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High Prevalence of Stroke in Rural Gadchiroli, India: A Community-Based Study

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Key Words
Stroke · Prevalence · Rural · India

Abstract
Background: In the near future, a majority of strokes are projected to occur in developing countries. However, population-level information on the prevalence of stroke from rural areas of developing countries, including India, is rare. We estimated the prevalence of stroke in a rural area of one of the most underdeveloped districts of India. ***Methods:*** Trained surveyors conducted a house-to-house survey using a validated screening questionnaire in a well-defined population of 45,053 living in 39 villages in a demographic surveillance site in Gadchiroli district. A trained physician and a neurologist evaluated screen-positive patients and diagnosed stroke using the World Health Organization's criteria. ***Results:*** In the screened population, 175 patients had stroke. The mean age of patients with stroke was 60.9 ± 14.7 years and 32.5% were women. The crude prevalence rate of stroke was 388.43 (95% CI 335.04–450.33) and the age-standardized prevalence rate of stroke was 535.58 (95% CI 492.41–583.01) per 100,000 population. The crude prevalence rate of stroke was significantly higher among men than among women (520 vs. 255/100,000 population, $p < 0.05$). ***Conclusion:*** In this prevalence study, conducted after a gap of 20 years in rural India, the prevalence of stroke was high and was more than twice the prevalence reported from the previous study. The prevalence was double among men compared to women. Stroke is emerging as a public health priority in rural India.

Introduction

Stroke is the second leading cause of death worldwide [1]. It is projected that by 2,050 80% of strokes will occur in developing countries [2]. However, data on the burden of stroke from these countries are sparse [3].

About one-sixth of the world's population lives in India, a majority (about 70%) of which lives in rural regions. Although 7 population-based prevalence studies have been conducted in rural areas of India, no study has been conducted in the last 20 years [4–10]. A significant change has occurred in the lifestyle in rural regions of India in the last 2 decades with a high likelihood of increase in the prevalence of stroke. In a recent study, we found that stroke was the leading cause of death and accounted for 14% of all deaths in rural Gadchiroli [11]. In this study, we estimated the prevalence of stroke in rural areas of Gadchiroli, one of the most underdeveloped districts of India.

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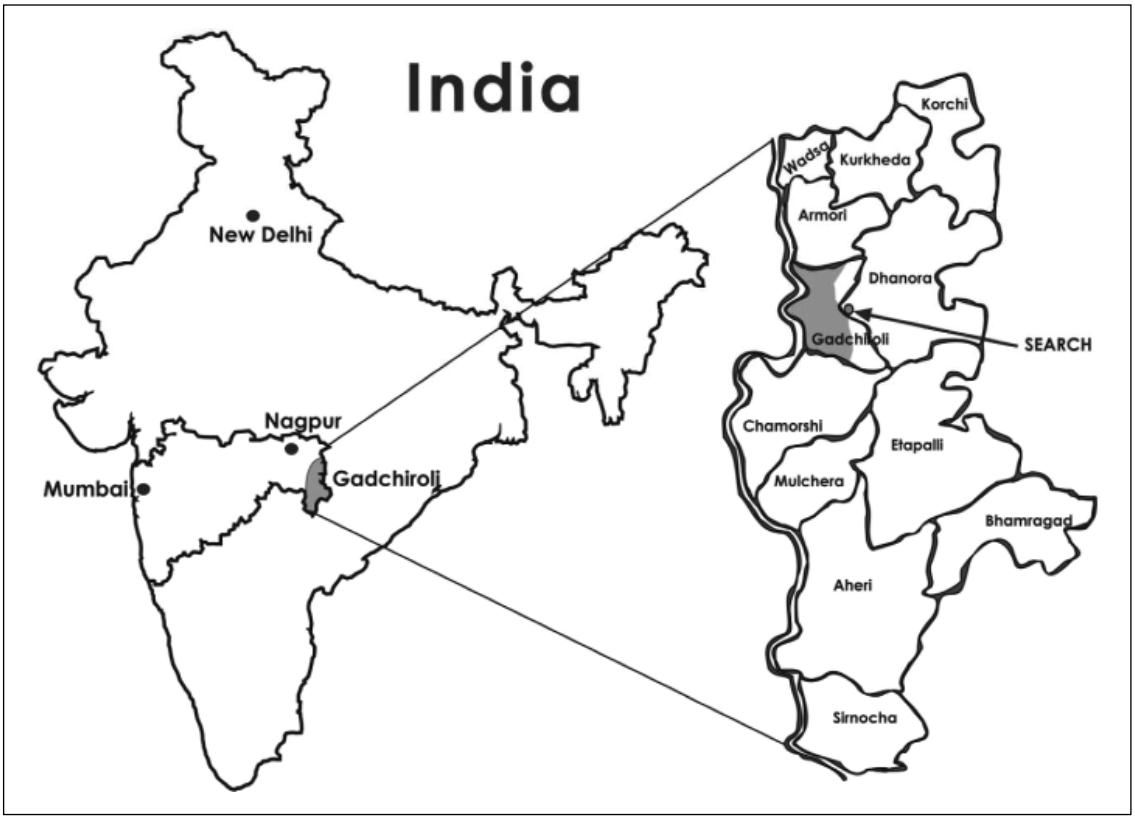

