

Dyslipidemia: A Cause of Stroke in Young Adults

Vijay B Gaikwad¹, Sharayu N Garud², Astha R Ganeriwal³

ABSTRACT

Stroke is a "Rapidly developing clinical signs of focal or global disturbances of cerebral functions lasting for more than 24 hours".¹ One of the most important causes of high morbidity and mortality all over the world is stroke. The diseases of cerebral blood vessels and their related infarcts and hemorrhages occur in the elderly as well as the young. The various abnormalities in lipid profile have been reported in young patients with stroke. Both hypercholesterolemia and hypertriglyceridemia appear to be important risk factors for atherosclerosis. A total of 50 subjects were selected by non-probability convenient sampling method at the tertiary care center. Out of all patients fulfilling the inclusion criteria of the age-group of 15–45 years. Dyslipidemia was seen in 32% [90% CI (22.31–43.53%)] of patients. Cortical venous thrombosis in 9 (18%) [90% CI (10.78–28.50%)] patients all of them were women. All but one was in a postpartum state. There was a single case of antiphospholipid antibody syndrome. Ten percent [90% CI (4.95–19.15%)] and 4% [90% CI (1.33–11.39%)] of patients were found to have rheumatic heart disease and systemic lupus erythematosus, respectively. One of the ischemic and hemorrhagic strokes was undiagnosed [90% CI (0.5–8.8%)]. Dyslipidemia as in elevated LDL and decreased HDL was a common finding. Dyslipidemia was found as the most common etiology for stroke in the young. Diagnostic challenges are to be expected while evaluating these patients.

Keywords: Dyslipidemia, Stroke, Young.

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INTRODUCTION

Stroke is defined by the World Health Organization as "Rapidly developing clinical signs of focal or global disturbances of cerebral functions lasting for more than 24 hours".¹ Stroke is one of the most important causes of high morbidity and mortality all over the world.

From the community-based surveys done in the West and Japan, in young people below the age of 45 years, the average annual incidence of stroke was found as 111–180/100,000 general population and 9–28/100,000. Data from major Indian hospitals show 24–35% of stroke in young of all neurological admissions.²

The diseases of cerebral blood vessels and the related infarcts and hemorrhages occur in the elderly as well as in the young. Although various studies on stroke in young included subjects from second to a fourth or fifth decade, generally, stroke in young includes subjects falling under the age-group of 15–45 years.³

The etiology may vary with different age-groups. The causes of stroke in young include vascular causes such as premature atherosclerosis and non-atherosclerotic disease like small artery disease (hypertensive), infective causes such as inflammatory and non-inflammatory. Few other causes are cardiogenic, hematological, and many other miscellaneous such as alcohol abuse and mitochondrial cytopathy.

The various abnormalities in lipid profile have been reported in young patients with stroke. Both hypercholesterolemia and hypertriglyceridemia appear to be important risk factors for atherosclerosis.⁴ The increase in cholesterol is mainly a rise in LDL cholesterol and an increase in triglycerides with a rise in VLDL. An increase in LDL cholesterol is a significant⁵ risk factor. There is increasing evidence that subpopulations of LDL that differ in lipid composition, density, and size, may have differing atherogenic potentials.⁶ Hence, small triglyceride enriched LDL appears to be a strong marker for the risk of developing premature atherosclerosis.⁶ In contrast to LDL, the role of VLDL is controversial.⁷ It is because of the relationship between increased triglyceride-rich lipoprotein and reduced HDL concentration.⁷

^{1,3}Department of Medicine, Govt Medical College, Jalgaon, Maharashtra, India

²Department of Medicine, Govt Medical College, Aurangabad, Maharashtra, India

Corresponding Author: Astha R Ganeriwal, Department of Medicine, Govt Medical College, Jalgaon, Maharashtra, India, Phone: +91 9960475854, e-mail: astha.dr@gmail.com

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Another reason is the large day-to-day variability of fasting plasma triglyceride concentration. Hence, some subpopulations of VLDL particles may have atherogenic potential LDL may have an atherogenic potential similar to that of VLDL remnants. Because of its low concentrations, very few studies have addressed this issue. Still, in a large meta-analysis, no association has been found between blood cholesterol levels and stroke mortality which was challenged by other workers.⁷

AIMS AND OBJECTIVES

The present study was undertaken to study the risk factors, clinical presentation, and radiological profile of stroke in young adults in cases of dyslipidemia.

