

# Epidemiological Profile of Stroke in Central Kerala

Abhilash Somasundaran, S. Narayanan Potty

Department of General Medicine, Amala Institute of Medical Sciences, Thrissur, Kerala, India

## Abstract

**Background:** There is a rising trend in the incidence of stroke among Keralites, but proper data regarding the same are scarce. To date, no study has been published delineating the epidemiological profile of stroke in Central Kerala harboring a population of more than 5 million.

**Objectives:** The objectives of the study were to characterize the clinical profile, risk factors, type, and etiology of stroke in Central Kerala.

**Methodology:** A prospective cohort study was conducted in the Department of General Medicine in Amala Institute of Medical Sciences, Thrissur, Kerala, from January 2014 to January 2015 that evaluated 464 patients admitted with a diagnosis of stroke. Based on clinical examination and brain computed tomography/magnetic resonance image findings, patients were classified into ischemic and hemorrhagic stroke subtypes and enrolled.

**Results:** Of the total 464 patients, 44.6% were female and 55.4% were male. A maximum amount of cases were observed in the age group between 61 and 70 years. Among them, 63.6% of patients were hypertensive, 45.5% were diabetic, 12.7% had a cardiac disease, and 0.6% of patients had peripheral vascular disease. The incidence of hemorrhagic stroke was 27.8% and ischemic stroke was 72.2%. Most of the ischemic strokes were due to large artery atherosclerosis.

**Conclusion:** Our study has shown that systemic hypertension followed by diabetes mellitus was the prime risk factor contributing to stroke among Central Keralites. Tobacco use is widely prevalent among males in Central Kerala which could account for the increasing incidence of stroke among males. There is an urgent need to improve the lifestyle of people, especially in the age group between 61 and 70 years who were the most susceptible to stroke by implementing proper monitoring and control of modifiable risk factors.

**Key words:** Epidemiology, Hypertension, Kerala, Smoking, Stroke

## BACKGROUND

Developing countries like India are having a huge burden of both communicable and non-communicable diseases. Among non-communicable diseases, stroke grabs a lion's share, in causing both mortality and morbidity among general population, especially the elderly. The poor are increasingly affected by stroke, because of both the changing population exposures to risk factors and, most tragically, not being able to afford the high cost for stroke care.

The World Health Organization (WHO) defines stroke as "a clinical syndrome of rapidly developing focal or global disturbance of brain function lasting >24 h or leading to death with no obvious non-vascular cause."<sup>1</sup>

Kerala is a state in Southwest India spread over an area of 38,863 km<sup>2</sup> with a population of 33,387,677 as per 2011 census. The study center is located in Thrissur district and its catchment area includes Thrissur, Palakkad, and parts of Malappuram and Ernakulam districts together harboring a population of more than 5 million.

In the past one decade, stroke has emerged as a major public health problem in Kerala demanding robust interventions from the public sector health system to have well-designed protocols in place to improve patient safety, reduce mortality and morbidity due to stroke, and ensure good quality of life for stroke survivors.

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**Corresponding Author:** Abhilash Somasundaran, Illikkal House, Near Alathur Road, Pazhayannur, Thrissur, Kerala, India.

Stroke may be due to two major pathological subtypes including ischemic as well as hemorrhagic. Optimal patient management largely depends on whether the stroke is hemorrhagic or ischemic. Diagnosis and onset of treatment has to be immediate because the tolerance of the brain tissue to ischemia is lower than any other tissue.

Till date, no data have been published regarding epidemiological profile of stroke in Central Kerala. The analysis of the trend in stroke, its clinical profile, subtypes, etiology, and risk factors should provide valuable data that can further organize the health system structures and improve management protocol.

**Objective**

The objective of the study was to determine the demographics, risk factors, etiology, and clinical profile of acute stroke in Central Kerala.

**METHODOLOGY**

The study was conducted at the Amala Institute of Medical Sciences, Thrissur, a tertiary hospital in Central Kerala. Since January 2014, we have prospectively included patients with ischemic stroke and non-traumatic intracerebral hemorrhage within 72 h of admission. The study period was for 1 year till January 2015.

A detailed history was obtained from the patient and bystanders followed by a meticulous clinical examination. Furthermore, an informed consent was taken from the patient or bystanders for participating in the study. A plain computed tomography (CT) brain and magnetic resonance image brain were taken immediately. The study was conducted after acquiring consent from the scientific and ethics committee and by abiding the rules and regulations as per Helsinki Declaration.

