



Original Research Article

Risk factors in patients with ischemic stroke - A prospective study

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How to cite this article: Prakash Gurudevahalli Madegowda, Sanju R. Risk factors in patients with ischemic stroke - A prospective study. IAIM, 2015; 2(6): 28-39.

Available online at www.iaimjournal.com

Received on: 15-05-2015

Accepted on: 23-05-2015

Abstract

Background: Stroke is a leading public health problem, it is second to heart disease as a worldwide cause of death and a leading cause of long term disability. The treatment for patients with ischemic stroke is still not very effective and prevention of stroke is a better option. The incidence of stroke can be reduced by adequate control of risk factors.

Aim: To evaluate the risk factors in patients with ischemic stroke. To find out the prognosis of ischemic stroke with reference to risk factors. To identify the patients having modifiable risk factors so that preventive care can be taken to improve the prognosis and prevent recurrences.

Materials and methods: 65 patients with ischemic stroke who met the inclusion criteria were evaluated with a comprehensive clinical history and detailed physical examination and relevant investigations. Their prognosis during the hospital stay was also determined.

Results: At the end of the study it was noted that the incidence of stroke in males was 58.46%. 50.9% of stroke occurred in people aged above 60 years. The most common risk factors were smoking (46.2%), hypertension (38.46%), dyslipidemia (18.46%), alcohol consumption (15.39%), diabetes mellitus (13.09%), heart diseases (10.7%), tobacco chewing (9.23%), history of recent delivery (1.6%) and family history of stroke (1.6%). It was also noted that 72.3% of patients had multiple risk factors of which 7% had complete recovery while 22.2% of patients with single risk factor had complete recovery.

Conclusion: It was found that stroke was more common in males when compared to females and increasing age (>60 years) was associated with increased incidence of stroke. Most common modifiable risk factors were smoking, hypertension, dyslipidemia, alcohol consumption and diabetes mellitus. The most common non modifiable risk factors were increasing age, male sex and family history of stroke. Prognosis depends on the number of risk factors present. It was also found that increasing age, hyperglycemia and multiple risk factors were associated with poor prognosis.



Key words

Risk factors, Ischemic stroke, Prognosis, Mortality.

Introduction

Ischemic stroke is a leading public health problem. Annually, approximately 7.5 lakh Americans have an initial or recurrent ischemic stroke. Stroke incidence is even higher in most other countries. Rates are particularly high in Asia and Eastern Europe. Changes in the rates of stroke vary considerably among regions. For example, the incidence of stroke is declining in Western Europe and North America while it is rising in Eastern Europe. Although definitive data from many third-world countries are not available, stroke is a rising problem in the developing world. With the advancing life expectancy of people in developing countries, the importance of ischemic stroke will grow as a worldwide problem [1, 2].

In India, community survey has shown a crude prevalence rate for hemiplegia in the range of 200 per 1 lakh population, nearly 1.5 percent of all urban hospital admission and 4.5% of all medical admission are neurological cases [3].

Stroke is second to heart disease as the worldwide cause of death. In the United States, stroke is the third most common cause of death following heart disease and cancer. Annually 1.5 lakh Americans die of stroke [1, 3].

Since the late 1990s, there has been an increase in survival after the stroke and therefore it has become a common cause of human suffering and the leading cause of long term disability. The stroke often precludes patient's abilities to return to work or to regain their role in the family. Thus by affecting both patients and loved ones, stroke is a family illness. Family relationships and dynamics are often changed irrevocably. Disability may require a spouse or

other relative to assume a new role or become a full time caregiver. Stroke is second only to dementia as the neurological disorder leading to long term institutionalized care. Recurrent stroke produces dementia and its effects exacerbate cognitive impairments from degenerative dementia such as Alzheimer's disease [1, 3].

Due to the high incidence of stroke and the high costs expenditure for each individual patient, it accounts for a sizeable amount of health care costs. Thus stroke and its sequelae are important issues for health care planners in Governments, Insurance companies and medical services everywhere. Because the costs of treatment and the economic consequences of lost productivity are so great, prevention of stroke will be a very cost effective strategy [1].

