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ORIGINAL RESEARCH ARTICLE

The Impact of Socioeconomic Status on Recurrent Ischemic Stroke in Indian Population

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Abstract

Introduction: Socioeconomic disparities present a significant risk for both first and recurrent ischemic stroke.

Objective: We conducted a study to investigate how socioeconomic status (SES) influences recurrent ischemic stroke.

Material and Methods: We enrolled 354 patients over 40 years of age, who had experienced two or more clinico-radiologically confirmed ischemic strokes. Our study was conducted in the neurology department at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, from April 2019 to March 2025.

Results: Out of 354 patients, 67.51% (n=239) were men and 32.49% (n=115) were women. The mean age of patients with recurrent stroke was 61.77 years. Hypertension was the leading risk factor, identified in 68.10% (n=241), with the highest frequency in the Class-IV socioeconomic population. Diabetes mellitus was another risk factor, which was observed in 38.70% (n=137), predominantly in the Class-IV socioeconomic population. Obesity (23.45%; n=83), dyslipidemia (8.19%; n=29) and atrial fibrillation (3.67%; n=13) were also dominant in lower socioeconomic class. Overall tobacco (55.37%; n=196) and alcohol (29.66%; n=116) consumption were more prevalent in lower socioeconomic status patients. We found 46.89% (n=176) of patients adhered to their treatment regimen.

conclusion: Our findings reveal a positive correlation between lower socioeconomic status and higher recurrence of ischemic stroke, especially in patients with higher prevalence of risk factors, alcohol and tobacco consumption, and poor adherence to treatment. Our study highlights the necessity and importance of public health programs and awareness along with affordable and accessible healthcare for this susceptible population.

Key words: Socioeconomic Status, Recurrent Ischemic Stroke, Modifiable Risk Factors, B. G. Prasad scale

1 | INTRODUCTION

One of the most significant risk factors for both primary and recurrent ischemic stroke is socioeconomic disparity. The incidence of ischemic stroke is highest in low and middle-income countries (LMICs), which accounts for over 70% of the global stroke burden. More than 87% of stroke-related deaths and disability are observed in LMICs. (1) While high-income countries (HICs) have successfully reduced their stroke rates by 42% in the last four decades, LMICs have experienced

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a more than double increase in stroke cases. (2) As compared to HICs, the age at onset of stroke in LMICs is 15 years younger. This results in the early loss of productivity and considerable strain on household and national resources. (3) The reason behind these differences are unequal access to healthcare, socioeconomic disparities, and lifestyle-related risks. Several studies indicate that Asian countries like India, China, Indonesia, and Japan experience high rates of ischemic stroke-related deaths and disability. (3)

A strong, independent association exists between lower socioeconomic status (SES) and increased stroke risk worldwide. (4) The rapid development in India is unfortunately accompanied by drastic change in lifestyle including an unhealthy dietary pattern and sedentary lifestyle which leads to higher incidence of stroke. (5) India has significant socioeconomic disparity and its poor population bears a burden of various risk factors such as hypertension, diabetes mellitus, tobacco consumption and obesity. (5, 6) A significant proportion of stroke is attributable to rheumatic heart disease, which is frequently observed in individuals from lower socioeconomic backgrounds. (6)

Socioeconomic status (SES) also significantly impacts stroke recurrence. (7) Research studies demonstrate that individuals with higher education and income experience fewer recurrent strokes, independent of conventional cardiovascular risk factors. (8) The patients of lower SES frequently face obstacles to effective secondary prevention of stroke despite current advancements. Poor access to healthcare, limited availability of critical medications, and suboptimal adherence to follow-up regimens are common causes. (8) Rural Indian populations often face challenges with limited health literacy and financial constraints. However, improved access to hospitals has correlated with reduced disease recurrence in younger individuals. (9)

We hypothesized that socioeconomic status significantly influences the repeated attack of ischemic stroke in the Indian population. By integrating traditional risk factors (such as hypertension, diabetes mellitus, obesity, dyslipidemia and tobacco consumption) and socioeconomic status, we may provide a comprehensive view of stroke recurrence. This is essential for creating targeted prevention policies and interventions, particularly for vulnerable populations. So, we conducted a study to know the impact of socioeconomic status (SES) on recurrent ischemic stroke in an Indian population.

Material & Methods

This cross-sectional study was conducted in the neurology department at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, from April 2019 to March 2025. The study was approved by the institutional ethics committee. All the participants provided written informed consent. Inclusion criteria were patients aged over 40 years who had experienced two or more than two clinico-radiologically confirmed ischemic strokes. The subsequent strokes should have occurred at least 28 days apart from the previous ischemic event. All participants underwent either a Computed tomography (CT) or Magnetic resonance imaging (MRI) brain scan.

