Original Research Article

A study on metabolic syndrome in young ischemic stroke in Ariyalur district

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Abstract

Introduction: Stroke is the leading cause of adult disability and is the second commonest cause of death worldwide. More than two-thirds of the global burden of stroke is borne by developing countries, where the average age of patients with stroke is 15 years younger than in developed countries. The term metabolic syndrome refers to a cluster of metabolic abnormalities related to a state of insulin resistance. The characteristics include insulin resistance, abdominal obesity, elevated blood pressure (BP), triglycerides (TG), and low levels of High-density lipoprotein (HDL).

Aim of the study: To assess the association between the metabolic syndrome and its components-fasting blood sugar (FBS), blood pressure (BP), HDL cholesterol (HDL-C), triglyceride (TG), and waist circumference (WC) and the first ischemic (non-embolic) stroke in young adults below 45 years. **Materials and methods:** This study was conducted in the Government headquarters hospital, Ariyalur from 2018 to 1019. Subjects aged less than 45 years were presented with first acute ischemic stroke-CT or/and MRI brain was taken for confirmation of ischemic stroke. Data collection was done by using a structured proforma. BP, fasting blood sugar, fasting lipids were taken approximately a week or later after stroke onset, as elevations in BP, blood sugar, and lipids are well documented during the acute phase of stroke waist circumference was measured at the highest point of the iliac crest at the end of normal expiration.

Results: Characteristics of the study population: Stroke patients had a high level of fasting blood sugar, BP, total cholesterol, triglycerides, and increased waist circumference compared to the control group. Stroke was common in males.73% of stroke patients were males. Stroke was more prevalent in

the 40-45 yrs age group. 53% of stroke patients were in the age group of 41-45yrs. 60% of stroke patients had metabolic syndrome and 10% of the control group had metabolic syndrome.

Conclusion: Metabolic syndrome and its components (high FBS and low HDL-C) were associated with increased risk for ischemic stroke in young adults. Smoking is an independent risk factor for ischemic stroke. Metabolic Syndrome was more prevalent in stroke patients. 60% of stroke patients had metabolic syndrome; 10% in the control group. 5. High FBS was associated with 4 fold stroke risk (4 odds, p 0.01) compared to the control group. 6. Low HDL-C was associated with 2 fold stroke risk (2 odds, p 0.03) compared to the control group. Metabolic Syndrome was associated with 9.6 fold stroke risk (9.6 odds, p 0.01) compared to the control group. Smoking was associated with 8 fold stroke risk (8 odds, p 0.02) compared to the control group.

Key words

Metabolic syndrome, Young ischemic stroke, Waist circumference, Dyslipidemia.

Introduction

Stroke is the leading cause of adult disability and is the second commonest cause of death worldwide. More than two-thirds of the global burden of stroke is borne by developing countries, where the average age of patients with stroke is 15 years younger than in developed countries [1]. The available data indicate that stroke occurring in young people is more often atherothrombotic in origin in developing countries, in contrast to the developed countries where arterial dissection and cardioembolic etiologies predominate [2]. Ischemic stroke occurring in young Indians may be a manifestation of accelerated cerebrovascular atherosclerosis, paralleling the early age of onset of cerebrovascular diseases noted for this population. Additionally based on prior data on the increased propensity for insulin resistance among South Asians, ischemic stroke in young adults in India may be associated with metabolic syndrome [3]. The term metabolic syndrome refers to a cluster of metabolic abnormalities related to a state of insulin resistance. The characteristics include insulin resistance, abdominal obesity, elevated blood pressure (BP), triglycerides (TG), and low levels of High-density lipoprotein (HDL). To assess the association between the metabolic syndrome (according to NCEP ATP III criteria) and the acute ischemic non-embolic stroke a case-control study was conducted, comparing 60 cases aged less than 45 years with a first ischemic (non-embolic) stroke with 30 controls of the same age group without prior history of stroke and heart disease [4]. Metabolic syndrome was diagnosed by using NCEP ATP III criteria except for waist circumference. The cutoff point for abnormal waist circumference according to NCEP ATP III criteria is $\geq$102 cm for males and $\geq$82 cm for females. This may be fit for the western population but it is very high for Indians. So the cutoff point for abnormal waist circumference was taken as per the new International Diabetes Federation (IDF) criteria where ethnic-specific values were given. The cutoff point for South Asians as per the IDF criteria is >90 cm for males and >80 cm for females [5, 6].

Materials and methods

This study was conducted in the Government headquarters hospital, Ariyalur from 2018 to 1019. Subjects aged less than 45 years. Presented with first acute ischemic stroke-CT or/and MRI brain was taken for confirmation of ischemic stroke. Data collection was done by using a structured proforma. BP, fasting blood sugar, fasting lipids were taken approximately a week or later after stroke onset, as elevations in BP, blood sugar, and lipids are well documented during the acute phase of stroke waist circumference was measured at the highest point of the iliac crest at the end of normal expiration. 60 patients aged less than 45 years hospitalized with a history of first ischemic stroke were included.