MATERIALS AND METHODS

A hospital-based observational study was done on a total of 50 subjects who were selected by non-probability convenient sampling method at the tertiary care center. All patients fulfilling the inclusion criteria of the age-group of 15–45 years and patients with abrupt onset of focal or global neurological deficit attributable

to vascular cause and persistent for >24 hours and the exclusion criteria were included in this study. A Proforma was prepared; detailed history, clinical examination and requisite investigations available in our hospital were noted. A detailed history of all symptoms pertaining to stroke with emphasis on all the risk factors attributable to the stroke in young was noted. Investigation like hemoglobin, total white cell count, erythrocyte sedimentation rate, routine urine analysis, blood glucose, blood urea, serum creatinine, blood VDRL, serum lipid profile, chest X-ray, CT scan head, lumbar puncture for CSF analysis and electrocardiography, etc., were collected and noted. The results were analyzed to assess the etiology, risk factors, and therefore the pattern of clinical and radiological profile of stroke in young. The consent was taken from the patients or attendants, for performing the necessary investigations or procedures. The subjects evaluated, were then based on the NIHSS score and the severity of stroke was decided with its impact on the brain:

NIHS score	Stroke severity	Impacted brain density
0	No stroke	↓
0–4	Minor stroke	
5–15	Moderate stroke	
16–20	Mod to severe stroke	
21–42	Severe stroke	

Statistical Methods

Chi-square test, Fisher's exact test, and 90% confidence interval had been used to find the significant association of clinical factors with the ventilation support requirement. The statistical software used is SPSS 15.0.

OBSERVATIONS AND RESULTS

A total of 50 patients, 29 (59%) males and 21 (42%) females diagnosed to have stroke were included in the study. The mean age of the study group was 31.92 ± 8.59 years and that of male and female patients was 33.65 ± 7.63 and 29.67 ± 9.51 years, respectively. The majority of strokes occurred between the ages of 36 years and 40 years in males where as in females it was in the ages between 21 years and 25 years.

Patients had several clinical features in our study. Fourteen percent [90% CI (7.77–23.92%)] of the study population presented with seizures. Decrease in consciousness was seen in 60% [90% CI (48.38–70.60%)] of patients. Thirty-four percent [90% CI (24.06–45.59%)] of patients had speech abnormalities. The most common cranial nerve affected was the facial nerve in 56% [90% CI (44.40–66.94%)], 6% [90% CI (2.42–14.09%)] of the patients had the oculomotor nerve affected, and 2% [90% CI (0.5–8.48%)] of the study group had other cranial nerve palsies. Motor deficit was seen in all the patients. Hemiparesis, hemiplegia, and monoparesis were seen in 86% [90% CI (76.08–92.23%)], 12% [90% CI (6.33–21.57%)], and 2% [90% CI (0.5–8.48%)] of the study group, respectively. Hemisensory loss was seen in 14% [90% CI (7.77–23.92%)] of the study group. Only 2% [90% CI (0.5–8.48%)] of the patients had cerebellar deficit (Tables 1 and 2).

Dyslipidemia was also investigated LDL and HDL were abnormal in 60% [90% CI (48.38–70.60%)] and 72% [90% CI (60.64–81.11%)] of patients, respectively. 61.5% of ischemic strokes and 54.5% of hemorrhagic strokes had abnormal LDL ($p = 0.736$) whereas 74.4%

of ischemic strokes and 63.6% of hemorrhage strokes had abnormal HDL ($p = 0.476$) (Figs 1, 2 and Tables 3 and 4).

