An Epidemiological Study of Stroke in a large tertiary care teaching hospital of northern India

Community Medicine

Kaul R R	Additional Professor, Community Medicine, Sher-i-Kashmir Institute of Medical Sciences, Srinagar (India) - 190011
*Tabish S A	Professor & Head Hospital Administration, Sher-i-Kashmir Institute of Medical Sciences, Srinagar (India) - 190011 *Corresponding Author
Khan Z A	Ex Postgraduate, Community Medicine, Sher-i-Kashmir Institute of Medical Sciences, Srinagar (India) - 190011
Shiekh S	Ex Professor Neurology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar (India) - 190011
Rafiq Ahmad	Associate Professor, Community Medicine, Sher-i-Kashmir Institute of Medical Sciences, Srinagar (India) - 190011

ABSTRACT

Background: Stroke causes a greater range of disabilities than any other condition. Where stroke mortalities are declining or stabilizing in developed countries, experts are concerned of the emerging epidemic of stroke in India. Various risk factors and determinants of stroke are on rise and so is the risk of stroke. Reliable morbidity and mortality estimates for stroke in India are limited due to incomplete death certification, incorrect death classification, and uncertainty of etiology in cases of sudden death of multiple co-morbidities.

Methodology: The study was conducted at the premier hospital of Jammu & Kashmir, an 800 bedded referral hospital, Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar. Study group included all the established cases of stroke diagnosed on the basis of WHO definition of stroke, clinical history and detailed examination fulfilling the inclusion criteria. The diagnosis of stroke was confirmed by neuro-imaging techniques. Cranial Computerized tomography (CT) Scan was done in all cases and wherever CT scan was normal, Magnetic resonance (MRI) was used as confirmative tool for establishing the diagnosis of stroke. Information was sought from the stroke patients of a close family member using predesigned and pretested questionnaire which included question pertaining to the socio-demographic variables and the information about the various factors associated with stroke. Various factors that were studied included hypertension, diabetes mellitus, hyperlipidemia, cardiac diseases (like rheumatic heart disease, Atrial fibrillation, etc.), tobacco exposure, pshyco-social stress, alcohol abuse, use of oral anticoagulant drugs, use of oral contraceptives in case of females, family or past history of stroke, dietary habits and physical inactivity. The data was tabulated and analyzed by bivariate and multivariate analysis with the help of SPSS for WINDOWS (version 20).

Results: During one year of study, a total of 46613 patients were admitted in the hospital, among which 1438 were diagnosed to have a stroke. Thus almost 3 out of 100 hospital admissions were due to stroke. The total incidence (per 100 admissions) was observed to be around 30.85.

Conclusion: 3.08% of all admissions in SKIMS hospital during one year were due to stroke. There is predominance of hemorrhagic strokes over ischemic strokes as 75% of the stroke cases are hemorrhagic. Hypertension, diabetes mellitus, tobacco abuse, hyperlipidemia and overweight/obesity were the most prevalent modifiable risk factors among these stroke patients.

KEYWORDS:

Stroke, Profile, Epidemiological study, Kashmir, Tertiary Care hospital

Introduction

Stroke is life-changing event that affects not only the person who may be, but their family and caregivers also. Stroke also called as brain attack is categorized among the non-communicable diseases. It is the second leading cause of death following coronary heart disease in the world[1], third leading cause of death following heart disease and cancer in the USA[2] and the fourth leading cause of death following coronary heart disease, diarrheal diseases and lung diseases in India[3]

Approximately 15 million people worldwide suffer a stroke each year and of these, 5 million die and another 5 million are left permanently disabled, placing a burden on family and community[4]. Stroke is the fourth leading cause of disability worldwide[5]. Stroke is no longer a disease of the developed world. Low and middle-income countries account for 85.5% of total stroke deaths worldwide and the number of disability-adjusted life years in these countries is approximately seven times that in high-income countries[6].

Globally the annual age standardized stroke incidence rate has shown an increase by 5.3% in low to middle-income countries in contrast to decrease by 1.1% in high income countries.[7] The incidence and prevalence of stroke in various regions of the world is shown in following table.[8]

Table 1: Regional Incidence and Prevalence of Stroke

Region	Incidence (Million)	Prevalence(Million)
World	9.0	30.7
Africa	0.7	1.6
America	0.9	4.8
Eastern Mediterranean	0.4	1.1
South East Asia	1.8	4.5
Western Pacific	3.3	9.1

Reliable morbidity and mortality estimates for stroke in India are limited due to incomplete death certification, incorrect death classification, and uncertainty of etiology in cases of sudden death of multiple co-morbidities.[9] However, it has been estimated in India that about 1.44-1.64 million cases of new acute strokes occur every year.[10,11] The overall age adjusted prevalence rate for stroke is estimated to lie between 84-262/100,000 in rural and between 334-424/100,000 in urban areas. [12,13] In India, the prevalence of stroke in younger individuals is high (18-32% of all stroke cases) compared with high-income countries. [14] In Kashmir the crude prevalence rate has been estimated to be around 143/100,000 and age adjusted prevalence rate around 244/100,000. [15]

Stroke is a leading cause of adult disability and causes a greater range of disabilities than any other condition.[16] More than half of all stroke survivors are left dependent on others for everyday activities, 22% have mild disability 14% have moderate disability, 10% have severe disability and 12% have very severe disability. [17] Globally, 12.6 million people have moderate to severe disability following stroke and of this, 8.9 million are from low and middle income countries. [8] The estimated life years lost due to stroke was 5289357 in 2004, an increase from the 1998 estimate of 4818740. [10] This is projected to increase to 61 million DALYs in 2020 and 84% of these DALYs lost will be in developing countries.[18] According to World Health Organization Statistics tables 2009, in India 6.39 million DALYs are estimated to be lost due to stroke.[19]

Where stroke mortalities are declining or stabilizing in developed countries, experts are concerned of the emerging epidemic of stroke in India. [15] Various risk factors and determinants of stroke are on rise and so is the risk of stroke. A lot of research has been done to get the detailed epidemiology of stroke in India.