The key exclusion criteria were patients age younger than 40 years, major head trauma within the last three weeks, surgical intervention within the last two weeks, a history of burns or acute infections, the presence of blood coagulation disorders (e.g., antiphospholipid antibody syndrome), or refusal of informed consent.

For each patient, we compiled data on demographics (age, sex, socioeconomic status) and cardiovascular risk factors (hypertension, diabetes mellitus, dyslipidemia, obesity, alcohol and tobacco consumption) by interviewing patients or their relatives and thoroughly reviewing their medical records. The socioeconomic status classification was determined by the B.G. Prasad scale. (10) The scale relies on monthly per capita income: Class-I (Upper: Rs. $\geq$8592), Class-II (Upper Middle: Rs. 4296-8591), Class-III (Middle: Rs. 2578-4295), Class-IV (Lower Middle: Rs. 1289-2577), Class-V (Lower: Rs. <1289). (10) All relevant statistical analyses were conducted using SPSS-21.

2 | RESULT

During the study period 354 patients were enrolled, comprising 67.51% (n=239) men and 32.49% (n=115) women. Males outnumbered females by a margin of roughly two to one. The mean age

of patients with recurrent ischemic stroke was 61.7 years. The highest prevalence (39.83%; n=141) of recurrent ischemic stroke was observed in Class-IV [Table-1].

It was observed that hypertension was the leading cardiovascular risk factor, present in 68.07% (n=241), with the highest frequency in Class-IV. Diabetic mellitus was observed in 38.70% (n=137) patients predominantly in Class-IV socioeconomic status. Obesity was highly prevalent in both Class-II (27.71%) and Class-IV (32.53%). Other risk factors such as dyslipidemia (37.93%; n=29) and atrial fibrillation (n=13) also showed higher prevalence in Class-IV [Table-2].

Patterns of tobacco and alcohol consumption varied significantly across socioeconomic classes. Overall tobacco use was more prevalent (55.37%; n=196) than alcohol use (29.66%; n=116). Class-IV had the highest prevalence rate of both tobacco and alcohol consumption (33.3%) [Table-3].

Our study also observed the patient's adherence pattern to standard treatment regimens. We found only half (46.89%; n=176) of patients adhered to their regimens. Patients from the Class-I showed highest (84.21%) compliance to their treatment advice. The patients from Class-IV had the highest prevalence (69.51%) of non-compliance with their treatment regime [Table-4].

3 | DISCUSSION

We enrolled 354 recurrent ischemic stroke patients for our cross sectional study. There was a male predominance of 67.5%, which is consistent with epidemiological data, particularly in younger and middle-aged populations. (9)

Among the study population, hypertension was the major risk factor (68.07%), followed by diabetes (38.70%), obesity (23.45%), dyslipidemia (8.19%), and atrial fibrillation (3.67%). The prevalence pattern showed that most of the traditional risk factors were concentrated around the low socioeconomic patients, specially in Class-IV. Furthermore, conditions such as dyslipidemia and atrial fibrillation also showed higher prevalence in Class-IV. Though previously it was thought that obesity was a disease of the upper socioeconomic class, our data showed it is also prevalent in the lower class. This distribution of obesity among lower socioeconomic groups showed how socioeconomic disparities contribute to the increased burden of non-communicable diseases in less affluent communities. (11, 12) Addressing these multifactorial risks through comprehensive, holistic care is crucial to reduce recurrence of ischemic strokes and other complications in lower socioeconomic susceptible individuals.

Among the studied patients the overall tobacco users (55.37%) were higher than alcohol users (29.66%). The prevalence of both tobacco and alcohol consumption was highest in Class-IV and lowest in Class-I. This trend is congruent with literature establishing a link between lower socioeconomic status (SES) and heightened tobacco and alcohol use, which in turn contributes to stroke pathogenesis and poorer long-term outcomes. (13) Therefore, it is important to target public health interventions to reduce tobacco and alcohol use among lower socioeconomic populations. We can implement direct, community-driven strategies to combat tobacco and alcohol use in these populations, such as establishing local outreach programs for cessation of alcohol, tobacco and smoking.

A significant observation in our study was patients' compliance with treatment. About less than half of our patients (46.89%) adhered to their medical advice. Patients in Class-I exhibited the highest rates (84.21%) of adherence to treatment regime, while non-compliant individuals were predominantly found in Class-IV. This disparity in adherence to treatment compliance is likely related to barriers prevalent in lower socioeconomic populations, including difficulties in accessing healthcare, financial constraints, and lower levels of health literacy. (14, 15) These findings suggest that healthcare systems should expand beyond clinical treatment to include patient education, robust primary care, and community-based support systems to improve compliance and ultimately reduce the burden of recurrent strokes.