Etiologies were varied, dyslipidemia was seen in 32% [90% CI (22.31–43.53%)] of patients. Cortical venous thrombosis in 9 (18%) [90% CI (10.78–28.50%)] patients all of them were women. All but one was in a postpartum state. There was a single case of antiphospholipid antibody syndrome. Rheumatic heart disease and systemic lupus erythematosus were seen in 10% [90% CI (4.95–19.15%)] and 4% [90% CI (1.33–11.39%)] of patients, respectively. One of the ischemic and hemorrhagic strokes was undiagnosed [90% CI (0.5–8.8%)] (Table 5).

DISCUSSION

This study was based in the Marathwada region, comprising mainly of a mixed population. The purpose of the study is to provide an insight into the diagnosis, management, and prognosis of young stroke patients in similar areas. A total of 50 consecutive patients diagnosed with stroke who satisfied the inclusion criteria were selected for the study. The mean age of all the patients in our study was found as 31.92 years, the findings were corroborated by a similar study in north India done by Mehndiratta et al.² that had a similar mean age of 31.97 years. The mean ages of males and females were 30.66 years and 33.28 years,² respectively. Our study had a significantly higher mean age-group among men. Sex ratio in our study was found as 1.3:1 (male:female). The mean age in our study population was 31.92 ± 8.59 years. Male and female patients were 33.65 ± 7.63 and 29.67 ± 9.51 years, respectively. The majority of strokes occurred between the ages of 36 years and 40 years in a male whereas in females it was in the ages between 21 years and 25 years. Out of 50 patients, 14% of the study population presented with seizures. Decrease in consciousness was seen in 60% of the patients. Thirty-four percent of the patients had speech abnormalities. The most common cranial nerve affected was the facial nerve at 56% of the study population. Motor deficit was seen in all 100% of the study population. Hemisensory loss was seen in 14% of the study group. Only 2% of the study patients had cerebellar deficit. Dyslipidemia and hypertension had emerged as the main etiological factor responsible for stroke in 32% of the patients in our study. Transient ischemic attacks and previous family history of stroke were both seen in 2% of the study patients. 2.6% of ischemic strokes also had the same; none of the hemorrhagic strokes. Whereas a study done by Mehndiratta et al.² showed incidence of TIA 7.87%. LDL and HDL were abnormal in 60% and 72% of patients, respectively. Ischemic strokes had abnormal LDL and HDL in 61.5% and 74.4% of the patients, respectively. Among hemorrhagic strokes, LDL and HDL were seen to be abnormal in 54.5% and 63.6% of patients, respectively. Dyslipidemia had emerged as the main responsible factor for 32% of the patients in our study. Atherosclerosis was considered based on the criteria similar to Adams et al.⁸ when the patient had two or more risk factors for atherosclerosis in the absence of identifiable causes (Table 4).

Triglyceride concentrations determine the composition, size, and density of LDL.⁴ Hence, hypertriglyceridemia would be a risk factor for atherosclerosis, even though it is not directly related to lesion formation. In contrast to atherogenic apo-B lipoprotein, the apo-A containing lipoprotein or HDL appears to have an antiatherogenic potential. Low HDL cholesterol levels are commonly associated with other lipid and apolipoprotein abnormalities causing the stroke.⁴ Probable mechanisms for the antiatherogenic nature of HDL are: A vehicle for the reverse

Table 1: Age and sex distribution

Age in years	Female		Male		Combined	
	No.	%	No.	%	No.	%
16–20	4	19.0	1	3.4	5	10.0
21–25	6	28.6	5	17.2	11	22.0
26–30	3	14.3	6	20.7	9	18.0
31–35	2	9.5	3	10.3	5	10.0
36–40	2	9.5	10	34.5	12	24.0
41–45	4	19.0	4	13.8	8	16.0
Total	21	100.0	29	100.0	50	100.0
Mean	29.67	9.51	33.65	7.63	31.92	8.59

