

Etiology and Risk Factors of Stroke in Young: A Prospective Study

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Abstract

Introduction: Stroke is one of the most important causes of high morbidity and mortality worldwide. Stroke was defined by World Health Organization criteria as rapidly developing clinical signs of focal, at times, global disturbance of cerebral function lasting for more than 24 h or leading to death with no apparent cause other than vascular origin.

Materials and Methods: This study was prospective descriptive and clinical study. Patients diagnosed to have stroke in young admitted in MGM Hospital in the Department of Medicine from January 2012 to August 2013.

Results: Sex ratio in our study was 1.7:1 (male:female). The mean age in the study population was 31.3 years. Male and female patients were 31.88 and 30.5 years, respectively. The majority of strokes occurred between the ages of 36 and 40 years at 40% and 43.75% of male patients were also in the same age group; whereas in females, it was only 28%. 36% of the all the patients were smokers, and among ischemic and hemorrhagic strokes 33.3% and 50% were smokers, respectively. Alcohol consumption was seen in 42% of patients and among ischemic strokes 39.1% and hemorrhagic strokes 75%. Diabetes mellitus (DM) was seen in 4% of patients, and they have ischemic stroke. Hypertension (HTN) was seen in 14% of the study group. Among ischemic strokes, 8.6% were hypertensive. Whereas HTN was seen in 75% of intracerebral hemorrhage cases. Transient ischemic attacks and previous family history of stroke were both seen in 24% of the patients. 21.7% of ischemic strokes also had the same, 50% of the hemorrhagic strokes had this history.

Conclusion: Smoking and alcohol consumption were important acquired risk factors for stroke among young. HTN and DM were nonmodifiable risk factors commonly seen, especially HTN in cases of intracerebral hemorrhage. Rarer risk factors like homocysteinemia should be considered during evaluation. Diagnostic challenges are to be expected when evaluating these patients.

Key words: Risk Factors, Stroke, Young

INTRODUCTION

Stroke is one of the most important causes of high morbidity and mortality worldwide. Stroke was defined by World Health Organization criteria as rapidly developing clinical signs of focal, at times, global disturbance of cerebral function lasting for more than 24 h or leading to death with no apparent cause other than vascular origin.¹ The diseases of cerebral blood vessels and the related

infarcts and hemorrhages, though principally occur in the elderly, the young are not spared. Community-based surveys from the West and Japan indicate average annual incidence of stroke as 111-180/100,000 general population and 9-28/100,000 in young people below the age of 45 years. Data from major Indian hospitals show 5-15% of stroke in young of all neurological admissions.²

Although various studies on stroke in young included subjects from second to fourth or fifth decade, in general, stroke in young includes subjects falling under the age group of 40 years.^{3,4} The etiology may vary with different age groups, but most of the risk factors are common to all age groups. Still, certain factors are confined to the young.

Stroke affecting the young has potentially devastating consequences on the individual, his family and the society

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in general. Several studies have analyzed the risk factors of stroke in young, but considering its impact on younger generation, it needs more studies for identification and modification of risk factors.⁵⁻¹⁰

MATERIALS AND METHODS

Study Design

A prospective descriptive and clinical study.

Source of Data

Patients diagnosed to have stroke in young admitted in MGM Hospital in the Department of Medicine from January 2012 to August 2013 and fulfilled the inclusion and exclusion criteria. The sample size was restricted to 50 cases.

Inclusion criteria: (1) Age <40 years, (2) patients with abrupt onset of focal or global neurological deficit attributable to vascular cause and persist for more than 24 h.

Exclusion criteria: Head injury.