In Kashmir excluding a few isolated studies there is no extensive study on the epidemiology of stroke that can give us information on detailed magnitude, risk factors and outcome in terms of mortality of stroke in Kashmir. In addition to common risk factors of stoke prevalent globally, certain risk factors like excess salt intake in form of salt, pickles, more salty diet and the influence of cold climate existing here needs to be studied. Also factors like psychological stress whose relation to stroke risk has been studied in other parts of world and is more prevalent here due to political turmoil for last few decades, need to be evaluated. This study is therefore an attempt to study the epidemiology of stroke in Kashmir in relation to commonly studied risk factors and in addition, other risk factors like diet, stress and lifestyle and so on that are equally important. The study has been conducted with the objective of finding the burden of stroke, its fatality rate and the contributing risk factors so that necessary measures/steps could be suggested to prevent the occurrence of the same and reduce the morbidity and mortality in this population.

Objectives
This prospective study was conducted at Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Srinagar, for a period of one year. SKIMS is the premier tertiary care teaching hospital of Kashmir located at Srinagar and it receives most of the stroke patients from Kashmir province.

Methods
Study Group
It included all the established cases of stroke diagnosed on the basis of WHO definition of stroke,[20] clinical history and detailed examination fulfilling the inclusion criteria as laid down in the study. The diagnosis of stroke was confirmed by neuro-imaging techniques. Cranial Computerized tomography (CT) Scan was done in all cases and wherever CT scan was normal, Magnetic resonance (MRI) was used as confirmative tool for establishing the diagnosis of stroke.

Inclusion Criteria: Sudden onset focal neurological deficit and/or at times global loss of cerebral function lasting for more than 24 hours and confirmed by clinical and neuro-radiological findings. Age >15 years.

Exclusion Criteria:
Exclusion criteria for all stroke cases - clinically silent strokes, symptoms lasting for less than 24 hours and patients dying before admission to the hospital.

Exclusion criteria for study group - Above criteria plus patients with subarachnoid hemorrhage, a close family member not available for extracting information where the patient was not in condition to be interviewed, patient dying before evaluating for the risk factors of stroke completely and wherever consent could not be obtained.

Study Variables
In this study, information was sought from the stroke patients of a close family member using predesigned and pretested questionnaire which included question pertaining to the socio-demographic variables and the information about the various factors associated with stroke. Various factors that were studied included hypertension, diabetes mellitus, hyperlipidemia, cardiac diseases (like rheumatic heart disease, Atrial fibrillation, etc.), tobacco exposure, pshyco-social stress, alcohol abuse, use of oral anticoagulant drugs, use of oral contraceptives in case of females, family or past history of stroke, dietary habits and physical inactivity.

For rural/urban demarcation, patients from urban area included those residing within the jurisdiction of Srinagar Municipal Corporation, whereas those from areas outside Srinagar Municipal Corporation were regarded as from rural area.[21]
Socio-economic status of the patients was assessed with the help of modified BG Prasad's classification[22] for the year 2012 by using average all India consumer Price Index for the year 2012 which is equal to 969.[23]

The history of pre-existing stroke risk factors was assessed and investigations for diabetes mellitus (fasting blood glucose), hyperlipidemia (total cholesterol and triglycerides) and ECG were done in all the cases echocardiography was done wherever indicated.
The risk factor of hypertension was taken positive among the cases who had preadmission history of hypertension or antihypertensive drug intake or had two measurements of blood pressure≥140/90

mmHg. Blood pressure was classified according to JNC 7 classification of blood pressure.[24]
The risk of diabetes mellitus was taken positive among the cases who had preadmission history of diabetes mellitus or use of drugs for the same or fasting glucose of >126 mg/dl. For grading of fasting blood glucose ADA (American Diabetes Association) diagnostic criteria or diabetes were used in the study.[25]

The risk factor of hyperlipidemia was taken positive among the cases who had preadmission history of hyperlipidemia or use of drugs for hyperlipidemia or with total cholesterol>200 mg/dl and/or triglyceride>150 mg/dl.[26]

Heart disease was positive if history, clinical examination, available investigation on admission of investigation requested during hospitalization like ECG, echocardiography, etc. yielded one of more of the following findings: rheumatic heart disease, atrial fibrilliation ischemic heart disease, cardiomyopathy, etc.

Information regarding tobacco exposure was obtained with respect to type of exposure (viz. current smoking, former smoking, passive smoking and smokeless tobacco use) and also duration tobacco exposure. Never Smokers include those who have never smoked a cigarette or who smoked fewer than 100 cigarettes in their entire lifetime. Current smokers include those who have smoked 100 cigarettes in their lifetime and currently smoke cigarettes. Former smokers include those who have smoked at least 100 cigarettes in their lifetime, but currently do not smoke.[27] Passive smoking is the inhalation of smoke by persons other than the intended "active" smoker.[28]

We also gathered information on family history of stroke, history of previous stroke, alcohol abuse, oral anticoagulant use, oral contraceptive use among females, physical activity related to job/leisure time and the dietary profile with emphasis on frequency of fruit intake, vegetable intake, meat intake (both red and white), fish intake and approximate estimation of salt consumption by the patients (according to patient's close family member's perception) prior to onset of stroke.

Intensity of physical activity was graded into vigorous, moderate and sedentary levels according to WHO criteria.[29] Vigorous intensity activities included activities that cause large increases in breathing or heart rate (like carrying or lifting heavy loads, digging or construction work) for at least 10 minutes continuously. Moderate intensity activities included activities that cause small increase in breathing or heart rate (such as brisk walking or carrying light loads) for at least 10 minutes continuously. Sedentary behavior included activities that cause no increase in breathing or heart rate like sitting or reclining at work, at home, getting to and from places, or with friends including time spent sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television, etc. but do not include time spent in sleeping.[29]

For assessing the obesity/overweight, grading of obesity for the Asians was applied where the cut off for normal BMI is 23 kg/m^2.[30,31] The four grades for classifying BMI include underweight (BMI < 18.5), normal (BMI 18.5 – 22.9), pre-obese/overweight (BMI 23 -27.5) and obese (BMI > 27.5).[30]

Stress assessment was done in the patients with the help of Holmes and Rahe Stress Scale.[32]

Outcome was determined in terms of case fatality rate in hospital and 28 days after the onset of stroke. Patients discharged from the hospital were followed up telephonically to determine the 28th day case fatality rate of stroke.

Awareness about the risk factors of the stroke and their early detection by screening, measures to prevent stroke, recognition of signs and symptoms of stroke and seeking of medical care as soon as possible after the onset of stroke was provided to patients and attendants.