Ischemic cerebrovascular disease encompasses a broad spectrum of clinical events based on the type and duration of the neurological symptoms, the area of brain affected, the involved artery and the presumed cause. This classification is important in establishing patients' prognosis and making decisions about evaluation and treatment. Although the term cerebrovascular accident (CVA) is used widely by the physician and the other health care professionals, it is an appalling pseudoscientific characterization of stroke that substitutes labelling for understanding. The term should be abandoned because many strokes are not accidents, but preventable catastrophes [3].

A transient ischemic attack (TIA) is an acute loss of focal brain or monocular function with symptoms lasting less than 24 hours and is thought to be due to inadequate cerebral or ocular blood supply as a result of arterial



thrombosis, embolism or low flow, associated with arterial, cardiac or hematological disease [4].

According to World Health organization definition of stroke (introduced in 1970 and still used) is rapid developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin [4]. Thus clinical, laboratory support and brain image are required for diagnosis. The clinical manifestations of stroke are variable because of the complex anatomy of the brain and its vasculature [5, 6, 7].

Materials and methods

The present study included patients with ischemic stroke who were admitted to the intensive care unit under department of Medicine at Sri Adichunchanagiri hospital and Research center, BG nagar for a period of one year. 65 patients were enrolled for the study. The criterias for the selection of patients were as follows.

Inclusion criteria

Ischemic stroke was diagnosed if the following criterias were present.

- Symptoms and signs suggestive of acute loss of focal or global cerebral function.
- Evidence of ischemia on CT scan of head.

Exclusion criteria

- Patients with focal epilepsy, migraine, and structural brain lesions (such as tumors).
- Patients with evidence of hemorrhage on CT scan of head.
- Stroke secondary to infection and connective tissue disorders.

The patients enrolled in the study were subjected to detailed clinical history and physical examination. Clinical history was obtained from the attenders when the patients were having speech disturbances. Laboratory investigation like complete blood count, urine analysis, fasting blood sugar, blood urea, serum creatinine, lipid profile and ECG, echo with colour doppler, CT Scan of head were done in all the patients. Written informed consent was taken from the patient or the guardian. The institutional ethics committee approved the study.

The risk factor profile of each patient was evaluated during the stay in the study

- Hypertension was defined as a BP recording of >140/90 mmHg on 3 separate occasions, taken on 3 different days. Patients who are already on antihypertensive medication were also taken as hypertensive.
- Dyslipidemia was taken as serum cholesterol >200 mg/dl, LDL cholesterol >130 mg/dl and HDL cholesterol <35 mg/dl in females and <40 mg/dl in males.
- Patients were included as suffering from heart disease if they had ischemic heart disease, congestive heart failure, rheumatic heart disease, atrial fibrillation or left ventricular hypertrophy on ECG or Echocardiography.
- Smoking, tobacco chewing and alcohol intake were based on the clinical history of past and present consumption of these substances.
- Diabetic patients were diagnosed as per the American diabetic association guidelines. Patients on anti-diabetic medication were also considered as diabetic.



- A family history of stroke was entertained if the first degree relatives of the patients suffered from stroke.
- Patients were considered as obese if their BMI was ≥ 30 .

Results

In the present study, 65 patients of acute ischemic stroke who met inclusion criteria and exclusion criteria were analyzed with regards to the risk factors individually and in combination and they were correlated with the outcome.

Among 65 patients, 38 (58.46%) were males and 27 (41.54%) were females. In the 38 male patients, 4 patients (10.52%) expired, 6 patients (15.78%) had complete recovery, 16 patients (42.12%) had partial recovery and 12 patients (31.57%) had no recovery. In the 27 females patients, 4 patients (14.81%) expired, 3 patients (11.11%) had complete recovery, 8 patients (29.62%) had partial recovery and 12 patients (44.44%) had no recovery. **(Table – 1)**