**Statistical Analysis**

The data were consolidated and entered into Microsoft Excel and all analyses were performed using SPSS16 Software. Description of the sociodemographic characteristics and clinical features was done in terms of frequencies and percentages.

**RESULTS**

**Epidemiology**

*Age and gender distribution*

Of the total 464 patients, 207 were female and 257 were male [Figure 1].

The age range of 464 patients included in this study was 20–100 years. Maximum amount of cases were observed in

the age group 61–70 years. While the most of the females belonged to the age group of 71–80 years, maximum males belonged to 61–70 years age group [Figure 2].

The presenting complaint among stroke patients included weakness, slurring of speech, altered consciousness, seizure, vomiting, headache, and sensory disturbances predominantly.

The usual comorbidities among these stroke patients were systemic hypertension, diabetes mellitus, cardiac disease, and peripheral vascular disease.

While 295 patients were hypertensive, 211 were diabetic and 59 had cardiac disease. Only three patients had peripheral vascular disease [Figure 3].

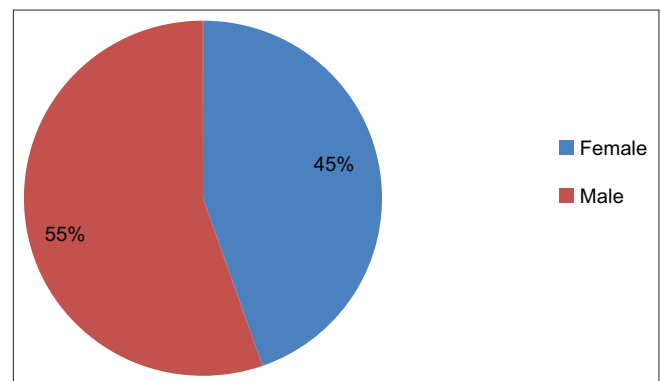
Of the 464 subjects studied, 129 were hemorrhagic stroke and 335 were ischemic strokes as confirmed by CT brain taken at the time of admission [Figure 4].

Ischemic stroke patients mostly presented with weakness and slurring of speech. Unlike ischemic stroke, hemorrhagic stroke patients most often presented with altered level of consciousness, seizure, vomiting, and headache [Table 1].

The most common etiology for ischemic stroke was large artery atherosclerosis followed by small vessel obstruction and cardioembolism [Figure 5].

**Table 1: Distribution of symptoms among stroke subtypes (original)**

Symptoms	Ischemic stroke (%)	Hemorrhagic stroke (%)
Weakness	69.60	52.70
Slurring of speech	53.40	41.90
Altered consciousness	31.60	67.40
Seizure	6.90	17.10
Vomiting	13.10	34.90
Headache	14.30	38.80
Sensory disturbances	6	4.70



**Figure 1: Gender distribution of stroke**

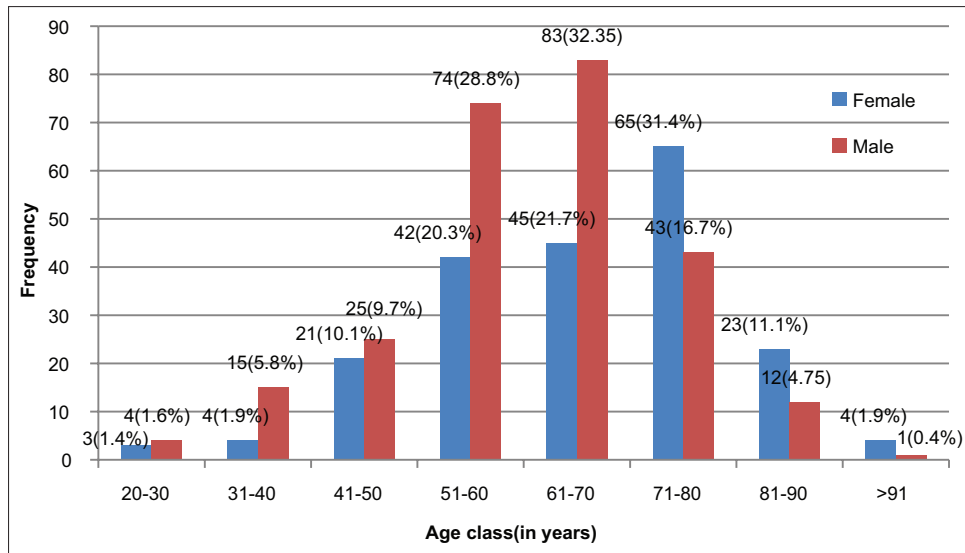


Figure 2: Age and gender distribution of stroke (original)