Method of Collection of Data

All patients who fulfilled the inclusion and exclusion criteria were included in this study. A pro forma was prepared which included detailed history, clinical examination and requisite investigations available in our hospital. History includes all symptoms pertaining to stroke in detail with emphasis on all the risk factors attributable to the stroke in young. A detailed clinical examination was done, and neurological deficits were identified. Relevant investigations such as hemoglobin, total white cell count, erythrocyte sedimentation rate, routine urine analysis, blood glucose, blood urea, serum creatinine, serum lipid profile, chest X-ray, computed tomography scan, electrocardiography, bleeding time, clotting time, test for HIV, echocardiogram, activated partial thromboplastin time, and thrombin time were done for all patients. Other 53 investigations such as protein C, protein S, antithrombin 3, serum homocysteine, serum fibrinogen, antinuclear antibody, antiphospholipid antibodies, magnetic resonance angiography, and magnetic resonance venography if required and sickling test (if required) were done.

RESULTS

In this study, it has shown that stroke in young is more common in age group between 31 and 40 (60%) than in age <30 years. Youngest recorded was 15-year-old female with internal carotid artery (ICA) dissection.

Stroke in young also more common in males (64%) than in females (36%).

Overall smoking is present in 18 patients, in that only 4 patients (8%) are under the age 30, remaining 14 patients (28%) are between the age group 31 and 40. Smoking is only seen in male patients.

Alcohol intake is seen in 21 (42%) patients, in which 6 (12%) are under the age 30 and 15 patients are in between the age group 31-40. Alcohol intake also presents only in males. Hypertension (HTN) is relatively less common in young stroke patients seen only in 7 (14%).

It is also relatively common in the age group between 31 and 40, i.e., 6 patients (12%). It is seen only in one patient under the 30 years age group.

Diabetes is rare in young stroke patients seen only in 2 (4%) patients; those are also in the age group between 31 and 40 years.

Family history of stroke is present in 24% (12) of patients. In that 8% (4) are under the age 30 and 16% (8) are between the age 31 and 40.

Dyslipidemias are present in 34% of patients in this 30% of patients are in the age group 31-40 years. Only 4% of patients are under 30 years.

In the young also ischemic stroke is more common constitutes 84% of cases, venous infarcts 8% and hemorrhage 8%.

Hemorrhagic stroke seen only in male patients and venous stroke is more commonly seen in female patients (female: male - 3:1).

All the common risk factors are compared for the outcome of stroke whether ischemic or hemorrhagic.

Except the risk factor HTN for the hemorrhagic stroke ($P < 0.0067$) all other risk factors are not significant for the type of stroke.

In 23 patients (42%) only etiology is established. Out of total 50 cases, 26% of cases are preventable as they are due to infectious in etiology. Atherosclerosis is more common as age advances. It is seen in 19 patients (38%), out of which 17 (34%) are in the age group 31-40.

Atherosclerosis is more commonly seen, i.e., 34% in the patients in whom the etiology is not known.

On the contrary, it is seen only in 4% of patients with known etiology for this P value is 0.03 which shows the association is statistically significant (Tables 1-15).

DISCUSSION

Our study was based in south India comprising mainly a rural population. It should prove useful, then, for the diagnosis, management and prognosis of young stroke patients in similar areas. Sex ratio in our study was 1.7:1 (male:female). Mehndiratta *et al.*² showed a ratio of 1:08 in North India. The mean age of all the patients in our study was 31.38 years; a study in north India by Mehndiratta *et al.*² showed a similar mean age of 31.97 years. The mean ages of males and females were 30.66 and 33.28 years.² Our study had a higher mean age group among men at 31.88 years; whereas among women, it was much lower at 30.5 years probably because there were more number of females in this study who presented with cerebral venous thrombosis (CVT) in the early age.

Nagaraj *et al.*⁵ had showed an incidence of smoking associated with stroke to be 15% Dalal⁶ 40%, Bogousslavsky and Pierce⁷ 36.6% and Alvarez *et al.*⁸ 56.7%. In meta-analysis of 32 separate studies of relation between smoking and

stroke analyzed by Shinton and Beevers,⁹ there was a strong association between smoking and incidence of stroke. Our study showed 36%.