4 patients (6.15%) were between 20-29 years of age, 6 patients (9.23%) were between 30-39 years of age, 9 patients (13.84%) were between 40-49 years of age, 13 patients (20%) were between 50-59 years, 22 patients (33.85%) were between 60-69 years and 11 patients (16.92%) were more than 70 years. In 20-29 years age group, one patient (25%) had no recovery and 2 patients (50%) had complete recovery, no death occurred in this age group. In 30-39 years age groups, 4 patients (66.6%) had partial recovery and one patient (16.66%) had complete recovery and one patient did not recover. In 40-49 years age group, 3 patient (33.33%) had no recovery and partial recovery was seen in 3 other patients(33.33). one patient (11.11%) had complete recovery and 2 patients (22.22%) expired. In 50-59 age groups, 1 patient (7.71%) had complete recovery and 1 patient expired. 7

patients (53.93%) had partial recovery and 4 patients (30.74%) had no recovery. In 60-69 age groups, 3 patients (13.63%) expired, 4 patients (18.18%) had complete recovery, 6 patients (27.17%) had partial recovery, and 9 patients (40.98%) had no recovery. In the age group more than 70 years, 2 patients (18.18%) expired, 3 patients (27.28%) had partial recovery and 6 patients (54.54%) had no recovery. **(Table – 2)**

Among 65 patients 25 (38.46%) patients had hypertension, 30 patients (46.20%) were smokers, 6 patients (9.23%) chewed tobacco, 12 patients (18.46%) had dyslipidemia, 9 patients (13.09%) had diabetes mellitus, 10 patients (15.39%) were alcoholic, 7 patients (10.76%) had heart disease, 1 patients each had history of recent delivery and family history of stroke respectively. **(Table – 3)**

Out of 65 patients 25 patients (38.46%) had history of hypertension. Among 25 patients who presented with hypertension 3 patients (12%) expired. 11 patients (44%) had partial recovery, 3 patients (12%) had complete recovery and 8 patients (32%) had no recovery. 40 patients who did not gave history of hypertension, 5 patients (12.5%) expired, 6 patients (15%) had complete recovery, 13 patients (32.5%) had partial recovery and 16 patients (40%) had no recovery. **(Table – 4)**

Out of 65 patients 9 patients (13.84%) had diabetes mellitus. Among 9 patients 2 patients (22.22%) expired, complete recovery was not noted in this category of patients. 3 patients (33.33%) had partial recovery and 4 patients (44.44%) had no recovery. Among 56 patients who were non-diabetes, 6 patients (10.71%) expired, 9 patients (16.7%) had complete recovery, 21 patients (37.5%) had partial recovery and 20 patients (35.7%) had no recovery. **(Table – 5)**



Out of 65 patients, 30 patients (46.2%) were smokers. Among these 30 patients, 2 patients (6.66%) expired, 5 patients (16.6%) had complete recovery, 13 patients (43.33%) had partial recovery and 10 patients (33.33%) had no recovery. In 35 patients who were non-smokers, 6 patients (17.14%) expired, 4 patients (11.42%) had complete recovery, 11 patients (31.42%) had partial recovery and 14 patients had no recovery. **(Table – 6)**

Among 65 patients, 6 patients (9.23%) gave history of tobacco chewing. Among them 4 patients (66.6%) had partial recovery and 2 patients (33.33%) had no recovery. Among 59 non- tobacco chewers, 9 patients (15.25%) had complete recovery, 20 patients (33.9%) had partial recovery, 22 patients (37.29%) had no recovery and 8 patients (13.56%) expired. **(Table – 7)**

Among 65 patients, 12 patients (18.46%) had dyslipidemia. Among these patients 3 patients (25%) expired, 5 patients (41.66%) had partial recovery and 4 patients (33.33%) had no recovery and complete recovery was not noted in any of them. Out of 65 patients, 53 patients did not show dyslipidemia. Among these patients, 9 patients (16.9%) had complete recovery, 19 patients (35.84%) had partial recovery and 20 patients (37.33%) had no recovery, 5 patients (9.43%) expired in this group. **(Table – 8)**

10 patients (15.38%) gave history of alcohol consumption. Among 10 patients, 1 patient (10%) expired, 2 patients (20%) had complete recovery, 5 patients (50%) had partial recovery and 2 patients (20%) had no recovery. Out of 65 patients, 55 patients were non-alcoholic. In this group 7 patients (12.72%) had complete recovery, 19 patients (34.54%) had partial recovery and 22 patients (40%) had no recovery,