Fig. 1. Study area.

Material and Methods

Study Area

The study was conducted in Gadchiroli district of India (fig. 1), which has a total population of 1,072,942. A majority (93%) of the population lives in rural areas [12]. There is only one neurologist (Y.V.K.) and one brain imaging facility in the district.

SEARCH is a non-governmental organization working in Gadchiroli district since 1986. The present study was conducted in a cluster of 39 villages in the Gadchiroli block in the demographic surveillance system of SEARCH (fig. 1). SEARCH has a population register in these villages which is updated yearly.

Sample Size Calculation

To detect a crude stroke prevalence of 115 of 100,000 population (the average of crude prevalence rate from previous studies from rural India conducted after 1980) [6–10], with 95% confidence, precision of 0.05, design effect of 2 and non-response of 15%, the minimum required sample size was 29,160 individuals. As this survey was a part of the yearly health status survey conducted by SEARCH in the 39 villages, for logistic purposes, we screened all the 45,053 individuals in these villages.

Data Collection

Stroke was defined according to the World Health Organization's clinical definition [13]. The data on the prevalence of stroke was collected by a 3-phased, community-based, cross-sectional survey conducted between January 2014 and May 2014. In the first phase, the trained community health workers of SEARCH conducted a house-to-house survey using a validated questionnaire previously used to estimate prevalence of stroke in India [14]. The questionnaire was translated into the local language, Marathi, and was used for the survey after validation (sensitivity 85.7%, specificity 99%). Patients who were screen-positive were evaluated by a trained physician to diagnose stroke. The Cohen's kappa for the agreement between the trained physician and the neurologist in diagnosing stroke was 0.92 indicating 'almost perfect agreement' [15]. The physician visited screen-positive patients in their houses, collected information about risk factors, conducted a standardized examination and reviewed all available investigations. Patients whose diagnosis of stroke was doubtful were evaluated by the study neurologist.

Ethical Approval

The study was approved by the Institutional Ethical Committee of SEARCH. Verbal consent was obtained from individuals during the screening survey and a written informed consent was obtained from the patients before evaluation by the physician.

Statistical Analysis

The population register of SEARCH provided the population data. The age standardized rates were calculated using the World Health Organization's world standard population [16]. Data were analyzed using statistical software Stata version 10 (College Station, Tex., USA).

Results

Among the 45,053 individuals screened, 845 were screen-positive for stroke and 175 were subsequently diagnosed with stroke (table 1 and fig. 2). The demographic characteristics of the patients are shown in table 2.

The crude prevalence rate of stroke was 388.4 (95% CI 335.04–450.33) and the age-standardized stroke prevalence was 535.58 (95% CI 492.41–583.01) per 100,000 individuals. The crude stroke prevalence rate was double among men compared to women (table 3). The age distribution of stroke patients is shown in table 3.

Brain imaging was done in only 21 (12%) patients (14.4% men vs. 7% women, p = 0.2). Imaging or reports were available for review in 17 (9.7%) patients with 14 (82.35%) having ischemic and 3 (17.65%) having hemorrhagic stroke.

