion (SVO), frequently associated with diabetes or hypertension, involves the

blockage of small penetrating arteries. Small (<1.5 cm) and found in deep brain areas, infarcts do not exhibit cortical signs or severe large-artery illness. Stroke of other defined etiologies includes uncommon causes such as genetic diseases, coagulopathies, vasculitides, and arterial dissection. After excluding common causes of stroke, specific investigations may be performed to confirm the diagnosis. Stroke of undetermined etiology, when there is no obvious etiology due to incomplete investigation, several probable reasons, or negative findings after thorough workup. Embolic stroke of undetermined source is the term used to describe embolic strokes that have no identifiable source [11].

The American Heart Association/American Stroke Association (AHA/ASA) guidelines advocate initiating antiplatelet medication within 24 h, anticoagulants for cardio-embolic causes, statins for cholesterol control, and careful monitoring of blood pressure in order to maintain cerebral perfusion [12]. Additional interventions such as early rehabilitation, oxygen therapy, and seizure management when necessary are considered [13]. Other supplements can also be advised to patients for neuro-health [14]. Classification methods such as TOAST are critical in guiding these treatments since they identify the underlying stroke subtype, allowing for more targeted and successful care [15]. This study is driven by the urgent need to improve AIS results by applying the TOAST diagnostic pattern and to improve the health and financial burden of stroke, particularly in high-burden areas such as Hyderabad, Telangana. Since stroke is one of the leading causes of death and disability in India and around the world, it is important to have a better understanding of modifiable risk factors too.

STUDY DESIGN AND METHODOLOGY

A prospective observational study was conducted for 6 months (October 2024–March 2025) in the Neurology inpatient department of a multi-specialty hospital at Hyderabad, Telangana. Ethical consent was given with Letter no.2024/6, and patient consent was obtained. A total of 100 participants were enrolled based on defined inclusion and exclusion criteria, with a consecutive sampling method enrolling all participants during the time period. Power analysis was not performed because the study's primary aim was descriptive (distribution of TOAST subtypes).

Inclusion criteria

Eligible participants were adults over 18 years of age with a history and diagnosis of AIS.

Exclusion criteria

Individuals under 18, or those with clinical diagnoses of transient ischemic attack, venous stroke, hemorrhagic stroke, aneurysm bleeding cases with SAH were excluded.

Data collection

Patient demographics, past medical and medication history, TOAST diagnosis, and treatment were recorded from the patient profile forms into structured data collection forms. Risk factors and TOAST classification were applied based on AHA guidelines and TOAST literature, respectively. In addition, clinical evaluation and neuroimaging findings such as computed tomography-brain, magnetic resonance imaging brain, magnetic resonance angiography, Carotid Doppler, and lipid profile were considered by neurologists in determining the diagnosis. The entire data are recorded and validated by neurologists only, and later recorded into data collection forms. The collected data were analyzed using Microsoft Excel to analyze patterns and draw statistically relevant conclusions. Significance of association was found with risk factors.

RESULTS

This study reported that 76% of the sample were male with a mean age of 59±15. 24% were female with a mean age of 60±17 (Fig. 1).

This study found that the incidence of stroke predominantly affects men between the age groups of 61–70 years, with 20 (26%) patients, followed by the age group of 51–60 years with 18 (24%). Women were affected in the age group 51–60 with 7 patients (29%) (Fig. 2).

Hypertension was identified as the major comorbidity in 58 (27%) patients. Other major comorbidities included diabetes mellitus 47 (22%), alcoholism 41 (19%), smoking 22 (10%), obesity 12 (6%), and dyslipidemia 11 (5%) (Fig. 3).

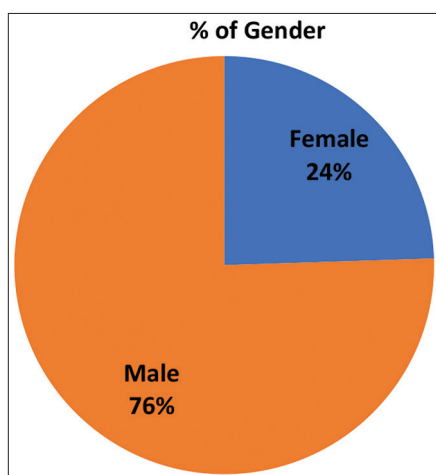


Fig. 1: The pie chart illustrates the distribution of cases or individuals by gender

Significant association was found with hypertension, diabetes, alcoholism, and smoking, whereas other risk factors were non-significant but still have clinical relevance ($p < 0.05$) (Table 1).

Based on cerebral circulation 73 patients (73%) of diagnosed strokes are affected in the anterior circulation whereas 27 (27%) in posterior circulation (Fig. 4). Regarding the types of AIS, the study found that LAA was found in 64 (64%) patients and was the most common type, followed by SVO 11 (11%), cardio-embolic stroke 10 (10%), undetermined stroke 8 (8%), and other determined stroke 7 (7%) (Fig. 5).