7 patients (12.72%) expired in this group. **(Table – 9)**

Among 65 patients, 7 patients had heart diseases (10.76%) which consisted of Atrial fibrillation (AF), Rheumatic heart disease (RHD), Ischemic heart disease (IHD), left ventricular hypertrophy (LVH). Among them 2 patients (28.57%) expired, 1 patient (14.28%) had complete recovery and 4 patients (57.14%) had partial recovery. 58 patients were without any heart disease, in this group 8 patients (13.86%) had complete recovery, 20 patients (34.48%) had partial recovery and 24 patients (41.37%) had no recovery, 6 patients (10.34%) expired in this group. **(Table – 10)**

Out of 27 female patients, 1 patient (3.7%) gave history of recent delivery. She had complete recovery. **(Table – 11)**

Out of 65 patients, 1 patient (1.6%) gave a family history of stroke. No recovery was seen in that patient. **(Table – 12)**

Among 65 patients, 47 patients (72.3%) had multiple risk factors like age >60 years, hypertension, smoking, diabetes mellitus. Among these 6 patients (12.76%) expired, 16 patients (34.04%) had no recovery, 20 patients (42.55%) had partial recovery and 5 patients (10.6%) had complete recovery. Among the 18 patients (27.6%) who had one or no risk factors 2 patients (11.11%) expired, 4 patients (22.22%) had complete recovery, 4 patients (22.22%) had partial recovery, and 8 patients (44.44%) had no recovery. **(Table – 13)**

When all the 65 patients were analyzed with respect to clinical presentation, motor weakness was most common manifestation being present in 49 patients (75.39%), speech disturbance was next frequent presentation found in 20 patients (30.7%), unconsciousness in 10 patients (15.4%),



headache in 9 patients (13.85%), vomiting and convulsion in 2 patients (3.07%) respectively and none of the patients in this series presented with sensory disturbance or with fever. **(Table – 14)**

Discussion

Stroke, especially ischemic is a common clinical problem and current treatment for patients with established stroke is relatively ineffective. Approximately 50% of patients are left with permanent disability. Effective risk factor intervention offers a real hope of reducing stroke morbidity and mortality. Certain risk factors have been consistently identified as significant predictor of stroke outcome, while some are less consistent.

In the present study which involved 65 patients of ischemic stroke admitted in the ICU attached to our Institute, we examined the prediction of stroke outcome in relation to sex, age, smoking, tobacco chewing, hypertension, heart disease (valvular heart disease, coronary heart disease, atrial fibrillation), diabetes mellitus, dyslipidemia and obesity. It was consistent with previous published studies that smoking, hypertension and dyslipidemia were the most common risk factors.

Sex

In the present study, ischemic stroke was predominant in males and is consistent with Bogoussalvsky study [8] and P.M. Dalal study [9]. **(Table – 15)**

Age

In the present study 33 patients (50.7%) were aged above 60 years and 5 patients (62.5%) who expired were from this group. This is consistent with the A.G. Shaper and A.N. Philips study [10].

Risk factors

Risk factors comparison was as per **Table – 16** [2, 11, 12].

Hypertension

In the present study 25 patients (38.46%) were hypertensive. This was low when compared to Bansal study [11] and Feigin study [2] but was consistent with the Sridharan study [12].

Diabetes mellitus

9 patients (13.09%) were diabetics in the present study and this was consistent with Feigin study [2].

Smoking

30 patients (46.2%) included in this study were smokers, this was higher when compared to other studies like Bansal study [11], Sridharan study [12].

Tobacco chewing

6 patients (9.23%) chewed tobacco in the present study. This was consistent with the Bansal study [11].

Dyslipidemia

In the present study 12 patients (18.46%) were suffering from dyslipidemia this was higher when compared with Bansal study [11].

Alcohol consumption

10 patients (15.39%) were alcoholic and this was consistent with the Bansal study [11].

Heart disease

7 patients (10.76%) suffered from heart ailments in the present study. This was much lower compared to Bansal study [11] and Sridharan study [12].

Family history of stroke

1 patient (1.6%) had family history of stroke in the present study and this was much lower than the Bansal study [11] and Feigin study [2].