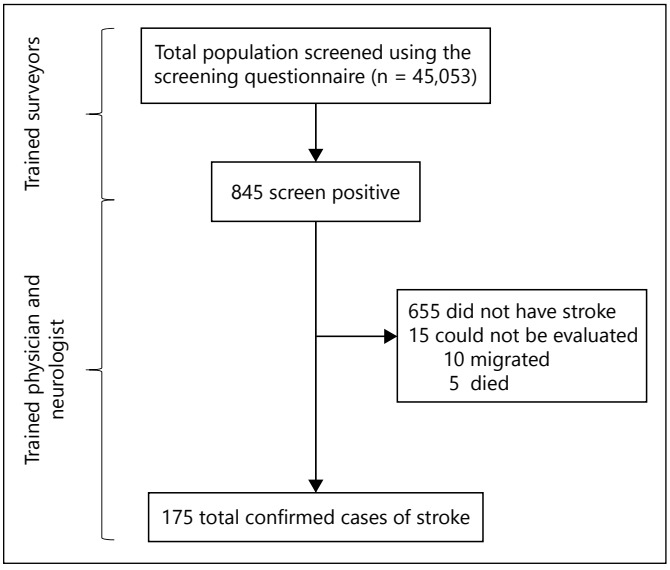

Fig. 2. The study scheme.

Discussion

In this community-based study, conducted after a gap of 20 years in rural India, we found a high prevalence of stroke in rural Gadchiroli. The prevalence rate in this study is higher than the age-adjusted prevalence rate of stroke from low and middle income countries (393.38, 95% CI 329.67–483.05) [17]. The crude prevalence of stroke in our study is also more than twice the reported prevalence from studies conducted in rural India in 1990s (126–165/100,000 population) [8, 10] and is comparable to that reported from the most recent study conducted at a site in urban India (545.10, 95% CI 479.68–617.05) [18].

In order to determine if the results obtained in our study could be predicted from previous population-based studies from rural India, we fitted a regression line to the point estimates of stroke from prevalence studies conducted in rural India after 1980 (fig. 3). Although the point estimate of the prevalence in our study is above the trend line, the trend line falls within the 95% CI of the prevalence. There seems a linearly increasing trend (coefficient of determination, $r^2 = 0.74$) in the prevalence of stroke with time in rural India (fig. 3). This increase is likely to be driven by factors such as increasing prevalence of risk factors and ageing of the population. The other factors contributing to the higher prevalence of stroke in our study could include lack of access to healthcare for stroke and a regional variation in the susceptibility to stroke.

The prevalence of stroke was double in men compared to women in our study. This finding is similar to that

Table 1. Study population and stroke prevalence rate

Number of villages	39
Total families	10,988
Study population	45,053
Female population, n (%)	22,339 (49.58)
Total stroke patients	175
Crude stroke prevalence rate/100,000 population (95% CI)	388.43 (335.04–450.33)
Age-standardized stroke prevalence rate/100,000 population (95% CI)	535.58 (492.41–583.01)

Table 2. Demographic features of patients with stroke

	Women	Men	Total
n, %	57 (32.57)	118 (67.43)	175 (100)
Mean age, years (SD)	58.35 (16.31)	62.16 (13.75)	60.9 (14.7)
Education, n (%)			
Illiterate	45 (78.95)*	51 (43.22)	96 (54.86)
Primary or secondary education	12 (21.05)*	67 (56.77)	79 (45.14)
Occupation, n (%)			
Farming and labor	49 (85.96)	96 (81.36)	145 (82.86)
Other	8 (14.04)	22 (18.64)	30 (17.14)
Socioeconomic status of the family, n (%)			
Own farm land	44 (77.19)	95 (80.51)	139 (79.43)
Have electricity at home	52 (91.22)	105 (88.89)	157 (89.71)
Own a mobile phone	35 (61.40)	68 (57.62)	103 (58.86)
Own a television,	33 (57.89)	53 (44.91)	86 (49.14)

* $p < 0.05$ for difference between women and men.