Statistical Analysis
The data was tabulated and analyzed by bivariate and multivariate analysis with the help of SPSS for WINDOWS (version 20). T-test for difference of means was used for quantitative differences while as bivariate analysis was done by using Chi Square Test and calculating the odds ratio. All these tests were two sided and were referenced for p

values for their significance. Any p value less than 0.05 (I.e. p< 0.05) was considered statistically significant. Multiple logistic regression was carried out to determine joint effects and interactions of these independent variables as risk factors for stroke. The method adopted here was "forward step-wise regression method" which involves starting with no *the* variable (if any) that improves the model the most, and repeating the process until now improves variables in the model, testing the addition of each variable using a chosen model comparison criterion, adding the model. The final model thus obtained helped in measurement of relationship between stroke and its various independent risk factors. In the final model of multiple logistic regression analysis, since the confounding effect of various factors is removed the value of odd helps in correct measurement of association of risk factors with stroke.

Results
This hospital based descriptive study on the epidemiology of stroke in Kashmir valley conducted in a tertiary care hospital of this region revealed the following findings.
Magnitude and Socio-Demographic Findings
The results described below were obtained by studying all the stroke patients admitted at SKIMS during the year 2012.

Table 2: Distribution of Stroke Patients by Gender and Incidence per 1000 Admissions in the hospital for the Year 2012

Gender	No. of patients		Total admissions in 2012	Incidence of stroke per 1000 admissions	Percentage of stroke cases
	With stroke	Without stroke			
Males	816	27066	27882	29.27	2.93%
Females	622	18109	18731	33.21	3.32%
TOTAL	1438	45175	46613	30.85	3.08%

(p=0.016)

Table 2 shows gender wise distribution of incidence of stroke patients per 1000 admissions and percentage of stroke cases among the total admissions in the institute for the year 2012. Total admissions for the mentioned period were 46613 with 27882 male and 18731 female patients. Total number of patients with stroke was 1438 with 816 males and 622 females. The total incidence of stroke was 30.85 per 1000 admissions and incidence in males and females was 29.27 and 33.21 per 1000 admissions respectively. Among all the patients admitted in 2012, 3 out of 100 hospital admissions were due to stroke as 3.08 % of cases had stroke. Among all female patients admitted, 3.32% patients had stroke while among males, 2.93% patients had stroke and this difference was found to be statistically significant **(p=0.016)**

Table 3: Distribution Of The Stroke Patients By Rural/Urban Settings

Residence	No of patients		Total admissions in year 2012	Percentage of stroke cases
	With stroke	Without stroke		
Urban	272	14335	14607	1.86%
Rural	1166	30840	32006	3.64%
TOTAL	1438	45175	46613	3.08%

(p< 0.001)
Table 3 shows the distribution of stroke patients by rural/urban settings. Out of 14607 patients from urban areas 1.86% (272) of patients had stroke and out 32006 patients from rural areas 3.64% (1166) of patients had stroke. This difference was found to be statistically significant **(p<0.001).**

Table 4: Distribution of Stroke Patients by Age and Gender

Age (IN years)	Male		Female		Total	
	n	%	n	%	N	%
15-25	11	47.8%	12	52.2%	23	1.6%
26-35	28	45.2%	34	54.8%	62	4.3%
36-45	70	49.3%	72	50.7%	142	9.9%
46-55	173	54.1%	147	45.9%	320	22.3%
56-65	255	56.8%	194	43.2%	449	31.2%
66-75	193	61.7%	120	38.3%	313	21.8%
76-85	67	65.0%	36	35.0%	103	7.2%
>85	19	73.1%	7	26.9%	26	1.8%

Total	816	56.7%	622	26.9%	1438	100%
Mean ± SD	61.01 ± 13.46		58.03 ± 13.59		59.72 ± 13.59	
Range	16 – 99		15 - 95		15 – 99	

Table 4 shows distribution of stroke patients by age and gender. The age range of patients was 15-19years. Mean age of all patients was 59.72 ± 13.59 and males had higher mean age (61.01 ± 13.46T) than females (58.03 ± 13.59). This difference was found to be statistically significant ($p < 0.001$). Among 1438 patients, 816 males predominated over 622 females. Maximum number of patients i.e., 449 belonged to age group 56-65 years followed by 320 patients in the age group of 46-55 years and 313 patients in the age group of 66-75 years. Least number of patients i.e. 23 patients belonged to age group of 15-25 years. Maximum gender difference in the number of patients was observed above the age group of > 85 years (73.1 % males versus 26.9%). Females predominated over males in the age groups between 15 and 45 while males predominated in the age groups of 5 years. This difference was found to be statistically significant.

Table 5: Distribution Of The Stroke Patients By Age And Rural/Urban Settings

Age (in years)	Urban		Rural	
	N	%	N	%
15-25	5	1.84%	18	1.54%
26-35	15	5.51%	47	4.69%
36-45	29	10.66%	113	9.69%
46-55	67	24.63%	253	21.70%
56-65	79	29.04%	370	31.73%
66-75	53	19.49%	260	22.30%
76-85	21	7.72%	82	7.03%
>85	3	1.11%	23	1.97%
Total	272	18.9%	1166	81.1%

Table 5 indicates that 272(18.9%) patients were from urban areas while 1166 (81.1%) patients were from rural areas and majority of the patients in both the groups were between the age group of 46 to 75 years. 5 patients from urban and 18 from rural areas belonged to age group of 15-25 years. 15 patients from urban and 47 from rural areas belonged to age group of 36-45 years. 29 patients from urban and 113 from rural areas belonged to age group of 36-45 years. 67 patients from urban and 253 from rural areas belonged to age group of 46-55 years. 79 patients from urban and 370 from rural areas belonged to age group 56-65 years. 53 patients from urban and 260 from rural areas belonged to the age group of 66-75 years. 21 patients from urban areas and 82 from rural areas belonged to the age group 76-85 years. 3 patients from urban areas and 23 patients from rural areas belonged to age of >85 years.

