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# Study of underlying risk factors for stroke in young.

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## Abstract

**Stroke is one of the leading causes of death and disability throughout the world. Unlike developed countries, in India about substantial proportion of all stroke cases occur in young. In our study, we assessed some physio-chemical parameters like blood pressure (both systolic and diastolic), lipid profile (total cholesterol: High Density Lipoprotein- cholesterol ratio) and Body Mass Index (BMI) in 36 stroke patients of 27-49 years of age and 20 age-sex matched healthy control. We found a significant association between the incidence of stroke in young and high blood pressure (both systolic and diastolic), high fasting blood sugar and dyslipidemia ($p<0.05$ in each case). No significant association could be found between stroke incidence and high BMI among the young ($p>0.05$). Our study concludes that, stroke in young is closely associated with underlying risk factors like high blood pressure, high fasting blood sugar and dyslipidemia, modification of which may curtail the risk of stroke among the said population.**

**Key words:** stroke in young, BMI, dyslipidemia, hypertension fasting blood sugar.

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## Introduction

Stroke signifies a rapidly developed cerebral dysfunction arising out of vascular abnormalities like stenosis, occlusion or rupture of feeding arteries of different regions of brain. Stroke may arise in different clinical situations with different etiologies, epidemiological background and prognosis. Whatever may be the exact situation, stoke as a whole contribute substantially to death and disability world wide. In India, prevalence rate of stroke is 1.54 with a death rate of 0.6 per 1000 population [1]. Though, stroke can occur at any age, incidence rate rises steeply with age. However, proportion of stroke in young (below 45 years) is significantly more in India than in any developed country. This may be attributed to high prevalence of rheumatic heart diseases, ischemic stroke in peripartum period, arteriopathies in different CNS infections like tubercular meningitis etc. in this country [1].

Stroke in young patients merits an extensive diagnostic work-up because of its wide array of etiology. Different authors concluded differently regarding the etiological background of stroke in young. Jones et al found trauma and migraine to be the most commonly identified predisposing factor where as Martin et al opined that extra cranial arterial dissection, cardio embolism, premature atherosclerosis, hematological and immunological disorders are the principal causes of stroke in young [2, 3]. Conventional risk parameters for stroke in elderly age group, like atherothrombosis, hypertension, hyperlipidemia, diabetes have debated role in young stroke cases. In many studies they have been shown to have insignificant role in causation of stroke in young [2, 4].

In our present study we assessed some modifiable physio-chemical parameters like blood pressure, blood sugar, lipid profile and Body Mass Index (BMI) in young stroke patients and compared them with that of healthy community controls and thereby verified their likely association with pathogenesis of stroke in young.

## Material and Method

Study was conducted on 36 patients of stroke (diagnosed clinically and by radiological imaging) in an age group of 27-49 years admitted to the Department of Medicine in the Medical College and Hospital, Kolkata and 20 age sex matched healthy control from the community without having any kind of neurodeficit or symptoms or history of coronary artery diseases. All the tests were done with due permission from the Institutional Ethical Committee and informed consent from the legal relatives of the subjects.

After taking detailed history, physical examination was done. Physical parameters noted for the study were blood pressure (both systolic and diastolic), BMI (weight in kg/ height in meter$^2$). Blood samples (after 12 hours of fasting) were collected from the subjects for the evaluation of

blood sugar, total cholesterol and HDL - cholesterol along with their ratio. All the blood parameters were measured in the clinical laboratory of Medical College and Hospital, Kolkata by standard techniques.
Normal reference range of different study parameters used for comparison was as follows: blood pressure: 130/85 mm of Hg, fasting blood sugar: <120 mg/dl, BMI: 18.5- 24.99, Total cholesterol: HDL- cholesterol ratio< 3.5 [1].

Data collected were stored for statistical analysis. All calculations were done in Microsoft Excel software. Existence of association between the study parameters and the incidence of stroke were assessed by Chi-square test ($X^2$ test). P value <0.05 was considered to be significant at appropriate degree of freedom (df).

## Results

Among 36 patients of stroke 12 were female and 24 were male. They were in an age range of 27- 49 years. Among 20 controls 7 were female and 13 were male. They were in the same age range and from comparable socio economic background having same type of dietary habit.