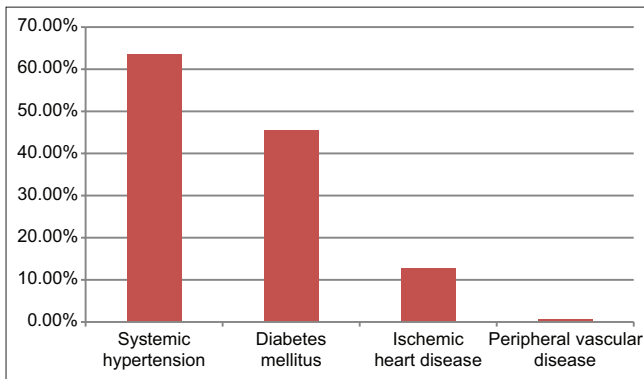


Figure 3: Distribution of comorbidities among stroke patients (original)

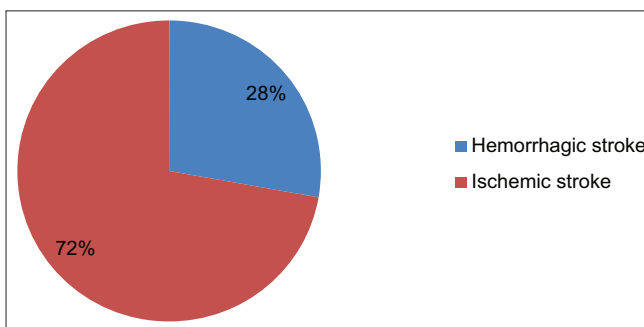


Figure 4: Distribution of stroke subtypes (original)

## DISCUSSION

### Age and Gender

Majority of these patients belonged to the age group of 61–70 years ( $n = 173$ ). This is in comparison with the study done by Sridharan *et al.* in Kerala population where the mean age of stroke occurrence was 67 years.<sup>[2]</sup> The

increasing incidence of stroke with increasing age has been demonstrated convincingly by the Framingham study.<sup>[3]</sup> While the maximum cases of females belonged to the age group of 71–80 years, maximum number of males belonged to 61–70 years age group. Out of the total study population, 55.4% ( $n = 257$ ) were male and 44.6% ( $n = 207$ ) were female making up the male-to-female ratio, 1.2:1 showing almost similar distribution between the two genders. This is again in tally with the findings of Framingham study.<sup>[3]</sup>

The main presenting complaint of stroke patients was weakness ( $n = 301, 64.9%$ ) followed by slurring of speech ( $n = 233, 50.2%$ ) and altered consciousness ( $n = 193, 41.6%$ ). Headache, vomiting, seizure, and sensory disturbances were other complaints. Unlike ischemic stroke, hemorrhagic stroke patients presented predominantly with altered consciousness, headache, and vomiting. Their general condition was poor when compared to ischemic stroke at the time of admission.

### Risk Factors

Hypertension (63.6%) and diabetes (45.5%) were frequent risk factors. Few had history of ischemic heart disease and rheumatic heart disease, and very few patients had peripheral vascular disease. Systemic hypertension alone or in combination with other risk factors can contribute significantly to stroke occurrence. Many studies have proven the role of these comorbidities in contributing to stroke. Lowering of blood pressure can significantly contribute to reduction of stroke incidence<sup>[4]</sup> and has been proven by many studies such as HOPE,<sup>[5]</sup> PROGRESS,<sup>[6]</sup> and LIFE study.<sup>[7]</sup> In the present study, 63.6% had systemic hypertension. This