Radiographic Findings/Stroke Types
Table 6: Radiographic Findings of the Stroke Patients

Findings	CT		CT and MRI	
	N	%	N	%
Normal	110	7.6%	0	0%
Infarct	216	15.0%	276	19.2%
Lacunar Infarct	31	2.2%	81	5.6%
Intracerebral hemorrhage	724	50.4%	724	50.4%
ICH with IVE	194	13.5%	194	13.5%
Subarachnoi hemorrhage	163	11.3%	163	11.3%
Total	1438	100.0%	1438	100.0%

Table 6 above represents CT and MRI findings of the stroke patients attending the institute in the year 2012. 110 patients were represented normal by CT but were confirmed to have stroke by MRI. CT findings revealed that 216 patients had infarct and combined CT and MRI findings show that 276 cases had infarct. CT showed 31 lacunar infarcts while combined CT and MRI showed 81 such cases. Intracerebral hemorrhage cases were shown to 724 by both methods. Same was the case ICH with IVE by both methods. Subarachnoid hemorrhage was shown as 163 cases by both CT method and CT + MRI method.

Table 7: Distribution of the Stroke Patients by Age and Type of Stroke

AGE (in years)	Ischemic		Hemorrhagic	
	N	%	n	%
15-25	1	0.4%	4	0.8%
26-35	10	4.3%	16	3.2%
36-45	17	7.2%	44	8.8%
46-55	41	17.4%	115	23.0%
56-65	82	34.9%	167	33.5%
66-75	60	25.5%	104	20.8%
76-85	20	8.5%	38	7.6%
>85	4	1.7%	11	2.2%
Total	235	32%	499	68%

Table 7 depicts that among the patients of study group, 235 (32%) were of ischemic type and 499 (68%) were of hemorrhagic type. Maximum of these are of the age group 56-65 years in both types. Minimum belonged to the age group of 15-25 years in both cases.

Table 8: Distribution of the Stroke Patients by Gender and Type of Stroke

Gender	Ischemic		Hemorrhagic		P value
	n	%	n	%	
Male (425)	118	27.8%	307	72.2%	0.004
Female(309)	117	37.9%	192	62.1%	(sig.)

Table 8 shows the distribution the stroke patients by gender and type of stroke. Among 425 males, 27.8% patients were having ischemic stroke whereas among 309 females, a higher percentage of patients 37.9% were having ischemic stroke.

Distribution of the Stroke Patients by Socio-demographic Characteristics
Analysis of the data showed that out of 734 patients, majority of the patients (717) were Muslims, 12 were Hindus, and 5 were Sikhs. With respect to ethnicity, 701 were Kashmiri and 24 were Gujjar/Bakarwals (Tribals). Most of the patients 446 were illiterate, 41 were educated up to primary, 98 middle, 78 high school, 30 intermediate, 40 graduate/post-graduate, one of them was of highest level of education (professional). In terms of occupation, a major portion 341 of the patients was unemployed, followed by 213 clerical/shop-owners/farmers and 92 skilled workers. 46 were unskilled workers, 23 were semi-skilled workers and 18 were semi-professional. Only one was professional. Most of the patients were currently married (597), followed by 116 widowed, 17 never married and only 4 divorced. 438 patients belonged to 3 generation family, 159 to joint family and 137 to nuclear family.

Table 9: Represents the distribution of various risk factors associated with stroke.

Risk Factor	PRESENT		ABSENT	
	N	%	N	%
Hypertension	669	91.1%	65	8.9%
Diabetes mellitus	155	21.1%	579	78.9%
Hyperlipidemia	255	36.2%	468	63.8%
Tobacco exposure	513	69.9%	221	30.1%
Alcohol abuse	13	1.8%	721	98.2%
H/O Drug abuse	3	0.4%	731	99.6%
Oral anticoagulant intake	9	1.2%	725	98.8%
H/O oral contraceptive (OCP) Intake	10	1.4%	724	98.6%
CVD	93	12.7%	641	87.3%
Previous stroke	116	15.8%	618	84.2%
Family H/O stroke	86	11.7%	648	88.3%
BMI> 23 kg/m2	238	32.4%	496	67.6%
Pregnancy/Purperium	2	0.3%	732	99.7%

Table 9 represents the distribution of various risk factors associated with stroke. Hypertension was observed as the most frequent risk factor in 91.1% cases, followed by tobacco exposure in 69.9% cases, hyperlipidemia in 36.2% cases, overweight in 32.4% cases, diabetes in 21.1% cases, h/o previous stroke in 15.8%, CVD (RHD, AF, etc) in 12.7% and family history of stroke was observed in 11.7% cases, Alcohol abuse in 1.8%, oral contraceptive intake in 1.2% patients, history of oral contraceptive intake in 1.4% cases, drug in 0.4% and pregnancy in 0.3% cases.

Table 10: Distribution of the Stroke Patients by Risk Factors and Gender

RISK FACTOR		MALE		FEMALE		P VALUE
		n (425)	%	n(309)	%	
Hypertension	Yes	387	91.1	282	91.3	0.009
	No	38	8.9	27	8.7	
Diabetes mellitus	Yes	76	17.9	79	25.6	0.012
	No	349	82.1	230	74.4	
Hperlipidemia	Yes	150	35.3	116	37.5	0.532
	No	275	64.7	193	62.5	
Tobacco exposure	Yes	347	81.6	166	53.7	<0.001
	No	78	18.4	143	46.3	
Alcohol abuse	Yes	13	3.1	0	0	0.002
	No	412	96.9	309	100	
H/O drug abuse	Yes	3	0.7	0	0	0.139
	No	422	99.3	309	100	
Oral anticoagulant intake	Yes	5	1.2	4	1.3	0.886
	No	420	98.8	305	98.7	
H/O oral contraceptive intake	Yes	0	0	10	3.2	0.001
	No	425	100	299	96.8	
CVD	Yes	38	8.9	55	17.8	<0.001
	No	387	91.1	254	82.2	
Previous stroke	Yes	61	14.4	55	17.8	0.206
	No	364	85.6	254	82.2	
Family history of stroke	Yes	50	11.8	36	11.7	0.962
	No	375	88.2	273	88.3	

Table 10 represents the distribution of stroke patients by risk factors and gender. On comparing gender differences among various risk factors, tobacco exposure (81.6% males versus 53.7%) and alcohol abuse (3.1% males versus 0% females) was more common in male gender. The Risk factors more common in females included diabetes (25.6%), hyperlipidemia (37.5%), CVD (17.8%) and history of previous stroke.

