RESEARCH ARTICLE

STUDY OF METABOLIC SYNDROME AND DIABETES MELLITUS AMONG ISCHEMIC STROKE PATIENTS IN A TERTIARY HOSPITAL, NORTHERN KARNATAKA

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Manuscript Info

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Abstract

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Introduction: Stroke is significant global health problem and major cause of mortality and morbidity in developed countries and increasingly in low-middle income countries. In 2016, Global Burden of Disease project estimated the number of incident cases of stroke in India to be 1,175,778 and number of deaths due to stroke to be 9.4 million. Metabolic syndrome is known as an independent risk factor of stroke.

Objectives:

1. To estimate prevalence of metabolic syndrome among Ischemic stroke patients.
2. To assess the association between metabolic syndrome and Ischemic stroke
3. To assess the association between Diabetes Mellitus type 2 and Ischemic stroke

Methods: A observational study was performed on 100 out patients and inpatients admitted in Basaveshwara Teaching and General Hospital attached to Mahadevappa Rampure Medical College Kalaburagi for a period of 1 year. A detailed history was collected from qualifying patients using a pre-designed, structured proforma. Further, general examination and a detailed systemic examination, followed by relevant investigations (FBS: A blood sample is taken after an 8 hour overnight fast., Fasting Lipid Profile) were conducted and the results were noted.

Results: Prevalence of metabolic syndrome in this study was 58 (58%) of them presented with metabolic syndrome. Higher prevalence was observed in 50-59 years age group 17 (74%) and among males 43 (64.3%). Smoking and diet were significantly associated with metabolic syndrome. Mean values of the components of metabolic syndrome were significantly higher in patients with metabolic syndrome. Prevalence of Diabetes was 73% and among them majority presented with metabolic syndrome. Diabetes Mellitus was significantly associated with stroke.

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Conclusion: In this study both metabolic syndrome and Diabetes Mellitus were significantly associated with stroke. Hence, they can be used as independent predictors for stroke.

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Introduction:-

Stroke is a significant global health problem and a major cause of mortality and morbidity in developed countries and increasingly in low-middle income countries (LMICs).[1] Stroke is the third commonest cause of death worldwide[2]. In the early 1980s the prevalence rates of stroke were around 500-700 per 100,000 in the western countries[3] and 900 per 100,000 in Asia[4]. Higher prevalence in urban compared to rural regions has been reported in South Asia.[5] Developing countries, including India are passing through a phase of epidemiological transition with increasing burden of non-communicable diseases (NCD). Among the NCDs, neurological disorders like stroke form major burden in India. In 2016, the Global Burden of Disease project estimated the number of incident cases of stroke in India to be 1,175,778 and number of death due to stroke to be 9.4 million.[6]

The Framingham Heart Study and other international prospective epidemiological studies identified the major atherogenic risk factors for stroke as hypertension, diabetes mellitus, hyperlipidemia and smoking.[7] Furthermore, metabolic syndrome (MetS) is known as an independent risk factor of CAD and stroke either.[8] Metabolic syndrome is a cluster of risk factors for atherosclerosis, including abdominal obesity, hypertension, insulin resistance, and dyslipidemia with high triglycerides and low HDL cholesterol[9].

MetS is a series of metabolic disorders including impaired glucose tolerance, central obesity, dyslipidemia, and hypertension that was first recognized with an international definition in 1998.[10] In the National Health and Nutrition Examination Survey among 10,357 subjects, the prevalence of MetS was significantly higher in persons with a self-reported history of stroke (43.5%) than in subjects with no history of vascular disease (22.8%). MetS was independently associated with stroke history in all ethnic groups and in both sexes (OR, 2.16; 95% CI, 1.48 to 3.16).[11]

Objectives:-

1. To estimate prevalence of metabolic syndrome among stroke patients.
2. To assess the association between metabolic syndrome and Ischemic stroke
3. To assess the association between Diabetes Mellitus and Ischemic stroke

Materials and Methods:-

A observational study was conducted on the in-patients and out-patients attending department of General Medicine, Basaveshwara Teaching and General Hospital which is attached to Mahadevappa Rampure Medical College, Kalaburagi for a period of 1 year.

Inclusion Criteria:

This study included the patients with fresh thrombotic strokes within the carotid territory area and undergoing routine stroke work up.