Obesity

Has been much less significant risk factor in the present study, which is consistent with Davia rastenyte study [13]. **(Table – 16)**

Prognosis

Hyperglycemia is an adverse prognostic factor. In the present study of the 9 diabetic patients there are 4 diabetic patients (44.44%) who had no recovery, 3 patients (33.33%) had partial recovery. This was consistent with Copenhagen stroke study [14]. Increasing age was also an adverse prognostic factor with 9 patients (40.98%) in the age group 60-69 years and 6 patients (54.54%) in the age group >70 years having no recovery. This is consistent with the A.G. Shaper, et al. study [10]. In the present study 47 patients (72.3%) were associated with multiple risk factors; they had a higher morbidity (complete recovery 7%) than the 18 patients (27.69%) who had single risk factors (complete recovery 22.22%). This was consistent with the Bogousslavsky [8] and Bansal study [11].

Prognosis during hospital stay

In the present study the mortality was more when compared with the Bogousslavsky [8] study but consistent with Natan [15] study. Other prognostic parameters like complete recovery (13%), partial recovery (37%) and no recovery (36%) were consistent with Bogousslavsky [8] study. **(Table – 17)**

Conclusion

Commonest modifiable risk factors in ischemic stroke are hypertension, smoking, dyslipidemia, alcohol consumption and diabetes mellitus. Commonest non modifiable risk factors are increasing age, male sex, and family history of stroke. Prognosis depends on the number of risk factors present. Multiple risk factors are associated with poorer prognosis. Increasing age and hyperglycemia are also associated with poorer prognosis. Treatment or prevention of

modifiable risk factors can reduce the mortality and morbidity of stroke.

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Source of support: Nil

Conflict of interest: None declared.

Table – 1: Sex distribution.

Sex	Total	Expired	Complete recovery	Partial recovery	No recovery
Male	38 (58.46%)	4 (10.52%)	6 (15.78%)	16 (42.12%)	12 (31.57%)
Female	27 (41.54%)	4 (14.81%)	3 (11.11%)	8 (29.62%)	12 (44.44%)

Table – 2: Age distribution.

Age in years	Total	Expired	Complete recovery	Partial recovery	No recovery
20-29	4 (6.15%)	0	2 (50%)	1 (25%)	1 (25%)
30-39	6 (9.23%)	0	1 (16.60%)	4 (66.66%)	1 (16.66%)
40-49	9 (13.84%)	2 (22.22%)	1 (11.11%)	3 (33.33%)	3 (33.33%)
50-59	13 (20%)	1 (7.71%)	1 (7.71%)	7 (53.93%)	4 (30.74%)
60-69	22 (33.85%)	3 (13.63%)	4 (18.18%)	6 (27.17%)	9 (40.98%)
> 70 years	11 (16.92%)	2 (18.18)	0	3 (27.28%)	6 (54.54%)

Table – 3: Risk factors observed in ischemic stroke patients.

Risk factors	No. of patients	Percentage (%)
Hypertension	25	38.46
Diabetes mellitus	09	13.09
Smoking	30	46.20
Tobacco chewing	06	9.23
Dyslipidemia	12	18.46
Alcohol	10	15.39
Heart disease	07	10.76
History of Recent delivery	01	1.6
Family history of Stroke	01	1.6

Table – 4: Incidence of hypertension.

Subjects	Total		Expired		Complete recovery		Partial recovery		No recovery	
	No cases	%	No cases	%	No cases	%	No cases	%	No cases	%
No of cases with history of hypertension	25	38.46	3	12	3	12	11	44	8	32
No of cases without history of hypertension	40	61.5	5	12.5	6	15	13	32.5	16	40

Table – 5: Incidence of Diabetes mellitus.

Subjects	Total		Expired		Complete recovery		Partial recovery		No recovery	
	No cases	%	No cases	%	No cases	%	No cases	%	No cases	%
No of cases with diabetes	09	02	22.22	0	0	03	33.33	04	44.44	
No of cases without diabetes	56	06	10.71	09	16.7	21	37.5	20	35.71	

Table – 6: Incidence of smoking.