Statistically significant differences were in distribution of risk factors of stroke w.r.t. to gender in hypertension (p= 0.009), diabetes mellitus (p=0.012), tobacco exposure, alcohol abuse, h/o oral contraceptive intake and cardiovascular disease, but the differences were statistically insignificant in hyperlipidemia (p=0.532), h/o drug abuse, oral anticoagulant intake, previous stoke and BMI

Table 11: Distribution of Stroke Patients by Type of Stroke and Stress Assessment Using Holmes and Rahe Stress Scale

STRESS SCORE	ISCHEMIC		HEMORRHAGIC		TOTAL		P Value
	n(235)	%	n(499)	%	n (734)	%	
>300	41	17.4%	42	8.4%	83	11.3%	<0.001
150-300	101	43.0%	169	33.9%	270	36.8%	(sig.)
< 150	93	39.6%	288	57.7%	381	51.9%	

Table 11 depicts stress assessment of patients using Holmes and Rahe Scale. 83 patients had score of > 300, 270 had score of 150 – 300 and 381 had a score of < 150. Majority of the ischemic stroke patients (n= 101; 43%) had stress score of 150 – 300 while majority of hemorrhagic stroke patients (n 288; 57.7%) had stress score < 150. Among the patients with ischemic stroke, 41 (17.4%) had stress score > 300 and 93 had score < 150. Among the patients of hemorrhagic stroke patients, 42 (8.4%) had score > 300 and 169 (33.9%) had score of 150 – 300. A statistically significant difference (p <0.001) was observed in stress score with respect to type of stroke.

Table 12: Distribution of the Stroke Patients According to JNC 7 Classification of Blood Pressure

GRADE	n(734)	%
Normal	55	7.5%
Pre-hypertension	132	18.0%
Stage 1 hypertension	198	27.0%
Stage 2 hypertension	349	47.5%

Table 12 represents the distribution of stroke patients according to Joint National Committee 7 Classification of blood pressure. Majority (47.5%) of the patients had Stage 2 hypertension followed by Stage 1

hypertension (27%). 7.5% patients had normal blood pressure and 18% of the patients had pre-hypertension.

Table 13: Distribution of Stroke Patients by Level of Consciousness at Presentation and Type of Stroke

Level of consciousness at presentation	Ischemic		Hemorrhagic		Total		p value
	n (235)	%	N (499)	%	n (734)	%	
Grade 1 (GCS 13-15)	114	48.5%	164	32.9%	278	37.9%	<0.001 (sig.)
Grade 2 (GCS 9-12)	106	45.1%	255	51.1%	361	49.2%	
Grade 3 (GCS 4-8)	15	6.4%	78	15.6%	93	12.7%	
Grade 4 (GCS 3)	0	0.0%	2	0.4%	2	0.3%	

Table13 represents the distribution of stroke patients according to level of consciousness/Glasgow coma scale (GCS) at the time of admission. Maximum number (n=361, 49.2%) of patients had grade 2 level of consciousness followed by 278 (37.9%) with grade level of consciousness, 93 (12.7%) with grade 3 level of consciousness and 2 (0.3%) had grade 4 level of consciousness at presentation. Among ischemic stroke patients, maximum cases (48.5%) had grade 1 level of consciousness, followed by 45.1% cases with grade 2 and none with grade 4 level of consciousness. Among hemorrhagic patients, maximum cases (51.1%) had grade 2 level of consciousness, followed by 32.9% cases with grade 1 level of consciousness and 0.4% with grade 4 level of consciousness at admission. A statistically significant difference (p = 0.007) was observed in stroke patients by level of consciousness at presentation and type of stroke.

Table 14: Bivariate Analysis Depicting Statistically Significant Factors Associated with Stroke.

Factors		Ischemic	Hemorrhagic	OR	X2	p vale
Sex	Male	118	307	0.63	8.38	0.004 (sig.)
	Female	117	192			
Occupation	Unemployed	126	215	1.53	7.12	0.008 (sig.)
	Employed	109	284			
Education	Up to high school	204	459	0.57	4.9	0.027 (sig.)
	Above high school	31	40			
BMI	>23	61	177	0.64	6.6	0.010 (sig.)
	<23	174	322			
Family h/o sudden death	Yes	9	39	0.47	4.15	0.042 (sig.)
	No	226	460			
H/O hypertension	Yes	186	450	0.41	16.81	<0.001 (sig.)
	No	49	49			
Duration of hypertension	>5 yrs	110	211	1.63	7.9	0.005 (sig.)
	<5 yrs	76	239			
Hypertension treatment	Non-compliance	136	403	0.32	27.51	<0.001 (sig.)
	Compliance	50	47			
H/O diabetes	Yes	33	44	1.69	4.65	0.031 (sig.)
	No	202	455			
Tobacco exposure	Yes	149	364	0.64	6.91	0.009 (sig.)
	No	86	135			
Smokeless tobacco	Yes	36	120	0.57	7.27	<0.001 (sig.)
	No	199	379			
Total years of tobacco use	>30	71	173	1.78	5.21	0.022 (sig.)
	<30	28	121			
Stress score	>150	142	211	2.08	21.06	<0.001 (sig.)
	<150	93	288			
Oral anticoagulant use	Yes	7	2	7.63	8.77	0.003 (sig.)
	No	228	497			

Fruit intake	Less frequently	92	240	1.45	5.16	0.023 (sig.)
	Frequently	143	259			
Fish intake	Less frequently	222	487	0.35	4.75	0.029 (sig.)
	Frequently	13	12			
Salt tea intake	>3 cups/day	159	435	0.31	39.41	<0.001 (sig.)
	<3 cups/day	76	64			
Sedentary lifestyle	Yes	211	419	1.68	4.45	0.035 (sig.)
	No	24	80			
H/O CVD	Yes	52	4	35.1	103.1	<0.001 (sig.)
	No	183	495			
Old & newly detected CVD	Yes	82	11	23.77	154.29	<0.001 (sig.)
	No	153	488			
Winter season of occurrence	Yes	100	147	1.77	12.27	<0.001 (sig.)
	No	135	352			
Time of onset	12 am – 12 pm	125	212	1.54	7.38	0.007 (sig.)
	12 pm – 12 am	110	287			
Hypertension (in hospital)	Yes	116	365	0.36	40.01	<0.001 (sig.)
	No	119	134			
Hyperlipidemia (in hospital)	Yes	71	191	0.7	4.53	0.033 (sig.)
	No	164	308			

Table 14 depicts the statistically significant factors associated with stroke derived from bivariaate analysis. These included gender (p = 0.004), education (p = 0.027), occupation (p= 0.008), BMI (p = 0.010), family history of sudden death (p = 0.042), history of hypertension (p =<0.001), duration of hypertension (p = 0.005), non-compliance to antihypertensives (p < 0.001), history of diabetes (p = 0.031), tobacco use (p = 0.009), smokeless tobacco use (p <0.001), total years of tobacco use (p = 0.022), stress score (p <0.001), oral anticoagulant use (p = 0.003), fruit intake (p = 0.023), fish intake (p = 0.029), salt tea intake (p <0.001), sedentary lifestyle (p = 0.035), history of cardiovascular disease (p <0.001), season of occurrence (p <0.001), time of onset (p = 0.007), hypertension (p <0.001), and hyperlipidemia (p = 0.033). Other factors like age, socioeconomic status, history of hyperlipidemia, alcohol abuse, drug abuse, history of oral contraceptive use, dietary habit and previous stroke were statistically insignificant.