Parameters under study (blood pressure, fasting blood sugar, BMI, Total cholesterol: HDL - cholesterol ratio) showed following results in stroke and the control group:

***Table1. Distribution of high and normal systolic blood pressure in study and control group.***

| Level of systolic blood pressure | Number of subjects in Stroke group | Number of subjects in control group | p-value (by $X^2$ test) |
|---|---|---|---|
| 130 mm of Hg or above | 32 | 6 | < 0.05 (df =1) |
| <130mm of Hg | 4 | 14 | |

***Table2. Distribution of high and normal diastolic blood pressure in study and control group***

| Level of diastolic blood pressure | Number of subjects in Stroke group | Number of subjects in control group | p-value (by $X^2$ test) |
|---|---|---|---|
| 85 mm of Hg or above | 20 | 4 | < 0.05 (df =1) |
| <85 mm of Hg | 12 | 16 | |

***Table 3. Distribution of high and normal fasting blood sugar in study and control group.***

| Level of fasting blood sugar | Number of subjects in Stroke group | Number of subjects in control group | p-value (by $X^2$ test) |
|---|---|---|---|
| 120 mg/dl or above | 18 | 2 | < 0.05 (df =1) |
| <120 mg/dl | 18 | 18 | |

***Table 4. Distribution of high and normal BMI in study and control group.***

| Value of BMI | Number of subjects in Stroke group | Number of subjects in control group | p-value (by $X^2$ test) |
|---|---|---|---|
| 24.99 or above | 12 | 5 | >0.05 (df =1) |
| <24.99 | 24 | 15 | |

***Table 5. Distribution of high and normal total cholesterol: HDL- cholesterol ratio in study and control group.***

| Value of Total cholesterol: HDL- cholesterol ratio | Number of subjects in Stroke group | Number of subjects in control group | p-value (by $X^2$ test) |
|---|---|---|---|
| 3.5 or above | 23 | 3 | < 0.05 (df =1) |
| <3.5 | 13 | 17 | |

***Fasting blood sugar***

Mean fasting blood sugar in stroke and control group were estimated to be 139 ± 41 and 99.7 ± 10.5 mg/dl respectively.

***BMI***

Mean BMI in stroke and control group were found to be 23.75± 3.5 and 23.15 ± 2 respectively.

***Total cholesterol: HDL- cholesterol ratio***

Mean Total cholesterol: HDL- cholesterol ratio**s** in stroke and control group were measured to be 4.93 ± 1.9 and 2.8 ± 0.73 respectively.

## Discussion

Unlike stroke in general, stroke in young has often been related to rare but identifiable and treatable disorders than to atherothrombosis and hypertension [2]. During past few decades, with the advent of newer diagnostic techniques, several unconventional causes of stroke in young have been emphasized among which arterial dissection, prothrombotic state associated with lupus anticoagulant, embolism related to mitral valve prolapse and occult cardiac disorders have drawn much attention [5]. But even after extensive evaluation, underlying causes remain obscure in almost 30% of all stroke cases [6]. Recently main focus of stroke control has been shifted on its primary prevention [1]. Primary prevention on the other hand is based on eliminating the modifiable risk factors which have strong association with the disease causation.

In our study we found a significant association between high blood pressure (both systolic and diastolic) and occurrence of stroke in young. Hypertension is an independent predisposing factor for heart failure, coronary artery disease, stroke, renal disease and peripheral arterial diseases (PAD) [6]. It has been estimated that even a small reduction in average blood pressure of the whole population by mere 2-3 mm of Hg would produce a large reduction in the incidence of cardiovascular complications [1]. In spite of such a great risk liability, hypertension is a grossly under reported factor for cardio vascular mortality. Moreover, hypertension is often considered to be a problem in elderly as blood pressure rises with age in both sexes. But it is also a fact that, the rise is greater in those with higher initial blood pressure [1]. Therefore, it is becoming important to track the at risk young adults who are potential candidates for developing hypertensive emergencies at future date. Association between hypertension and stroke in young has also been found in some of the previous studies [7, 8]. Chopra JS et al on the other hand, had a different opinion in this regard [9]. As per their finding, diabetes mellitus and hypertension contribute very little to the stroke in younger population. However, it is observed that even mild hypertension may accelerate the atherosclerotic process which may be the underlying pathology of different systemic disorders including stroke [1]. Moreover, hypertension is an established precondition for intracerebral hemorrhage which is another leading cause of stroke. It accounts for ~10% of all strokes and is associated with a 50% case fatality rate [6]. Therefore, our study emphasizes the likely role of hypertension in the pathogenesis of stroke even in younger population, control of which may curtail the future risk of cerebrovascular accident in young population.