Subjects	Total		Expired		Complete recovery		Partial recovery		No recovery	
	No cases	%	No cases	%	No cases	%	No cases	%	No cases	%
Smokers	30	02	6.66	05	16.6	13	43.33	10	33.33	
Non-Smokers	35	06	17.14	04	11.42	11	31.42	14	40.0	

Table – 7: Incidence of tobacco chewing.

Subjects	Total		Expired		Complete recovery		Partial recovery		No recovery	
	No cases	%	No cases	%	No cases	%	No cases	%	No cases	%
Tobacco Chewers	06	9.23	0	0	0	0	04	66.6	02	33.33
No Tobacco Chewers	59	90.76	08	13.56	09	15.25	20	33.90	22	37.29

Table – 8: Incidence of dyslipidemia.

Subjects	Total		Expired		Complete recovery		Partial recovery		No recovery	
	No cases	%	No cases	%	No cases	%	No cases	%	No cases	%
No of cases with Dyslipidemia	12	18.46	3	25	0	0	05	41.66	04	33.33
No of cases without Dyslipidemia	53	81.54	5	9.43	09	16.98	19	35.84	20	37.33

Table – 9: Alcohol consumption.

Subjects	Total	Expired		Complete recovery		Partial recovery		No recovery	
		No cases	%	No cases	%	No cases	%	No cases	%
No of cases with Alcohol consumption	10	01	10.0	02	20	05	50	02	20.0
No of cases without Alcohol consumption	55	07	12.72	07	12.72	19	34.54	22	40.0

Table – 10: Patients with heart diseases.

Subjects	Total	Expired		Complete recovery		Partial recovery		No recovery	
		No cases	%	No cases	%	No cases	%	No cases	%
No of cases with Heart Diseases	07	02	28.57	01	14.28	04	57.14	0	0
No of cases without Heart Diseases	58	06	10.34	08	13.86	20	34.48	24	41.37

Table – 11: History of recent delivery.

Subject	Total	Expired		Complete recovery		Partial recovery		No recovery	
		No	%	No cases	%	No	%	No	%
History of Recent Delivery	01	0	0	01	100	0	0	0	0

Table – 12: Family history of stroke.

Subject	Total	Expired		Complete recovery		Partial recovery		No recovery	
		No cases	%	No cases	%	No cases	%	No cases	%
No of cases with Family History of Stroke	01	0	0	0	0	0	0	01	100

Table – 13: Multiple risk factors and its outcome.

Subjects	Total	Expired		Complete recovery		Partial recovery		No recovery	
		No cases	%	No cases	%	No cases	%	No cases	%
No of cases with Risk Factors > 1	47	06	12.76	05	10.6	20	42.55	16	34.04
No of cases with Risk Factors < 1	18	02	11.11	04	22.22	04	22.22	08	44.44

Table – 14: Clinical presentation of Ischemic stroke.

Symptoms	No of patients	Percentage (%)
Unconsciousness	10	15.4
Motor Weakness	49	75.39
Sensory Disturbance	0	0
Speech Disturbance	20	30.7
Headache	09	13.85
Vomiting	02	3.07
Convulsions	02	3.07
Fever	0	0

Table – 15: Sex.

	Sex ratio
Present study	1.4:1
P.M. Dalal study [9]	1.2:1

Table – 16: Risk factors.

Risk factors	Bansal Study [11]	Feigin Study [2]	Sridharan Study [12]	Present Study
Hypertension	56.4	84.4	38.7	38.46
Diabetes mellitus	22.1	7.2	29.4	13.09
Smoking	38.6	19.4	22.5	46.2
Tobacco chewing	7.8	-	-	9.23
Dyslipidemia	8.8	-	-	18.46
Alcohol	15	-	14.7	15.39
Heart diseases	22.9	39.2	29.9	10.76
Recent Delivery	-	-	-	1.6
Family history of stroke	27	18.1	-	1.6
Obesity	-	27.9	-	-

Table – 17: Prognosis during hospital stay.

	Bogousslavsky [8] study (%)	Natan [15] study (%)	Present study (%)
Expired	05	13.8	12.30
Complete recovery	14	-	13
Partial recovery	40	-	37
No recovery	30	-	36