Discussion
Magnitude of Stroke
Kashmir is located at the northern-most part of India and SKIMS hospital, the prime tertiary care hospital of this region registered around 1438 stroke patients during one year (2012), a drastic increase from 1080 cases registered in the year 2011 and more than double the cases registered in the year 2005 i.e. around 700 cases.[34] During our study, a total of 46613 patients were admitted at SKIMS among which 1438 were diagnosed to have a stroke. Thus almost 3 out of 100 hospital admissions were due to stroke. Vohra EA[33] in Karachi, Pakistan reported 6 out of 100 hospital admissions due to stroke. The total incidence (per 100 admissions) was observed to be around 30.85 in total. Among total patients admitted, 27882 were males of which 816 had stroke giving the incidence (per 1000 admissions) of 29.27 in males while 18371 were females of which 622 had stroke giving the incidence of 33.21 in females. Though the number o males admitted were more than females, the incidence o stroke per 1000 admissions was more in females. In our study the incidence of stroke has been calculated for per 1000 hospital admissions not per 1000 population as the incidence per 1000 population could underestimate the actual incidence of stroke in the valley as some of the patients report to other referral hospital of the valley and some may die before reaching the hospital.

Radiographic Findings
Computerized tomography (CT) was done in all 1438 patients and normal CT findings, even after repeating CT, were observed in 7.6% cases. These cases were confirmed by Magnetic Resonance Imaging (MRI). Intraventricular extension of intracerebral hemorrhage was observed in 13.5% o all cases (21.12% of ICH cases) These findings were supported by Wani M M et al[34] in a study conducted in 173

stroke patients in which 15.6% patients had normal CT at admission and 12.14% of all cases had Intraventricular extension of intracerebral hemorrhage. Intracerebral hemorrhage was seen in 63.9% cases and subarachnoid hemorrhage was seen in 11.3% cases. Similar findings were reported by Shah PA et al[21] in a study at SMHS hospital Srinagar, in which 64.7% cases had Intracerebral hemorrhage and 8.2% had subarachnoid hemorrhage. Contrary to this Badiuzzaman M et al[35] in Dhaka, Bangladesh reported that 38.25% cases had ICH and 5.5% cases had SAH. Marawat MS et al[36] in Pakistan reported that 29.5% cases had ICH and 11.3% had SAH. Damaseeno A et al[37] in Mozambique reported that 40.3% cases had ICH and 1.3% had SAH. Ali S et al[38] in Pakistan reported that 47.9% cases had ICH and 7% cases had SAH. Among 1438 patients, infarct was seen in 19.2% of cases and lacunar infarct was seen in 5.6% of cases. Wani MM et al[34] also reported that lacunar stroke was observed in 14.5% of ishchemic strokes. Rosman KD et al[39] in South Africa reported 20% of ischemic strokes as lacunar infarcts. Contrary to this Shah PA et al[21]reported that among all cases, 8.8 had infarct and 17.8% had lacunar infarct and Akbar DH et al[40] in Saudi Arabia reported that 33% o ischemic strokes among Saudis were lacunar infarcts.

Socio-demographic Characteristics of Study Group
Muslims comprised of 97.7% of cases as Kashmir is a Muslim dominated region. With respect to ethnicity, 95.5% patients were Kashmiris and only 3.3% were Gujjar/Bakerwals (Tribals) which can be attributed to the fact that majority of the people in Kashmir are Kashmiri in origin while only small percentage are Gujjar/Bakerwals (Tribals). Non Muslims have also migrated from Kashmir valley because of political turmoil from last few decades. Most of the patients were illiterate (60.8%) in our study and only 5.6% had received education up to primary. Damasceno A et al[41] in Mozambique reported that only 28% stroke cases were illiterate in their study. Hanchaiphiboolkul S et al[42] in Thailand reported that 72 % had received education up to primary and only 3.7% were illiterate while Deoke A et al[43] in Nagpur reported that 38% had received education up to primary. We also observed that majority (46.5%) of the patients were unemployed. Similar findings were reported by Hanchaiphiboolkul S et al[42] in Thailand in a study in which 56.6% cases were unemployed. Ivanovic M et al[44] in Croatia reported retired people as major proportion of stroke cases in their study. In our study 13.5% cases were of low socioeconomic status while Deoke A et al[43] in Nagpur reported that 25% cases were of low socioeconomic status. We also observed in our study that 81.3% patients were currently married, followed by 15.8% widowed, 2.3% never married and only 0.5% patients were divorced. These findings are supported by a study conducted by Hanchaiphiboolkul S et al[42] in Thailand who also reported that most (72.8%) of the patients were married, followed by 16.8% widowed, 6.1% separated and 4.3% single.

Cardiovascular Disease
A total of 12.67% patients had cardiovascular disease (CVD) out of which past h/o cardiovascular disease was present in 7.63% patients and 5.04% were newly diagnosed. Rheumatic heart disease (RHD) was present in 2.72% of patients and atrial fibrillation (AF) was present in 7.63% cases. Our findings are supported by Brunn B et al[45]in New York, who reported that 12.5% of stroke patients had CVD and Baskar D et al[46] in Chennai who reported CVD in 13.7% of stroke patients. Similarly Vohra EA et al[33] in Karachi, Pakistan also reported CVD in 13% of patients in their study and RHD in 2% patients. Rosman KD et al[37] in South Africa reported AF in 6.9% cases and Damasceno A et al[41] in Mozambique also reported AF in 6.1% of stroke patients. Alemayehu B et al[47] in Ethiopia also reported AF in 8.5% patients but a higher percentage of patients with RHD (8.1%) than ours. Also Mahajan SK et al[35] in Himachal Pradesh reported AF in 6% cases an RHD in 6% of patients. In contrast to our findings, Badiuzzaman M et al[48] in Dhaka, Bangladesh reported CVD in 25.75% stroke patients and Maskey A et al[49] in Nepal reported AF in 23% of patients. Also Sweileh WM et al[50] in Palestine reported AF in 14% and Rathore JA et al[51] in Muzaffarabad reported AF in 12% cases. Pandiyan U et al[52] in Chennai also reported AF in only 3.2% cases. Sundar U et al[53] in Mumbai reported RHD in 7% cases while Shah PA et al[21]reported RHD in 0.6% cases only.