Inclusion criteria: Subjects aged less than 45 years, Presented with first acute ischemic stroke-CT or/ and MRI brain was taken for confirmation of ischemic stroke.

Exclusion criteria: Prior history of Stroke Hemorrhagic stroke, Presentation to the hospital more than 6 months after the stroke onset. Embolic stroke – complete cardiac evaluation & carotid Doppler was done to rule out embolic stroke, Stroke due to intracranial sinus thrombosis.

30 subjects from a community-based sample of individuals aged less than 45 years without prior history of stroke and heart disease were included. Data collection was done by using a structured proforma. BP, fasting blood sugar, fasting lipids were taken approximately a week or later after stroke onset, as elevations in BP, blood sugar, and lipids were well documented during the acute phase of stroke. Waist circumference was measured at the highest point of the iliac crest at the end of normal expiration.

Statistical analysis

Characteristics of the study population were assessed and the values were expressed as mean ± standard deviation except for age, sex and smoking. Prevalence of the individual risk factors and the metabolic syndrome in both groups were compared. The association between the metabolic syndrome and its components and stroke was determined by the logistic regression analysis. The odds ratio and their 95% confidence intervals were assessed. Significance was defined as value <0.05 in all cases.

Results

Stroke patients had a high level of fasting blood sugar, BP, total cholesterol, triglycerides, and increased waist circumference compared to the control group. Stroke was common in males.73% of stroke patients were males. Stroke was more prevalent in the 40-45 years age group. 53% of stroke patients were in the age group of 41-45 years. 60% of stroke patients had metabolic syndrome and 10% of the control group had metabolic syndrome (**Table – 1**).

Table – 1: Characteristic features of study population.

Characteristic feature		**Cases (n = 60)**	**Control (n = 30)**	**P value**
Gender	Male	44 (73.30%)	24 (80.00%)	
	Female	16 (26.70%)	06 (20.00%)	
Age group (Years)	30-35	05 (08.30%)	01 (03.30%)	
	36-40	23 (38.30%)	11 (36.70%)	
	41-45	32 (53.30%)	18 (60.00%)	
Smoking		33 (55.00%)	08 (26.7%)	<0.01
FBS		115.73±28.11	90.73±18.30	<0.01
Systolic BP		127.00±16.19	116.00±11.92	<0.01
Diastolic BP		81.58±08.90	78.17±08.90	0.07
HDL		42.62±08.44	46.63±09.12	0.04
Total cholesterol		196.80±59.35	164.90±40.78	0.01
Triglycerides		156.70±53.09	132.60±39.85	0.03
W.C		82.53±11.43	80.40±20.27	0.53

55% of stroke patients were smokers (P value 0.01) as per **Table – 2**.

65% of stroke patients had high blood sugar. 20% of control groups had high blood sugar (P-value <0.001) as per **Table – 3**.

46.7% of stroke patients had high BP.16.7% of the control group had high BP.P-value 0.005 (**Table – 4**).

Table – 2: Prevalence of smoking.

Smoking	Cases	Controls	Total
Smokers	33	08	41
Non-smokers	27	22	49
Total	60	30	90

Table – 3: Prevalence of high blood sugar (FBS≥100 mg/dl or diabetic on treatment).

Blood sugar	Cases	Controls	Total
High blood sugar	39	06	45
Normal blood sugar	21	24	45
Total	60	30	90

Table – 4: Prevalence of high blood pressure (BP ≥130/85 mmHg or on anti-hypertensive).

Blood pressure	Cases	Controls	Total
High BP	28	05	33
Low BP	32	25	57
Total	60	30	90

Table – 5: Prevalence of low HDL-C.

HDL	Cases	Controls	Total
<40 mg/dl	20	05	25
>40 mg/dl	24	19	43
Total	44	24	68

Table – 6: Prevalence of high triglycerides (TG ≥150 mg/DL).

TG	Cases	Controls	Total
High	31	08	39
Normal	29	22	51
Total	60	30	90

Table - 7: Prevalence of increased waist circumference in males (>90 cm for South Asian males according to IDF criteria).

Waist circumference	Cases	Controls	Total
High	14	02	16
Normal	30	22	52
Total	44	24	68

45.5% of stroke patients had low HDL.20.8% of the control group had low HDL (P-value 0.04) as per **Table - 5**.

51.7% of stroke patients had high TG. 26.7% of the control group had high TG (P-value 0.02) as per **Table - 6**.

31.8% of stroke patients had increased waist circumference. 8.3% of the control group had increased waist circumference (P-value 0.03) as per **Table - 7**.

37.5% of stroke patients had increased waist circumference. 33.3% of the control group had increased waist circumference (P-value was not significant) as per **Table - 8**.

Table – 8: Prevalence of increased waist circumference in females (>80 cm for South Asian females according to IDF criteria).