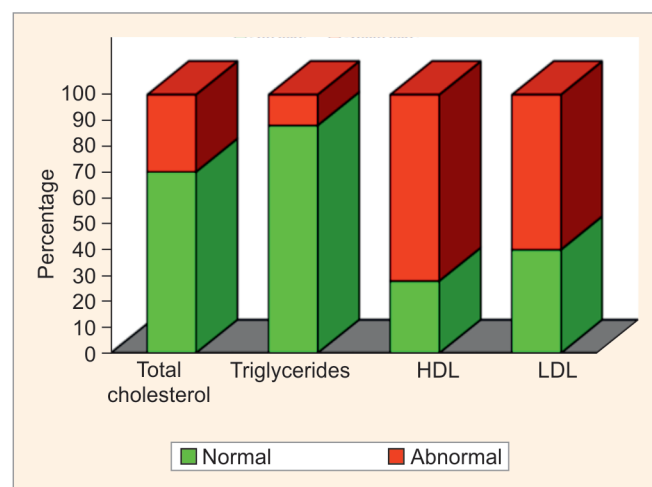
Table 2: Clinical features of stroke

Clinical features	Number	%	90% CI
Seizures			
Absent	43	86.0	76.08–92.23
Present	7	14.0	7.77–23.92
Consciousness			
Normal	20	40.0	29.40–51.62
Decreased	30	60.0	48.38–70.60
Speech			
Normal	18	36.0	25.82–47.62
Dysphasia	17	34.0	24.06–45.59
Could not	15	30.0	20.59–41.46
Cranial Nerve deficit			
Normal	18	36.0	25.82–47.62
Oculomotor	3	6.0	2.42–14.09
Facial	28	56.0	44.40–66.94
Multiple	1	2.0	0.5–8.48
Motor deficit			
Hemiparesis	43	86.0	76.08–92.23
Hemiplegia	6	12.0	6.33–21.57
Monoparesis	1	2.0	0.5–8.48
Sensory deficit			
Normal	43	86.0	76.08–92.23
Hemisensory loss	7	14.0	7.77–23.92
Cerebellar deficit			
Absent	49	98.0	91.52–99.55
Present	1	2.0	0.5–8.48

transport of cholesterol in the body. Ability to remove cholesterol directly from foam cells in lesions. Ability to protect LDL from oxidative modification. Its role in the metabolism of eicosanoids.⁵ Lipoprotein (A) detected first in 1983 has an LDL-like structure, in which, apolipoprotein (A) is covalently linked to apolipoprotein (B). It inhibits plasminogen from binding to receptors in endothelial cells and thus facilitates thrombogenesis. Increased lipoprotein (A) levels have been identified as an independent risk factor for stroke in young.⁹ Their levels are under genetic control and are not significantly correlated with age, sex, blood pressure, or size of lipoprotein particles. However, they tend to increase in diabetic patients. Various proposed effects of dyslipidemia on atherogenesis are: endothelial damage, induction of endothelial gene expression by mildly oxidized lipoproteins, increased susceptibility to oxidation

Table 3: Lipid profile associated with stroke

	Number	%	90% CI
Total cholesterol (<200)			
Normal	35	70.0	58.54–79.41
Abnormal	15	30.0	20.59–41.46
Triglycerides (<150)			
Normal	44	88.0	78.43–93.67
Abnormal	6	12.0	6.33–21.57
HDL (M < 35; F < 38)			
Normal	14	28.0	18.89–39.36
Abnormal	36	72.0	60.64–81.11
LDL (<100)			
Normal	20	40.0	29.40–51.62
Abnormal	30	60.0	48.38–70.60

**Fig. 1:** Lipid profile associated with stroke patients

of small dense lipoproteins, lipid accumulation, and procoagulant effects. Reduced cholesterol efflux from cells in the presence of low HDL. Cortical venous thrombosis was seen in 18% of patients all of whom were women. There was a single case of antiphospholipid antibody syndrome. Rheumatic heart disease and systemic lupus erythematosus were seen in 10 and 4% of patients, respectively. CT scan showed 60% of patients having arterial infarction. Cortical venous thrombosis was seen in 18% of patients and intracerebral hemorrhage was seen in 22%. Evaluations of various risk factors