CVD were present more in females (17.8% in females versus 8.9% males) and also in ischemic stroke cases 34.9% in ischemic stroke versus 2.2% in hemorrhagic stroke). Similarly Baskar D et al[46] in Chennai also reported CVD more commonly in females as 16% females had CVD compared to 12% males in their study. Sallam AR et

al[54] in Kuwait also reported CVD more in females than males. Mahajan SK et al[35] in Himachal Pradesh reported AF only in ischemic stroke cases and none o the hemorrhagic stroke cases.

Overweight and Obesity
Mean BMI of our patients was 21.45 ± 3.47 kg/sq m with minimum BMI of 16 kg/sq m and maximum of 32.4 kg/sq m. In contrast Hanchaiphiboolkul S et al[42] in Thailand reported mean BMI Of 24.5 ± 4.1 kg/sq m in their study. In our patients 32.4 % patients had BMI of >23 kg/ sq m and 12.5% patients had BMI > 25 kg/sq m. Almost similar findings were observed by Deoke A et al[43] in Nagpur who reported that 16% patients had BMI >25 kg/m^2.

Temporal Patterns of Stroke Onset
Most of the strokes occurred in the late morning hours between 6 am to 12 noon as 36.1% of strokes occurred in between this time. In both ischemic and hemorrhagic stroke maximum cases occurred between the above given time (38.7% in ischemic and 34.9% in hemorrhagic strokes). Our findings are supported by some studies that report similar circadian variation in the timing of the stroke onset. Hayes MK et al[55] reported that the most frequent time period for the onset o a stroke is the late morning, 8 am to 12 noon. Similarly Elliot WJ et al[56] in 1998 reported that onset of stroke symptoms has a circadian variation, with a higher risk in the early morning viz. hours 6 am to noon, and lower risk during the night time period(midnight to 6 am).

The most frequent month o onset of stroke was January (10.2% cases) followed by February (10% cases) while least number of cases occurred in the month of July (6.3%). Almost similar findings with some differences were reported by Hayes MK et al[55] in The Framingham Study, in which August and January were the two most frequent months when strokes occurred and July was the least frequent month of occurrence.

Maximum number of cases, i.e. 421 (29.3%) were admitted in the winter season (December, January, February) and least (445, 31%) in the autumn season (September, October, November). Similarly Sweileh WM et al[50]in Palestine in a study reported that majority of the cases (58%) occurred during the cold months of December, January, February and March and least number (29.6%) of cases occurred in the hot month of May, June, July and August. On the contrary Hayes MK et al[55] in the Framingham Study reported almost even distribution of stroke cases according to season of occurrence.

Factors that were found to be statistically significant were Gender, education, Occupation, BMI, family h/o hypertension, duration of hypertension, non-compliance to HTN treatment, h/o diabetes, tobacco use, smokeless tobacco use, total years of tobacco use, stress score, oral anticoagulant use, fruit intake, fish intake, salt tea intake, sedentary lifestyle, h/o CVD, old and newly detected CVD, season of occurrence, time o onset, hypertension (in hospital), hyperlipidemia (in hospital).Similarly Hanchaiphiboolkul S et al[42] in Thailand reported age, male gender, education level, occupation, region, waist circumference, smoking, hypertension, diabetes mellitus and hypercholesterolemia as statistically significant factors associated with stroke. Also Deoke A et al[43] in Nagpur found sedentary life-style, history of transient ischemic attack, family history of stroke, coronary artery disease, systemic hypertension and abnormal ECG significant risk factors.

After adjustment for potential confounders by multiple logistic regression analysis, factors that remained statistically significant associated with stroke were winter season, non-compliance hypertension treatment, psychosocial stress, less frequent intake, salt tea $\geq$ 3 cups/day, sedentary lifestyle, hypertension, and BMI $\geq$ 23. Hanchaiphiboolkul S et al[42]in Thailand reported male gender, occupation, hypertension, diabetes mellitus and hypercholesterolemia as statically significant risk factors after multiple logistic regression analysis.

Case Fatality Rate
Stroke is one of the non-communicable diseases that has a high case fatality rate that keeps on increasing as the time passes from the onset of stroke. In our study, out of 1438 patients, 448 patients died in the hospital giving the case fatality rate of 31.2%. Our findings were supported by many studies conducted worldwide that also reported almost similar case fatality rate. Brunn B et al[45] in New York reported the case fatality rate of 34.8 % in their study. Vohra EA et al[33] in

Karachi, Pakistan reported the case fatality rate o 34.8% in their study. Akbar DH et al[40] in Saudi Arabia compared the case fatality rate of Saudis and non-Saudis (16%). Damasceno A et al[41] in Mozambique reported the case fatality rate of 33.3%. However some studies reported a lower case fatality rate compared to ours. Sundar U et al[53] in Mumbai the case fatality rate of 16.84% and Sweileh WM et al[50] in Palestine reported the case fatality rate of 21%. Meyer Ket al[57] in Switzerland reported the case fatality rate of 11.6% while Sallam AR et al[54] in Kuwait reported the case fatality rate of 24.1%. Ivanovic M et al[44] in Croatia reported the case fatality rate of 20.24% in their study.

In our study we also observed that males had slightly higher case fatality rate as it was 32.7% in males and 29.1% in females. Vohra EA et al[33] in Karachi, Pakistan also reported higher case fatality rate among males compared to females (36.2% among males versus 29.6% among females). A slight difference was also reported b Meyer K et al[57] in Switzerland (11.8 % among males versus 11.4% in females).