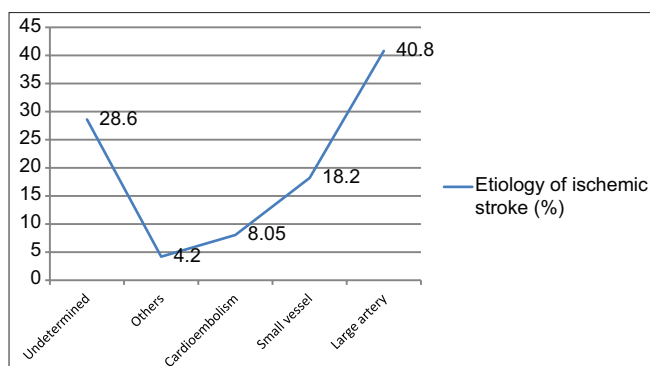


Figure 5: Etiology of ischemic stroke (original)

means almost two-third of the study population were hypertensive. The presence of hypertension could not be ruled out in the rest of the patients and hence the emphasis on periodic blood pressure measurements is highlighted. Ralph *et al.*<sup>[8]</sup> reported hypertension as the most powerful modifiable risk factor for stroke. Hypertension was more prevalent among hemorrhagic stroke (68.2%) when compared to ischemic stroke (61.8%). The SHEP study<sup>[9]</sup> was the first to show that treatment of isolated blood pressure specifically decreased the risk of hemorrhagic stroke. Thus far, the treatment of hypertension is the only proven preventive therapy for stroke.

Unlike hypertension, the incidence of diabetes mellitus in our study was only 45% reflecting that it is not a significant risk factor when compared to hypertension in the etiology of stroke. Tziomalos *et al.*<sup>[10]</sup> conducted a study which concluded that Type 2 diabetes is associated with a worse functional outcome of ischemic stroke. Furthermore, in the present study, the prevalence of diabetes is less among hemorrhagic strokes (39.5%) when compared to that of ischemic strokes (47.8%). Jørgensen *et al.*<sup>[11]</sup> had similar results and, in their study, intracerebral hemorrhages were 6 times less frequent in diabetic patients.

Smoking almost doubled the risk for stroke.<sup>[12]</sup> "Cigarette smoking is clearly identified as the chief preventable cause of death in our society and the most important public health issue of our time." This statement was first articulated in 1982 by the US Surgeon General C Everett Koop, and unfortunately, it remains accurate today. In the present study, more than two-third of the male stroke patients were smokers and none of the females smoked. Of the 257 males enrolled, 171 were smokers (66.55%). Among male hemorrhagic stroke patients, 75% were smokers and among ischemic stroke patients, 63% were smokers. The significantly higher frequency of smoking among males is probably related to the cultural background, as these habits

are quite common among Indian males and are almost nil among females.

### Epidemiology

Among the study population, 72.2% were ischemic strokes and rest 27.8% were hemorrhagic strokes as confirmed by CT brain. Reviewing the Indian stroke epidemiological data, the Mumbai registry has recorded 80.2% ischemic strokes and 17.7% hemorrhagic strokes.<sup>[13]</sup> Data from Kerala state were obtained from the Trivandrum Stroke Registry where 83.6% were ischemic strokes and 16.4% were hemorrhagic stroke.<sup>[2]</sup> While these data are from South Kerala, our study reflects the epidemiology of stroke in Central Kerala.

There were more strokes of undetermined type in patients enrolled from the rural communities because of a lack of neuroimaging information due to financial constraints. It was in Kolkata study where 32% of the patients had hemorrhagic stroke, which is the highest figure reported so far from India.<sup>[14]</sup>

### Limitations

Our patients were mostly from the urban community and hence the results may not be applicable to rural population and this is a single hospital-based study.

### CONCLUSION

- Age and gender distribution of patients with stroke in Central Kerala were consistent with the findings in similar studies done worldwide. The incidence of stroke was found to increase with age
- Among stroke subtypes, the incidence of ischemic stroke predominated over hemorrhagic stroke and this is comparable with other Indian studies
- While most of ischemic stroke patients presented with weakness as chief complaint, hemorrhagic stroke patients presented predominantly with altered sensorium, headache, and vomiting
- The general condition of hemorrhagic stroke patients was poor when compared to ischemic stroke patients at the time of admission
- Large artery atherosclerosis was the leading cause for ischemic strokes followed by small vessel occlusion and cardioembolism
- Systemic hypertension is the single largest risk factor for both ischemic and hemorrhagic stroke followed by diabetes and cardiac diseases
- Our study observed a high rate of tobacco use among males ending up in stroke which could be the reason for higher incidence of stroke among males than females. Henceforth, rehabilitation of tobacco users

and making them aware of the chaos tobacco can create to one's health is of prime importance.

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