In the study of Nagaraj *et al.*, the frequency of alcohol consumption was 15%, Alvarez *et al.*⁷ 37.8% and Dalal⁶ 40%, the present study had 42%. In study by Nagaraj *et al.*,⁵ the incidence of diabetes was 11%, Dalal⁶ 20%, Grindal *et al.*¹⁰ 5.2%, Zunni *et al.*¹¹ 14.8% and Alvarez *et al.*⁸ 10.9%, whereas in our study it was 4%. In this study, 7 patients (14%) had HTN Dalal⁶ showed an incidence of 46.7%, Alvarez *et al.*⁸ 23%, Nagaraj *et al.*⁸ 22.6% and Grindal *et al.*¹⁰ 17.2%.

In the study of Mehndiratta *et al.*,² the incidence of homocysteinemia was 0.9%. This study showed 12% which did not concur with the above study probably because the levels of homocysteine can elevate temporarily after stroke, so it should be measured again after 8 weeks. In this study, homocysteine was measured during presentation of stroke.

Tubercular meningitis comprised 12% of cases which is higher in comparison to Mehndiratta *et al.*² But in a study by Grau *et al.*¹¹ showed an incidence of 19.2% which concurred with the present study. Rheumatic heart disease (RHD) leading to cardioembolic stroke comprised 10% of the cases. In a study by Mehndiratta *et al.*² showed 30%. Bansal *et al.*¹² showed an incidence of 16%. This study had less number of cases of RHD in comparison to other Indian studies probably because of small study group and incidence of RHD is decreasing now.

Diagnosis in other determined etiology includes hypercoagulable states 12%, viral encephalitis 4%,

Table 1: Clinical and laboratory parameters of the patients

Parameters	N (%)
Total number of cases	50
Male:Female ratio	32:18 (64%:36%)
Number of patients <30 years	20 (40)
Number of patients between 31 and 40 years	30 (60)
Smoking+	18 (36)
Alcohol intake+	21 (42)
HTN+	7 (14)
DM+	2 (4)
Dyslipidemia+	8 (16)
Ischemic stroke	42 (84)
Venous stroke	4 (8)
Hemorrhagic stroke	4 (8)
Homocysteine levels elevated	6 (12)
Etiology known	23 (46)
Carotid artery atherosclerosis+	19 (38)

DM: Diabetes mellitus, HTN: Hypertension

Table 2: Age and sex distribution

Age (years)	Female	Male	Total
<30	8	12	20
31-40	10	20	30
Total	18	32	50

Table 3: Smoking

Age (years)	Present	Absent	Total
<30	4	16	20
31-40	14	16	30
Total	18	32	50

Table 4: Alcohol

Age (years)	Yes	No	Total
<30	6	14	20
31-40	15	15	30
Total	21	29	50

Table 5: HTN

Age (years)	Present	Absent	Total
<30	1	19	20
31-40	6	24	30
Total	7	43	50

HTN: Hypertension

Table 6: Diabetes

Age (years)	Present	Absent	Total
<30	0	20	20
31-40	2	28	30
Total	2	48	50

Table 7: Family history of stroke

Age (years)	Present	Absent	Total
<31	4	16	20
31-40	8	22	30
Total	12	38	50

Table 8: Dyslipidaemia

Age (years)	Present	Absent	Total
<30	2	18	20
31-40	6	24	30
Total	8	32	50

Table 9: Type of stroke

Sex	Ischemic	Venous	Hemorrhagic	Total
Female	15	3	0	18
Male	27	1	4	32
Total	42	4	4	50

Table 10: Risk factor – Type of stroke

Risk factor	Infarct	Haemorrhage	P value
Age			
<30 years	20	0	0.14
31-40 years	26	4	
Sex			
Female	18	0	0.28
Male	28	4	
Smoking			
Present	16	2	0.6
Absent	32	2	
Alcohol			
Present	18	3	0.3
Absent	28	1	
HTN			
Present	4	3	0.0067
Absent	42	1	
DM			
Present	2	0	1.0
Absent	44	4	
Family h/o stroke			
Present	10	2	0.23
Absent	36	2	
Hypercoagulable states			
Present	6	0	1.0
Absent	40	4	

