

REVIEW ARTICLE

Epidemiology of stroke in India

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Abstract

Several population-based surveys on stroke were conducted from different parts of India. During the last decade, the age-adjusted prevalence rate of stroke was between 250-350/100,000. Recent studies showed that the age-adjusted annual incidence rate was 105/100,000 in the urban community of Kolkata and 262/100,000 in a rural community of Bengal. The ratio of cerebral infarct to hemorrhage was 2.21. Hypertension was the most important risk factor. Stroke represented 1.2% of total deaths in India.

INTRODUCTION

After coronary heart disease (CHD) and cancer of all types, stroke is the third commonest cause of death worldwide. However unlike the Caucasians, Asians have a lower rate of CHD and a higher prevalence of stroke.¹ Among the Asians, the number who died from stroke was more than three times that for CHD.²⁻⁴ In one report, the age-standardized, gender-specific stroke mortality rate was 44 to 102.6/100,000 for Asian males, compared with only 19.3 for Australian white males.⁵ In the early 1980s the prevalence rates of stroke were around 500-700 per 100,000 in the western countries⁶ and 900 per 100,000 in Asia.⁷ The disparity between the stroke and CHD incidence rates is usually attributed to high prevalence of hypertension and low levels of blood lipids among the Orientals.⁸ Hypertension was related to high salt intake and perhaps to genetic factors and low serum lipid was due to low levels of animal fats and protein in oriental diet.

The above epidemiological data among Asians is based upon surveys carried out in the Chinese population. Among the native Japanese, the three consecutive decades following World War II witnessed stroke as the commonest cause of death. But in the recent two decades, there had been a substantial reduction of stroke mortality. By 1985, CHD became commoner than stroke as the cause of death among the Japanese.⁸ This change in mortality profile paralleled the change in dietary pattern, with the current Japanese diet showing

increase in animal fat and animal protein and reduction in the amount of common salt.⁹ Intracerebral hemorrhage occurs several times more frequently in the Japanese than in US whites or blacks. Besides, there is predominance of intracranial atherosclerotic disease in Japanese. This is in contrast to the pattern in white Americans, where extracranial arteries are the focus of the majority of atherosclerotic occlusive disease.⁹

Apart from Chinese and Japanese, comprehensive epidemiological data of stroke among the other races in Asia is still sparse. A recent study comparing stroke disorders among three Asian races in Singapore revealed that Chinese had higher prevalence of stroke when compared to Indians and Malay Singaporeans.¹⁰ In India, several epidemiological studies¹¹ have been undertaken in different parts of the country since the eighties. Most of these population-based surveys however, were cross-sectional and determined the prevalence rates of stroke in the communities. This article is an overview of the major epidemiological surveys on stroke reported in India.

STROKE PREVALENCE, INCIDENCE AND SUBTYPES

The first community-based study on stroke was carried out in and around the town of Vellore in South India¹² during the period 1969-71, followed by the study in Rohtak in North India¹³ during 1971-74. Subsequently there was a spate of

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Table 1. The prevalence rates of stroke from various major epidemiological studies in India

Zone	Place	Rural/ urban	Year	Population	Crude prevalence rate per 100,000	Age adjusted prevalence rate per 100,000
North	Rohtak, Haryana ¹³	Urban	1971-74	79,046	44	—
	Kuthar Valley, Kashmir ¹⁴	Rural	1986	63,645	143	244*
West	Mumbai, among the Parsis ¹⁵	Urban	1985	14,010	842	424*
	Mumbai ¹⁶	Urban	1997	145,456	220	—
East	Malda, West Bengal ¹⁷	Rural	1989-90	37,286	126	—
	Baruipur, West Bengal ¹⁸	Rural	1992-93	20,842	147	—
	Kolkata ¹⁹	Urban	1998-99	50,291	147	334**
South	Vellore ¹²	Rural	1969-71	258,576	57	84 [#]
	Gowribidnur, Karnataka ²⁰	Rural	1982-84	57,660	52	—
	Bangalore ²¹	Rural	1993-95	51,055	165	262 [#]
	Bangalore ²¹	Urban	1993-95	51,502	136	—

*Age standardized to 1960 US population; **Age standardized to 1996 US population;

[#]Year of US population for age-standardization not known

Table 2. The Annual incidence rates of stroke from various epidemiological studies in India

Place	Rural/urban	Year	Population	Annual incidence rate per 100,000	Age adjusted annual incidence rate per 100,000
Vellore ¹²	Rural	1969-71	258,576	13	—
Kolkata ¹⁹	Urban	1998-99	50,291	36	105*
Baruipur, West Bengal ²²	Rural	1993-98	20,842	124	262**

*Age adjusted to 1996 US population; **Age-adjusted to 1990 US population

population-based surveys on stroke in various parts of India both in urban and in rural communities during the eighties and nineties.¹⁴⁻²¹ The prevalence rates determined from the major epidemiological surveys are listed in Table 1. It can be seen that other than the Parsis¹⁵, Indians had much lower prevalence of stroke when compared to Caucasians and Chinese. The age-adjusted prevalence rate of stroke was between 250-350/100,000. The Parsis originally came from Persia and settled in India during the 7th century. Their religion is Zoroastrianism and they are ethnically distinct from the rest of the Indians.