In a nutshell, our study highlights that individuals in the lowest socioeconomic class encounter the most difficulty with risk factors, tobacco and alcohol consumption and poor compliance to the treatment advice. To bridge existing health gaps, it is

vital to provide affordable and accessible treatment to reduce the risk of hypertension, diabetes mellitus, dyslipedema, obesity, etc. and create culturally sensitive educational programs about the importance of treatment compliance. Enhancing affordable and convenient access to both primary and specialty care for lower-income groups will be essential in mitigating their elevated stroke burden.

Our findings indicate a lower ischemic stroke recurrence rate in higher socioeconomic strata (10.74%) compared to middle and lower socioeconomic populations. This disparity likely reflects improved healthcare access and treatment adherence among those with higher socioeconomic status. The limited presence of Class-V patients in our data, could be explained by financial constraints, difficulties in reaching specialized care and a reliance on alternative therapies.

Several limitations restrict our conclusions. Because this was a cross-sectional study, we can't definitively say if lower socioeconomic status is associated with a high chance of recurrent ischemic stroke. Also, while the B.G. Prasad scale is good for stratifying socioeconomic status in India, it doesn't capture other health determinants like environmental exposures or subtle cultural practices. To build on this, a longitudinal study would help in explaining how socioeconomic factors lead to stroke recurrence and impact rehabilitation. Exploring the roles of health literacy, transportation access, and local health infrastructure would also shed light on mechanisms affecting treatment adherence.

4 | CONCLUSION

We observed a strong association between socioeconomic status and key health determinants in stroke patients, including traditional risk factors (hypertension, diabetes mellitus, dyslipidemia, obesity), tobacco and alcohol consumption, and adherence to treatment regimens. A patient's socioeconomic status (SES) significantly increases their chance for both first and recurrent strokes. The patients in lower socioeconomic class had a greater burden of risk factors, higher rates of tobacco and alcohol consumption, and poor adherence to treatment advice.

The effective path to optimize overall stroke care and to reduce recurrent ischemia stroke in such a group of patients is by focusing on preventative health planning, control of risk factors, health education and improved healthcare accessibility for this susceptible population. Our study highlights how deeply socioeconomic status impacts the health profile and care pathways for stroke patients. By prioritizing resources and interventions for economically vulnerable populations, healthcare systems can prevent recurrent strokes and improve longevity.

Table 1. Demographic Data

	Overall	Class-I	Class-II	Class-III	Class-IV	Class-V
Enrolled Patients	354	10.74% (38)	24.86% (88)	20.62% (73)	39.83% (141)	3.96% (14)
Male	239 (67.51%)	16 (6.70%)	65 (27.20%)	55 (23.01%)	95 (39.75%)	8 (3.35%)
Female	115 (32.49%)	22 (19.13%)	23 (20%)	18 (15.65%)	46 (40%)	6 (5.22%)
Mean Age (Years)	61.77	62.37	65.31	58.62	61.23	59.79

Table 2. Conventional Risk Factors For Ischemic Stroke

	Overall	Class-I	Class-II	Class-III	Class-IV	Class-V
Hypertension	68.07% (241)	10.79% (26)	20.33% (49)	18.26% (44)	47.72% (115)	2.91% (07)
Diabetes Mellitus-II	38.70% (137)	13.14% (18)	22.63% (31)	18.25% (25)	40.88% (56)	5.11% (07)
Dyslipidemia	8.19% (29)	13.79% (04)	24.14% (07)	17.24% (05)	37.93% (11)	6.89% (2)
Obesity	23.45% (83)	18.07% (15)	27.71% (23)	21.69% (18)	32.53% (27)	0
Atrial Fibrillation	3.67% (13)	0	0	0	100% (13)	0

Table 3. Tobacco and Alcohol Use Data

	Overall	Class-I	Class-II	Class-III	Class-IV	Class-V
Tobacco Use	55.37% (196)	8.16% (16)	26.53% (52)	23.47% (46)	39.80% (78)	2.55% (05)
Alcohol	29.66% (116)	11.21% (13)	21.55% (25)	26.72% (31)	36.21% (42)	4.31% (05)

Table 4. Treatment Compliance

Class Wise Patients	**Overall n=354**	**Class-I n=38**	**Class-II n=88**	**Class-III n=73**	**Class-IV n=141**	**Class-V n=14**
Treatment Compliance	46.89% (176)	84.21% (32)	63.64% (56)	54.79% (40)	30.49% (43)	35.71% (05)

Authorship Criteria

All the authors contributed to this study including concept and design, data collection, data analysis and interpretation. All the authors revised the manuscript multiple times before the final submission.

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Conflict of Interest

None declared

Ethical Approval

Taken from our ethics committee of institution

Statement of Human and Animal Rights

All the participants were informed about the study and written consent was taken from all the subjects.

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