Waist circumference	Cases	Controls	Total
High	06	02	08
Normal	10	04	14
Total	16	06	22

Table – 9: Prevalence of metabolic syndrome.

Metabolic syndrome	Cases	Controls	Total
Present	36	03	39
Absent	24	27	51
Total	60	30	90

60% of stroke patients had metabolic syndrome. 10% of the control group had metabolic syndrome (P-value <0.01) as per **Table – 9**.

Discussion

In this case-control study, stroke patients had higher fasting blood sugar, BP, abnormal lipid profile, and increased waist circumference compared to community controls. Stroke was more prevalent in the age group of 41-45 yrs. 53.3% of stroke patients belong to 41-45 yrs. Incidence of the stroke increases as age advances [7]. Stroke was more prevalent in males than females. 73.3% of stroke patients were males and 26.7% were females [8]. FBS was higher in the stroke group than the control group (115.73 VS 90.73, P-value <0.01). Higher FBS was associated with 4 fold stroke risk (4 odds, P-value 0.01) compared to the control group and statistically significant. Insulin resistance is the pathophysiological process underlying the clustering of vascular risk factors in metabolic syndrome. BP was higher in the stroke group than in the control group [9]. The presence of hypertension was associated with an increased risk of acute ischemic stroke. However, this association was not statistically significant because of the high rate of hypertension in the control group. It is well-documented that the prevalence of hypertension rises with advancing age. For example, in the Framingham cohort study, aged 70 to 79 almost 50% had borderline hypertension. Among metabolic syndrome components, hypertension is considered the least "metabolic. It is multifactorial in origin, with increased arterial stiffness significantly contributing to systolic hypertension in the elderly [10]. Dyslipidemia is a hallmark of Metabolic Syndrome. Stroke patients had low HDL-C, high total cholesterol (TC) to HDL-C ratio, and high triglycerides. HDL-C level was inversely related to the risk of ischemic stroke. The protective role of HDL-C was attenuated in the presence of the metabolic syndrome. In a case-control study involving 204 patients with acute ischemic stroke of all ages from Madras, South India, the authors found that while low HDL cholesterol and high total cholesterol to HDL cholesterol ratio were more frequent among patients [11]. Abdominal obesity in association with metabolic syndrome carries a high risk for stroke. Visceral fat is associated with insulin resistance than any other adipose tissue compartment. In this study stroke patients had increased WC than the control group. But association with stroke risk was not statistically significant [12]. According to NCEP-ATP III presence of three or more components is defined as metabolic syndrome. In this study, 60% of stroke patients had metabolic syndrome and it was associated with a nine-fold stroke risk which was statistically highly significant (9 Odds, P-value 0.01). Smokers were associated with an eight fold increased risk for stroke than non smokers which is statistically highly significant (8 Odds, P-value 0.02). Smoking is an independent risk factor for stroke. In this study, high fasting blood sugar, low HDL cholesterol,

smoking, and metabolic syndrome were associated with increased stroke risk which is statistically highly significant. The two case-control studies from India that included ischemic stroke in all age groups suggested that Hypertension, Diabetes mellitus, and smoking are important risk factors [13]. In the Lee T-S, et al. which compared 296 cases of incident ischemic stroke among black and white adults aged 18–44 years with 1220 community-based adults of the same age group, hypertension, diabetes mellitus, and current smoking emerged as important risk factors [14]. Leys D, where 201 patients with first onset stroke due to cerebral infarction aged 15–55 years compared with the same number of matched neighborhood control subjects showed hypertension, diabetes mellitus, current smoking, heart disease, and long term heavy alcohol consumption were major risk factors [15]. Although observational studies from Western countries have emphasized the preponderance of cardiogenic embolism, arterial dissection, procoagulant states, and non-atherosclerotic vasculopathies as possible etiologies, careful analytic comparisons have shown the importance of traditional risk factors in the pathogenesis of stroke in young adults [16, 17].

Conclusion

Prevalence of stroke increases as age advances. Stroke was more prevalent in males than females. Stroke patients had high fasting blood sugar, high BP, elevated total cholesterol, triglyceride, low HDL-C, and increased waist circumference than the control group. Metabolic Syndrome was more prevalent in stroke patients. 60% of stroke patients had metabolic syndrome; 10% in the control group. High FBS was associated with 4 fold stroke risk (4 odds, p 0.01) compared to the control group. Low HDL-C was associated with 2 fold stroke risk (2 odds, p 0.03) compared to the control group. Metabolic Syndrome was associated with 9.6 fold stroke risk (9.6 odds, p 0.01) compared to the control group. Smoking was associated with 8 fold stroke risk (8 odds, p 0.02) compared to the control group. Metabolic syndrome and its components (high FBS and low HDL-C) were associated with increased risk for ischemic stroke in young adults. Smoking is an independent risk factor for ischemic stroke.

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