The Parsis seldom intermarry with the other ethnic groups. But even among the other Indians, there was variation in the different studies in the prevalence rates of stroke. This could be partly explained by the difference in age compositions of the surveyed populations. Some studies, because of small sample size, were not truly representative of the communities under study. It remains uncertain whether there are true variations in the prevalence of stroke in different parts of India. Age-adjusted prevalence rates were useful for better comparison with the prevalence rates in the western countries.

There were only a few surveys in India where the annual incidence rate (AIR) of stroke was determined. These were listed in Table 2. The AIR was 105/100,000 in the urban community of Kolkata¹⁹ and 262/100,000 in Baruipur, a rural community of West Bengal.²² However, all these AIR values were underestimates because only the stroke survivors and not stroke death cases were included. The AIR was age adjusted against the US population of 1990 and of 1996 in Baruipur²² and in Kolkata¹⁹ study respectively. The age-adjusted AIR of stroke in the West is between 100 to 300 per 100,000 populations. In mainland China, the age-adjusted incidence of first-ever stroke from a community survey of six cities in 1983 was 219/100,000 population, higher in the north than south from 441 to 136 per 100,000 population.¹ Thus, the limited data shows that the incidence of stroke in India falls within the range reported elsewhere.

The Kolkata study¹⁹ also determined the stroke subtypes in the community for the first time in India. Neuroimaging was performed soon after stroke in 59.5% cases. The imaging revealed cerebral infarcts in 68% and cerebral hemorrhage in 32% cases. The ratio of cerebral infarct to hemorrhage was 2.21. There were relatively more cases of cerebral hemorrhage than that observed in the western countries.

STROKE RELATED MORTALITY IN INDIA

There were limited data available on stroke related mortality in India. Although medical certification of the cause of death is a legal requirement, only 13.5% of all deaths in India were medically certified²³ in 1994. Therefore ascertainment of the cause of death was grossly inadequate in India. However, it was estimated that stroke represented 1.2 % of the total deaths in the country, when all ages were included.²⁴ The proportion of stroke death increased with age, and in the oldest group (> 70 years of age) stroke contributed to 2.4% of all deaths. The gender ratio of death due to stroke was 1.²⁴ One would expect a high mortality of stroke with low prevalence and median annual incidence of stroke in India.

RISK FACTORS FOR STROKE

The Framingham Heart Study and other international prospective epidemiological studies identified the major atherogenic risk factors for stroke as hypertension, diabetes mellitus, hyperlipidemia, and smoking.²⁵ The rural Japanese

prospective studies showed that low total serum cholesterol was related to increased incidence of cerebral hemorrhage.^{26,27} In India, a multicentric, prospective, hospital-based case-control study in the West Central region revealed that diabetes mellitus, hypertension, tobacco use and low hemoglobin rather than cholesterol level were the most important risk factors of ischemic stroke.²⁸ Prospective community based risk factor studies using well-defined protocols would be ideal but implementation of such project would be cost prohibitive in India.²⁸ Cross-sectional community based case-control study for risk factor analysis in Kolkata demonstrated that hypertension was the most important risk factor for stroke with odds ratio of 5.04 (95% CI 4.16-5.92) in women and 21.87 (95% CI 18.69-25.05) in men.¹⁹ Another community based cross-sectional case-control study showed heart disease, hypertension and smoking to be significantly associated with stroke.²²

CONCLUSION

Conducting epidemiological survey in a developing populous country like India is a daunting task. Yet several population-based surveys on stroke were conducted from different parts of India, but primarily to determine the cross-sectional prevalence rates of stroke. One report on stroke subtype analysis¹⁹ revealed that there was higher prevalence of cerebral hemorrhage in the community compared to that in the western countries. Only a few studies so far in India determined AIR. Besides, the AIR presented so far were underestimates, since only the stroke survivors were captured in the studies. According to the Asian Acute Stroke Advisory Panel, India is still ranked among the countries where the information on stroke is minimal.²⁹ A comprehensive 5-year prospective study on stroke is currently under way in the city of Kolkata where both the stroke survivors and the stroke death cases are being captured giving the true estimate of stroke incidence rates. This ongoing study will also determine prevalence, subtypes, case fatality rates and risk factors and will provide a valuable insight into stroke disorder of this country.

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