In terms of medication management, the study found that antiplatelets were the most commonly prescribed drugs (88%) in almost

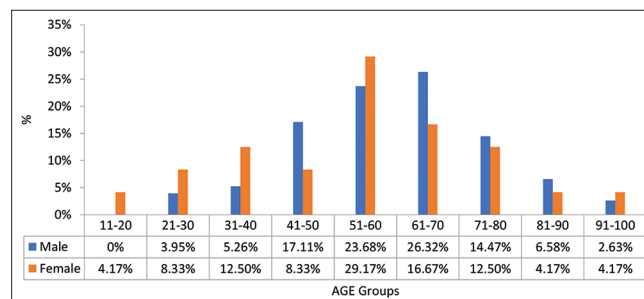


Fig. 2: The graph illustrates how the prevalence of acute ischemic stroke varies across different age and gender groups

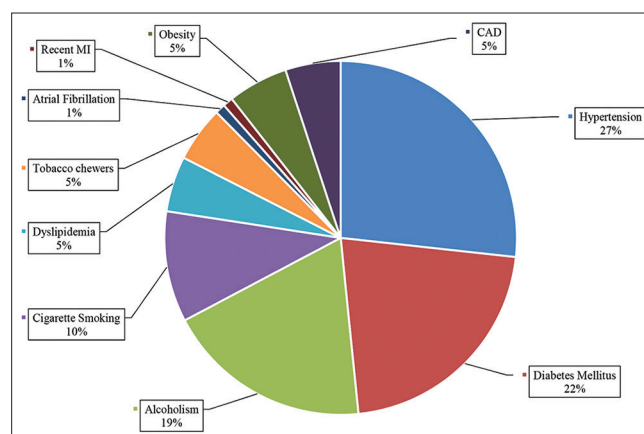


Fig. 3: The pie chart highlights several risk factors associated with acute ischemic stroke

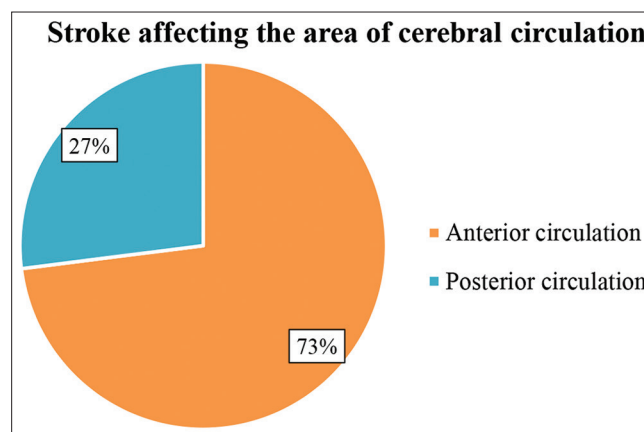
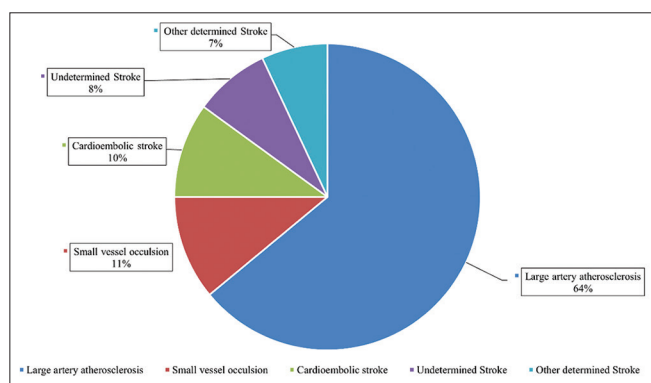


Fig. 4: The pie chart illustrates the distribution of strokes based on the affected cerebral circulation

Table 1: The table highlights the association between risk factors and AIS (p<0.05)

Risk factors	Frequency (n)	Percentage	p-value
Hypertension	58	58	0.0003
Diabetes mellitus	47	47	0.0011
Alcoholism	41	41	0.0024
Cigarette smoking	22	22	0.0001
Dyslipidemia	11	11	0.08
Tobacco chewers	11	11	0.12
Atrial fibrillation	2	2	0.34
Recent MI	2	2	0.41
Obesity	12	12	0.07
CAD	11	11	0.09

AIS: Acute ischemic stroke, MI: Myocardial infarction, CAD: Coronary artery disease

**Fig. 5: The pie chart illustrates the distribution of acute ischemic stroke subtypes based on the trial of Org 10172 in acute stroke treatment classification from the study**