1. Diagnosed stroke patients as per WHO definition as "Rapidly developing clinical signs of focal or global neurological deficits lasting for twenty-four hours or longer or resulting in death with no apparent cause other than vascular origin".
2. Patients admitted with cerebrovascular accident confirmed to be ischemic in nature on CT scan or MRI.
3. Age:>40yrs

Exclusion Criteria:

1. Patients with cerebral haemorrhage.
2. TIA without any CT Scan features of ischemic stroke.
3. Intracranial neoplasm.
4. Cases of meningitis, neurocysticercosis or any infections.
5. Head Injury.
6. Intracranial aneurysms.

7. AV malformations.
8. Any cardiac source of embolism.
9.   H/O intake of any lipid lowering drugs.
10. Coronary artery disease patients with renal failure and patients with a previous history of stroke

Sample size:
100 (study subjects were selected arbitarily based on inclusion and exclusion criteria).

Method of collection of data :
A cross-sectional study was performed on the out patients and inpatients admitted in Basaveshwara Teaching and General Hospital attached to MahadevappaRampure Medical College Kalaburagi for a period of 1 year after Ethical committee approval. After obtaining informed consent, a detailed history wascollected from qualifying patients using a pre-designed, structured proforma. Further, general examination and a detailed systemic examination, followed by relevant investigations (FBS : A blood sample is taken after an 8 hour overnight fast, Fasting Lipid Profile) were conducted and the results were noted.

Statistical Analysis: Data collected was compiled and entered into Microsoft excel sheet and was analysed using SPSS software version 26. Quantitative data was presented in mean and standard deviation, Qualitative data was presented in frequency and percentage. For assessing association/comparison between the groups unpaired t-test and Fisher exact test (for quantitative data) and chi-square test (for qualitative data) was used, P was considered significant at <0.05.

Metabolic syndrome:
According to the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) definition, MetS is present if three or more of the following five criteria are met[9]:
1. Waist circumference (WC) > 90cm (males) or 80cm inches (females),
2. BP > 130/85 mmHg,
3. Fasting triglyceride (TG) level > 150 mg/dl,
4. Fasting HDL-C level < 40 mg/dl (males) or 50 mg/dl (females), and
5. Fasting blood sugar (FBS) > 100 mg/dl.

Waist circumference:
Waist circumference was measuredby using a measuring tape positioned midway between the lowest rib and the iliac crest[12]

Blood pressure:
For all patients, blood pressure was taken after a rest period of 15 minutes and was measured by a mercury sphygmomanometer with the patient in supine position. The final blood pressure estimate was the average of three readings. Individuals on antihypertensive medications were considered as hypertension patients regardless of blood pressure levels.[12]

Diabetes Mellitus type 2 diagnosis:
Diabetes can be diagnosed either by the hemoglobin A1C criteria or plasma glucose concentration (fasting or 2-hour plasma glucose).[13]

As per ADA, fasting plasma glucose (FPG) level of more than 126 mg/dL (7.0 mm/L) is consistent with the diagnosis.[9]

Results:-
Total number of subjects included in the study were 100. Among them, majority were males 67 (67%) and 33 (33%) were females**.** Majority of the males i.e., 19 (28.3%) and females i.e., 10 (30.3%) belonged to 60-69 years age group. Only 6% among males and females were >80 years. Overall mean age in the study was 59.58± 10.31 years, mean age among males and females was 58.58 ± 11.93 years and 61.60 ± 11.08 years respectively. There was no statistical significant difference between mean age of males and females (P>0.05) as shown in table-1.

Among total 100 stroke cases 58 (58%) of them presented with metabolic syndrome (table-2). Among the age groups of 50-59 and 70-79 years, majority of the cases i.e., 17 (74%) and 12 (60%) respectively presented with metabolic syndrome. All other age groups had equal distribution of cases. Among males, majority i.e., 43 (64.3%) presented with metabolic syndrome whereas among females, majority i.e., 18 (54.5%) showed no metabolic syndrome but this difference within the gender was not statistically significant (table-3).

Among smokers, majority i.e., 43 (64.2%) presented with metabolic syndrome whereas among non-smokers 28 (51.8%) showed no metabolic syndrome and this difference was statistically significant (P<0.05%). Among alcoholics, majority i.e., 27 (46.5%) presented with metabolic syndrome whereas among non-alcholics 26 (61.9%) showed no metabolic syndrome and this difference was statistically non-significant (P>0.05%). Among non-vegetarians' majority i.e., 34 (69.4%) presented with metabolic syndrome whereas among vegetarians, majority i.e., 27 (53%) showed no metabolic syndrome and this difference was statistically significant (P<0.05%) as shown in table-3.