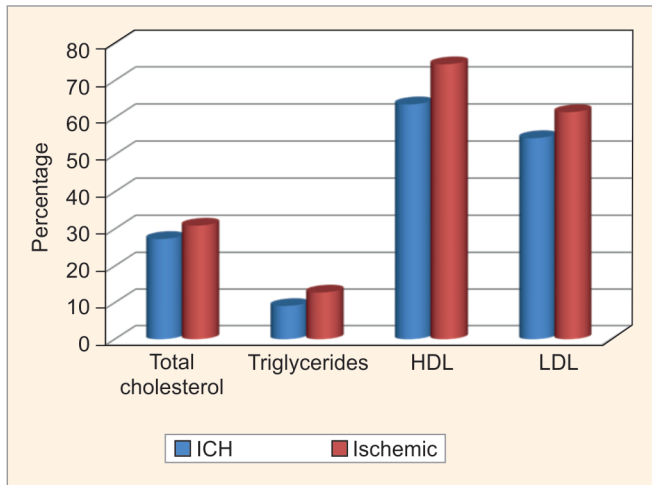


Fig. 2: Lipid profile associated with the type of stroke

Table 4: Lipid profile associated with the type of stroke

Lipid profile	Type of stroke		p value
	Hemorrhagic	Ischemic	
Total cholesterol (<200)			
Normal	8 (72.7%)	27	0.800
Abnormal	3 (27.3%)	(69.2%)	
Triglycerides (<150)	10 (90.9%)	34	
HDL (M < 35; F < 38)			
Normal	4 (36.4%)	10	
LDL (<100)			
Normal	5 (45.5%)	15	

Table 5: Etiology

Etiology	Number	%	90% CI
1. Dyslipidemia	16	32.0	22.31–43.53
2. Hypertension	16	32.0	22.31–43.53
3. CVT	9	18.0	10.78–28.50
4. RHD	5	10.0	4.95–19.15
5. SLE	2	4.0	1.33–11.39
6. Bleed–undetermined	1	2.0	0.5–8.8
7. Infarct–undetermined	1	2.0	0.5–8.8

of stroke in young are important as they may play a major role in predisposing an individual to a disease that has a terrible impact on the family and society. 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.

CONCLUSION

This was one of the few studies done about strokes in young in mixed populations in our country. The majority of the age distribution of stroke during this study was in the range of 36–40

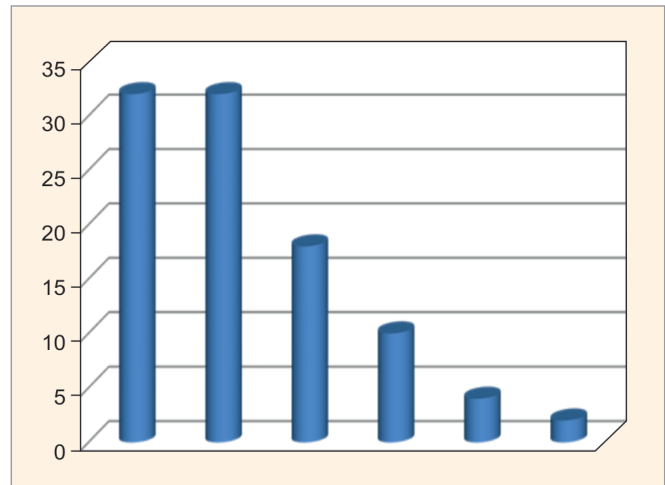


Fig. 3: Etiology

years in males, but it was lower in females at 21–25 years. The clinical picture in the form of decrease in consciousness and motor deficit were outstanding. Smoking and alcohol consumption were non-heritable risk factors for stroke among young. Dyslipidemia in the form of elevated LDL and decreased HDL was also commonly seen. Dyslipidemia emerged as the most common etiology for stroke in young in our study. A diagnosis of cortical venous thrombosis should be kept in mind in young females. Diagnostic challenges are to be expected while evaluating these patients.

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