Hemorrhagic stroke cases had higher 'In hospital' case fatality rate (37%) compared to ischemic stroke cases (13.4%). All the studies across the globe indicate that hemorrhagic stroke has higher mortality than ischemic stroke. Brunn B et al[45] in New York also observed similar scenario but the figures were much higher than ours as they reported case fatality rate (in hospital) of 76.9% in hemorrhagic stroke and 25.8% in ischemic stroke. Rosman KD et al[39] in South Africa also reported case fatality rate of 57.9% in hemorrhagic stroke and 22.4% in ischemic stroke. Sallam AR et al[54] in Kuwait reported case fatality rate of 28.8% in hemorrhagic stroke and 19.7% in ischemic stroke. Damasceeno A et al[41] in Mozambique reported case fatality rate of 47.9% in hemorrhagic stroke and 17.4% in ischemic stroke. Ivanovic M et al[44] in Croatia reported case fatality rate of 26.7% in hemorrhagic stroke and 19.4% in ischemic stroke.

This study revealed that 3 out of 100 hospitals admissions were due to stroke. Females had a higher incidence of stroke per 1000 admissions than males (33.21 in females and 29.27 in males). Among all the 27882 male admissions in the institute, 2.93% of males had stroke whereas among all 18731 female admissions, 3.32% of females had stroke. This difference was found to be statistically significant (p=0.016). In the SKIMS hospital, 1.86% of 14607 admissions from urban areas had stroke whereas 3.32% off 18371 admissions from rural areas had stroke. This difference was found to be significant (p< 0.001). The descriptive analysis of 1438 stroke patients showed male preponderance with 56.7% males and 43.3% females. Most of the patients were from rural areas and only 18.9% cases were from urban areas. Mean age of male stroke patients was higher than that of female patients and this difference was found to be statistically significant (p<0.001). Among all 1438 stroke patients, 75.2% of cases were hemorrhagic strokes an only 24.8% were ischemic strokes. Lacunar infarct comprised of 5.6% of all stroke cases and 22.7% o ischemic stroke patients while as SAH comprised of 11.3% of all stroke cases and 15.1% of hemorrhagic stroke cases. 27.97% strokes among females were ischemic whereas only 22.43% strokes among males were ischemic. This difference was found to found statistically significant (p=0.016). Out of four seasons, highest numbers of stroke cases were admitted during the winter season (29.3%) and least during autumn season (20.8%) with maximum numbers of ischemic strokes (35.3%) in the winter season and maximum numbers of hemorrhagic strokes (30.8%) in the spring season. Among the 734 patients of study group, 37.9% female stroke cases were ischemic whereas only 27.8% of male stroke cases were ischemic. This difference was found to be statistically significant (p=0.004). Hypertension was the most common risk factors observed in 91.1% patients, followed by tobacco exposure in 69.9% patients, hyperlipidemia in 36.2% patients, diabetes in 21.1% patients, previous history of stroke in 15.8% cases, cardiovascular disease in 12.7% cases and family history of stroke in 11.7% cases. Among the CVD majority of the patients had atrial fibrillation (7.63%) followed by rheumatic heart diseases (2.72%). Only 15.3% of patients with hypertension, 37.7% of patients with diabetes and 21.4% patients with hyperlipididemia were taking treatment regularly. Out of 734 patients, 70% were exposed to tobacco. Risk factors more common in females included diabetes (25.6%), hyperlipidemia (37.5%), CVD (17.8%) and history of previous stroke (17.8%) while risk factors common in males included tobacco exposure (81.6%) and alcohol abuse (3.1%). On the other hand, diabetes (23% versus 20.2%), oral anticoagulant intake(3% versus 0.4%), CVD (34.9% versus 2.2%) and history of previous stroke (17.9% versus 14.8%) were more common in ischemic stroke cases

than hemorrhagic cases. Majority of the patients had sedentary lifestyle as 56.1% had sedentary job profile and 98% were having sedentary behavior. 98.5% patients were non-veg. with more than 30% patients consumed meat once or more than once a week and around 17% patients consumed chicken once or more than once a week a week. Fish intake was less among cases as majority of the patients consumed fish once in 6 months followed by 40% once in 3 months, 3.4% once a month and 3.3% never consumed fish.

Salt consumption was very high among the stroke patients. More than 80% patients consumed 3 or more cups of green tea with salt per day, 32.4% patients consumed pickles frequently and 16.1% consumed chutney frequently. In spite of 86.6%patients having history of hypertension, only 23.4% patients consumed salt restricted diet. Majority of the strokes occurred during late morning hours, i.e. between 6 am -12 am. 18% patients had pre-hypertension and 31% patients had pre-diabetes. Majority of the stroke patients (49.2%) were in grade 2 level of consciousness at admission with majority of the ischemic stroke patients (48.5%) in grade 1 level of consciousness and majority of hemorrhagic stroke patients (51.1%) in grade 2 level of consciousness. 'In hospital' case fatality rate was 31.2% among all cases, 13.4% among ischemic stroke cases, 37% among hemorrhagic stroke cases, 32.7% among males and 29.1% among females. 28th day case fatality was 41.3% among all cases, 21.5% among ischemic stroke cases, 47.9% among hemorrhagic stroke cases, 43.3% among males and 38.9% among females.

Bivariate analysis revealed that sex, education, occupation, BMI, history of hypertension, duration of hypertension, non-compliance to antihypertensive drugs, history of diabetes, hyperlipidemia, tobacco exposure, smokeless tobacco use, sedentary lifestyle, CVD, frequency of fruit intake, season of occurrence and time of onset were all statistically significant factors.

On logistic regression analysis, statistically significant risk factors associated with stroke were hypertension, non compliance to antihypertensive drugs, BMI , sedentary lifestyle, stress, winter season high salt tea, and less frequent fruit intake.

Conclusion

We conclude that, 3.08% of all admissions in SKIMS hospital during the year 2012 were due to stroke. There is predominance of hemorrhagic strokes over ischemic strokes as 75% of the stroke cases are hemorrhagic. Hypertension, diabetes mellitus, tobacco use, hyperlipidemia and overweight/ obesity were the most prevalent modifiable risk factors among these stroke patients. Factors significantly associated with stroke after multivariate logistic regression in the present study were hypertension, non-compliance to antihypertensive drugs, obesity, sedentary lifestyle, stress, high salt green tea consumption, winter season and less frequent fruit intake. The 28 day case fatality rate is high especially in hemorrhagic stroke and is comparable to Indian figures but is higher than the global figures.

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