DM: Diabetes mellitus, HTN: Hypertension

ICA dissection 2%, sickle cell anemia 2%, gestational trophoblastic disease 2%, and middle cerebral artery stenosis in HIV 2% CVT was seen in 4 patients (8%). This does not concur with the study by Venkataraman *et al.*¹³ where incidence was 4.3%, but Towbin¹⁴ found CVT in 9% of 182 consecutive autopsies. Boussier and Barnett¹⁵ trial suggests that the true incidence is higher than that thought from autopsy series. Atherosclerosis had emerged

Table 11: Etiology of stroke

Etiology	Type of stroke	Number of patients
TB meningitis	Ischemic stroke	6
RHD	Ischemic stroke	5
Hypercoagulable states	Ischemic stroke	2
	Venous stroke	4
Viral encephalitis	Ischemic stroke	2
Other determined etiology	Ischemic stroke	4
Undetermined etiology	Ischemic stroke	27
Total		50

TB: Tuberculosis, RHD: Rheumatic heart disease

Table 12: Atherosclerosis with age

Carotid atherosclerosis	Present	Absent	Total
<30 years	2	18	20
31-40 years	17	13	30
Total	19	31	50

Table 13: Atherosclerosis with etiology

Carotid atherosclerosis	Known etiology	Unknown etiology	Total
Present	2	17	19
Absent	21	10	31
Total	23	27	50

as the main etiological factor responsible for 38% of the patients in our study. It is more seen as the age advances and seen more commonly in patients in whom etiology was not determined. So that it appears to be the major factor responsible for stroke in young also atherosclerosis was considered based on the criteria similar to Adams and Victor¹⁶ when the patient had 2 or more risk factors for atherosclerosis in the absence of identifiable causes. Bevan *et al.*¹⁷ showed 31%. In a case-control study at NIMHANS by Dakshinamurthy,¹⁸ it was found that 50% of stroke in young could be attributed to atherosclerosis.

Evaluations of various risk factors of stroke in young are important as they may play a major role in predisposing an individual to a disease which has terrible impact on the family and society. Stroke in young deserves an extensive evaluation that includes hematological, biochemical and angiographic studies. By these approaches, a large number of potential causes can be detected, and the treatment of these patients can be tailored according to the outcome.

Limitations of the Study

This study was conducted in only 50 patients. Studies with more number of patients are required to apply the results for the community. Rare causes cannot be found as there is no possibility to do genetic analysis and further investigations. Bias may occur as some patients may die even before reaching hospital or before complete testing.

Table 14: Comparison of risk factors

Risk factors	Present study	Dalal ⁶	Nagaraj <i>et al.</i> ⁵	Grindal <i>et al.</i> ¹⁰	Bogousslavsky and Pierce ⁷	Alvarez <i>et al.</i> ⁸
Smoking	36	40	15		36.6	56.7
Alcohol	42	40	15			37.8
DM	4	20	11	5.2		10.9
HTN	14	40	22.6	17.2	7.3	23.3
Family H/O stroke	24				17.1	

DM: Diabetes mellitus, HTN: Hypertension,

Table 15: Comparison of various etiology

Authors	Year	Common etiology
Srinivasan <i>et al.</i>	1984	Meningovascular syphilis, CVT
Adams <i>et al.</i> ¹⁶	1995	Cardioembolic, atherosclerosis
Bogousslavsky and Pierce	2000	Cardioembolic, atherosclerosis
Alvarez <i>et al.</i> ⁸	1989	Cardioembolic, atherosclerosis
Dalal <i>et al.</i> ⁶	1997	Atherosclerosis
Bevan <i>et al.</i>	1990	Cardioembolic, atherosclerosis
Nagaraj <i>et al.</i> ⁵	1997	APLA
Present study	2013	TB meningitis, cardioembolic, atherosclerosis

APLA: Antiphospholipid antibodies

CONCLUSION

This was one of the few studies done about strokes in young in rural populations in our country. The majority of the age distribution of stroke in this study was between the ages of 36 and 40 years, and it was the same among males. However, it was lower in females at 25-35 years. Smoking and alcohol consumption were important acquired risk factors for stroke among young. HTN and diabetes mellitus were nonmodifiable risk factors commonly seen, especially HTN in cases of intracerebral hemorrhage. Rarer risk factors like homocysteinemia should be considered during evaluation. Dyslipidemia in the form of elevated low-density lipoprotein and decreased high-density lipoprotein were also common. Atherosclerosis was the most common etiology for stroke in young. Cortical venous thrombosis should be kept in mind in young females. Diagnostic challenges are to be expected when evaluating these patients.