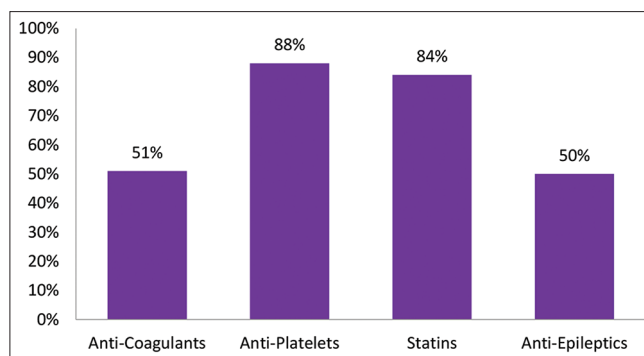
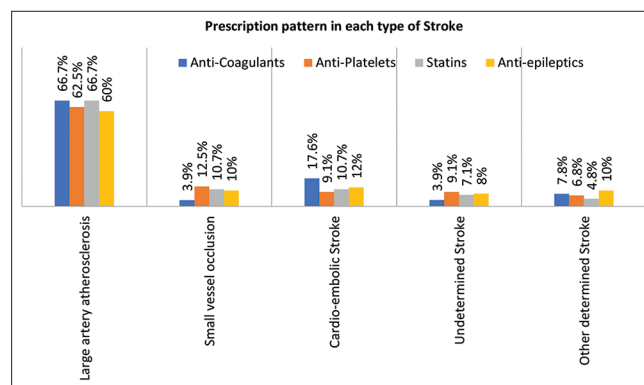
88 patients, followed by statins 84 (84%), anticoagulants 51 (51%), and antiepileptics 50 (50%). The most commonly used antiplatelet in the study was Ecosprin (aspirin 325 mg), with dual antiplatelet therapy (Ecosprin+Clopidogrel [aspirin+clopidogrel]) also suggested in certain cases. Clexane (enoxaparin) was the most commonly used anticoagulant, whereas rosuvastatin and atorvastatin were the most commonly used statins, and Levipil (levetiracetam) was the most commonly used (Fig. 6). Anticoagulants were prescribed the highest in large artery stenosis and cardio-embolic strokes. Statins were the next highest prescribed medications. While in SVO, antiplatelets were the highest prescribed drugs (Fig. 7).

DISCUSSION

A prospective study was conducted on the risk factors, TOAST classification, and management of AIS patients. The study found that males were more susceptible to stroke compared to females, due to habits such as smoking and alcohol consumption, and higher susceptibility to risk factors such as hypertension and diabetes mellitus. This is consistent with findings by Mohammad Yaseen Abbasi *et al.*, who reported that 66.3% of males and 33.3% of females were diagnosed with ischemic stroke [16].

This study also aligns with a study by Soto-Cámara *et al.*, which reported that the majority of patients were elderly, with a mean age of 75.39 years, and 62.15% were aged 75 years or older [17]. However, 19.27% of patients were under 65, indicating that younger individuals are also at risk [11]. These findings highlight the significance of age in stroke incidence and indicate the importance of preventive measures across all age groups.

The percentage of risk factors in this study correlates with a study by Monjezi *et al.* with similar prevalence rates of risk factors for ischemic stroke, including hypertension (71.4%), diabetes (50.4%), smoking

**Fig. 6: The bar graph illustrates the percentage of patients prescribed with different drug classes****Fig. 7: The bar graph illustrates the percentage of patients prescribed with different drug classes in each kind of acute ischemic stroke**

(42.4%), and cardiovascular disease (22.5%) [18]. The results of the classification of AIS align with a study by Adams and Biller, who evaluated the interrater reliability of the TOAST classification and found high interphysician agreement, with specific etiologic diagnoses reached in 11 out of 20 patients, whereas the cause remained undetermined in nine cases [19].

The treatment patterns of the study were found to be according to the reports by Majumder [20], where antiplatelet therapy is generally the highest, followed by statins. The AHA guidelines recommend the use of tissue plasminogen activator for stroke management, specifically Alteplase [12]. However, in the study setting, Tenecteplase was used due to its longer half-life and reduced monitoring requirements.

CONCLUSION

This study emphasizes the crucial need for better understanding and care of AIS, particularly in high-burden areas such as Hyderabad, Telangana. The findings show that while stroke primarily affects older persons, it also poses a considerable danger to younger groups, with males being more vulnerable due to lifestyle variables and comorbidities such as hypertension and diabetes. The most prevalent stroke subtype was found to be LAA, highlighting the significance of accurate TOAST classification in guiding specialized therapies. The need for focused preventative measures is further highlighted by the frequency of family history and modifiable risk factors. Furthermore, adherence to prescribed pharmaceutical regimens – such as the usage of statins, anticoagulants, and antiplatelets – is essential for enhancing patient outcomes. Addressing stroke diagnosis and treatment gaps has the potential to minimize the long-term health and economic consequences of stroke, enabling greater recovery and more prompt interventions in a variety of populations.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

FUNDING

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CLINICAL TRIAL NO

Not applicable.

HUMAN ETHICS AND CONSENT TO PARTICIPATE

IEC Approval has been cleared before starting the study. Informed consent was obtained before collecting data from the patient.

CONSENT FOR PUBLICATION

We provide consent for the publication of the manuscript and data figures, tables.

COMPETING INTEREST

The authors declare no financial or non-financial interests for the publication.

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