Previously considered as a disease of the middle aged and elderly, Diabetes mellitus (mainly type II) has recently involved all age groups including younger age groups and adolescents. Malnutrition related diabetes affects large number of young people. Moreover, prognosis is worse in young diabetics who tend to develop complications earlier than elderly. Chronic hyperglycemia plays a causative role in the pathogenesis of different macro and micro vascular complications. It has been shown that strict glycemic control can cause 42–57% reduction in cardiovascular events (nonfatal myocardial infarction, stroke, or death from other cardiovascular events) [6]. But whether tight control of blood sugar in patients with diabetes lowers the risk of stroke as such is uncertain [2, 6]. In our study a significant association between high fasting blood sugar and incidence of stroke in young was found. Hyperglycemia as a part of metabolic syndrome has also been correlated with incidence of stroke in young by Lipska K et al. and Marwat MA et al [8, 10]. So, it appears that, screening for high fasting blood sugar and its tight regulation may protect the young population from cardio vascular accidents.

Though the relationship between abnormal lipid profile (High Total cholesterol and low HDL– cholesterol etc.) and coronary atherosclerosis is an established fact [1], consistent reports about the relation between dyslipidemia and stroke in young are grossly lacking. A limited number of the previous studies addressed this topic but ended in conflicting reports. Low cholesterol was the only serum lipid index associated with an increased risk of ischemic stroke among 94 consecutive patients less than 45 years admitted to a tertiary care facility in Toulouse, France, when compared with 111 controls of the same age [11]. Higher prevalence of lower HDL- cholesterol was also found in young stroke cases by Lipska K et al when compared with community controls. In our study we found a significantly higher prevalence of dyslipidemia (reflected by total cholesterol: HDL- cholesterol ratio) among the young stroke cases than their age- sex matched healthy counterparts. This finding is consistent with that of Sridharan R et al [12]. Elevated LDL- cholesterol and Low HDL-cholesterol levels were found to increase the risk of ischemic stroke by Tziomalos et al but the importance of high triglyceride levels was less clear in their studies [13]. Variations in all such reports may be due to less defined criteria for dyslipidemia. To overcome this we took total cholesterol: HDL- cholesterol ratio as the predictor of dyslipidemia which is a recommended parameter in CHD prevention program [1]. Therefore, search for dyslipidemia and its prompt management can be a major step in controlling stroke in young. Several trials have confirmed that lipid lowering drugs (statin) can reduce the risk of stroke even in patients without elevated LDL- cholesterol or low HDL- cholesterol, it can also reduce the risk of further attack in patients with recent stroke [6].

Obesity is perhaps the most prevalent form of malnutrition. It is one of the most important contributors of ill health. It may predispose an individual to a number of comorbidity like hypertension, glucose intolerance, hyperlipidemia and long term complications like coronary heart diseases, diabetes, renal failure etc. Though obesity is mainly a problem of elderly, it may occur at any age. Again, infants with excessive weight gain have an increased incidence of obesity in later life [1]. Therefore, it's becoming a growing need to screen out the overweight subjects at an early date to avoid future adversities.

Data on the association between obesity and stroke in young are still limited and often controversial. In a population-based prospective study over 28 years, increased BMI in mid-life was found to be associated with an increased risk for ischemic and unspecified stroke, but not with hemorrhagic stroke. The result supports the role of mid-life BMI as a risk factor for stroke in later life and suggests a differentiated effect on stroke subtypes [14]. High BMI has been found to be a risk factor for both ischemic and hemorrhagic stroke in people of 40 to 64 years by another prospective study by Song YM et al [15]. However, in our present case-control study we did not find any significant association between high BMI and incidence of stroke in young. It may be due to the fact that adverse effects of obesity are more likely to manifest at a later date though it has its route in the early ages. Furthermore, the yard stick that we took to asses obesity (BMI= wt in kg/ height in meter$^2$) is not an ideal one. BMI can not distinguish between weight associated with muscle and weight associated with fat. As a result, the relation ship between BMI and body fat content varies according to body built and proportion. So, a given BMI may not correspond to the degree of fatness [1]. A previous study on the other hand highlighted the importance of long-term weight stabilization. They showed that young adults who maintained stable BMI over long time had minimal progression of risk factors and lower incidence of metabolic syndrome regardless of baseline BMI [16]. Therefore, our study finding underestimates the importance of single instance BMI checking for screening of young adults predisposed to stroke. Other more accurate techniques like measurement of total body water, total body potassium, body density should be considered for assessment of the obesity [1]. If at all BMI is used as a parameter of obesity, it should be checked on repeated occasion to asses the long term weight stabilization.

## Conclusion

Our study concludes that, stroke in young is closely associated with underlying risk factors like high blood pressure, high fasting blood sugar and dyslipidemia, modification of which may curtail the risk of stroke among the said population. So, it's not only the older population but also the young that should be targeted for primary prevention of stroke by correcting the physio- chemical parameters like high blood pressure, high fasting blood sugar, and dyslipidemia. But the exact role and extent of association between each of the study parameters and incidence of stroke in young merit a series of prospective cohort studies in different geographic areas.

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