REFERENCES

- Aho K, Harmsen P, Hatano S, Marquardsen J, Smirnov VE, Strasser T. Cerebrovascular disease in the community: Results of a WHO collaborative study. *Bull World Health Organ* 1980;58:113-30.
- Mehndiratta MM, Agarwal P, Sen K, Sharma B. Stroke in young adults: A study from a university hospital in North India. *Med Sci Monit* 2004;10:CR535-41.
- Adams RD, Victor M. Cerebrovascular disease. In: Ropper AH, Brown RH, editors. *Principles of Neurology*. 9th ed., Vol. 34. New York: McGraw-Hill; 2005. p. 660-746.
- Abraham J, Rao PS, Inbaraj SG, Shetty G, Jose CJ. An epidemiology of cerebro-vascular disease in India in recent concepts in stroke. *Stroke* 1970;1:477-9.
- Nagaraj D, Murthy SG, Taly AB, Subbakrishna K, Rao BS. Risk factors for stroke relative risk in young and elderly. *Neurol India* 1998;46:183-4.
- Dalal PM. Strokes in young and elderly: Risk factors and strategies for stroke prevention. *J Assoc Physicians India* 1997;45:125-30.
- Bogousslavsky J, Pierce P. Ischemic stroke in patients under age 45. *Neurol Clin* 2000;10:113-24.
- Alvarez J, Matias-Guiu J, Sumalla J, Molins M, Insa R, Moltó JM, *et al.* Ischemic stroke in young adults. I. Analysis of the etiological subgroups. *Acta Neurol Scand* 1989;80:28-34.
- Shinton R, Beevers G. Meta-analysis of relation between cigarette smoking and stroke. *BMJ* 1989;298:789-94.
- Grindal AB, Cohen RJ, Saul RF, Taylor JR. Cerebral infarction in young adults. *Stroke* 1978;9:39-42.
- Grau AJ, Buggle F, Heindl S, Steichen-Wiehn C, Banerjee T, Maiwald M, *et al.* Recent infection as a risk factor for cerebrovascular ischemia. *Stroke* 1995;26:373-91.
- Bansal BC, Prakash C, Jain AL, Brahmanandam KR. Cerebrovascular disease in young individuals below the age of 40 years. *Neurol India* 1973;21:11-8.
- Venkataraman S, Bhargava S, Virmani V. Cerebrovascular accidents: Clinical and radiological features. *J Assoc Physicians India* 1977;25:523-9.
- Towbin A. The syndrome of latent cerebral venous thrombosis: Its frequency and relation to age and congestive heart failure. *Stroke* 1973;4:419-30.
- Bousser MG, Barnett HJ. Cortical venous thrombosis. In: Barnett HJ, Mehr JP, Stein BM, Yatsu FM, editors. *Stroke, Pathophysiology Diagnosis and Management*. 3rd ed. New York: Churchill Livingstone; 1998. p. 623-47.
- Adams HP Jr, Kappelle LJ, Biller J, Gordon DL, Love BB, Gomez F, *et al.* Ischemic stroke in young adults. Experience in 329 patients enrolled in the Iowa Registry of stroke in young adults. *Arch Neurol* 1995;52:491-5.
- Bevan H, Sharma K, Bradley W. Stroke in young adults. *Stroke* 1990;21:382-6.
- Dakshinamurthy GN. Case Control Study of Non-hemorrhagic Stroke in Young, Thesis Submitted to Bangalore University for the D.M. Degree in Neurology; 1994.

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