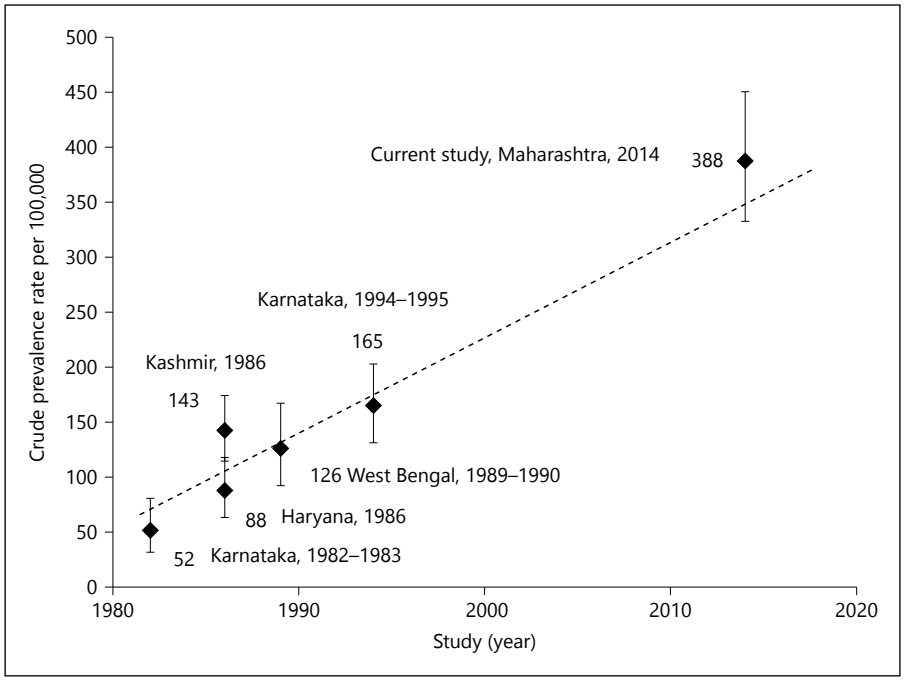

Fig. 3. Trend in the crude prevalence rate of stroke in the community-based studies conducted in rural India since 1980.

Table 3. Sex- and age-wise crude prevalence rate of stroke

Age group, years	Women			Men			Total		
	population	stroke cases	PR	population	stroke cases	PR	population	stroke cases	PR
<40	15,725	7	44.51	16,183	7	43.26	31,908	14	43.88
40–44	1,565	2	127.83	1,508	6	397.85	3,073	8	260.35
45–49	1,306	2	153.16	1,426	3	210.38	2,732	5	183.03
50–54	880	6	682.05	970	7	721.38	1,850	13	702.68
55–59	788	5	634.46	854	13	1,522.78	1,642	18	1,096.37
60–64	693	8	1,154.49	581	19	3,271.25	1,274	27	2,119.7
65–69	655	7	1,068.06	561	27	4,812.8	1,216	34	2,796.05
70–74	387	15	3,875.68	350	14	4,000.08	737	29	3,934.75
75–79	202	3	1,485.14	169	11	6,508.87	371	14	3,773.44
>80	138	2	1,449.28	113	11	9,734.51	250	13	5,200.00
All ages	22,339	57	255.16*	22,714	118	519.5	45,053	175	388.43
95% CI			193.31–330.46			430.19–621.81			333.1–450.3

PR = Prevalence rate per 100,000 population.
* $p < 0.05$ for the difference between women and men.

from a study from Northern India where the prevalence of stroke among men was twice that among women (crude stroke prevalence rate 187 vs. 94 of 100,000 population) [6]. The risk of stroke is known to be higher among men by about 40% compared to women [19] but the reason for such a high susceptibility among men in our study needs further investigation.

Our study has several strengths such as being a house-to-house survey in a well-defined population in one of the most underdeveloped parts of rural India using a validated questionnaire. The study physician evaluated 98.2% of the screen-positive individuals. The study also has some limitations. The diagnosis of stroke was mainly based on clinical evaluation as very few patients had brain imaging.

However, in a resource limited setting, the World Health Organization's STEP-wise method of stroke surveillance recommends clinical diagnosis of stroke [13]. Obtaining the age of the participants in rural areas remains challenging. However, efforts were made to obtain as accurate an estimate as possible by asking the respondents to recall their age at the time of key life events or by checking their age as documented on government-issued identity cards. Furthermore, although this study is conducted in a rural region of India, it may not be completely representative of rural India as various rural regions of India could be in different phases of epidemiological transition with different access to preventive and curative care.

Conclusion

The high prevalence of stroke in the rural population from one of the most underdeveloped districts of India indicates that the rural population in India is at high risk for stroke. There is an urgent need to systematically monitor prevalence of stroke in rural India and develop strategies to reduce the preventable morbidity, mortality and adverse economic consequences due to stroke.

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Disclosure Statement

The authors report no conflicts of interest.

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