Table-4 shows that mean value of all the parameters were significantly higher in stroke cases with metabolic syndrome than those without metabolic syndrome, significant association was observed between metabolic syndrome and stroke (P<0.05). Among all the parameters difference of mean values of FBS, PPBS, waist circumference and systolic BP between the groups was significant and for all other parameters the difference was highly significant (P<0.00001).

Among 100 stroke patients, 73 (73%) presented with Diabetes mellitus type 2(FBS>126). Mean value of FBS among stroke cases with metabolic syndrome was more compared to those without (158.05 ±66.50 v/s 130.10 ±67.77). Among 73 subjects who had FBS>126, majority i.e., 48 (65.8%) presented with metabolic syndrome and among 27 subjects with FBS<126, majority i.e., 17 (63%) showed no metabolic syndrome. This difference was statistically significant (P<0.05).

Table No.1:- Age and gender wise distribution of Stroke cases.

Age in years	Males		Females		Total	
	No.	%	No.	%	No.	%
40—49	17	25.4	5	15.2	22	22.0
50—59	16	23.9	7	21.2	23	23.0
60—69	19	28.3	10	30.3	29	29.0
70—79	11	16.4	9	27.3	20	20.0
≥ 80	4	6.0	2	6.0	6	6.0
Total	67	100.0	33	100.0	50	100.0
Mean ± SD	58.58 ± 11.93		61.60 ± 11.08		59.58 ± 10.31	
t-test, P-value	**t = 1.219, P = 0.226, NS**					

NS= not significant, S=significant, HS=highly significant

Table 2:- Distribution of Metabolic syndrome among Stroke cases.

Metabolic syndrome	Number	Percentage
Metabolic	58	58.0
Non-metabolic	42	42.0
Total	100	100.0

Table 3:- Comparsion between stroke cases with metabolic syndrome and without metabolic syndrome.

Variable	Number	Stroke cases		P value
		Metabolic	**Non-metabolic**	
Age				
40—49	22	11 (50.0%)	11 (50.0%)	**Fisher exact test**
50—59	23	17 (74.0%)	6 (26.0%)	**P = 0.273, NS**
60—69	29	15 (51.7%)	14 (48.3%)	
70—79	20	12 (60.0%)	8 (40.0%)	
≥ 80	6	3 (50.0%)	3 (50.0%)	

Gender				
Males	**67**	43 (64.2%)	27 (35.8%)	**χ2 = 2.528,**
Females	**33**	15 (45.5%)	18 (54.5%)	**P = 0.184, NS**
Total	**100**	58 (58.0%)	42 (42.0%)	
Habits				
Smoking	**Yes**	32 (69.6%)	14 (30.4%)	**χ2 = 5.87,**
	No	26 (48.1%)	28 (51.8%)	**P = 0.031, S**
	Total	58 (58.0%)	42 (42.0%)	
Alcohol	**Yes**	27 (46.5%)	16 (38.1%)	**χ2 = 0.710,**
	No	31 (53.5%)	26 (61.9%)	**P = 0.815, NS**
	Total	58 (58.0%)	42 (42.0%)	
Diet				
Vegetarian	**51**	24 (47.0%)	27 (53.0%)	**χ2 = 5.11,**
Non-vegetarian	**49**	34 (69.4%)	15 (30.6%)	**P = 0.019, S**
Total	**100**	58 (58.0%)	42 (42.0%)	

NS= not significant, S=significant, HS=highly significant,

Table 4:- Association of metabolic syndrome with stroke.

Paramaeters	**Stroke cases**		**t-test value and P-value**
	Metabolic	**Non-metabolic**	
	Mean ± SD	**Mean ± SD**	
Waist circumference	102.82 ± 9.69	98.23 ± 10.47	t = 2.258, P = 0.026, S
Systolic BP	158.55 ± 30.06	144.31 ± 27	t = 2.429, P = 0.017, S
Diastolic BP	90.48 ± 12.95	82.23 ± 11.57	t = 2.864, P = 0.005, HS
FBS	158.05 ± 66.50	130.10 ± 67.77	t = 2.062, P = 0.042, S
PPBS	213.83 ± 78.58	174.95 ± 80.94	t = 2.411, P = 0.018, S
HbA$_1$C	8.38 ± 2.36	7.01 ± 1.93	t = 3.075, P = 0.003, HS
HDL	38.27 ± 19.60	48.47 ± 10.55	t = -3.063, P = 0.003, HS
TGL	166.16 ± 44.79	127.05 ± 41.94	t = 4.424, P = 0.000, HS

NS= not significant, S=significant, HS=highly significant

Table 5:- Association of Diabetes with stroke.

FBS	**Number**	**Metabolic syndrome**		**t-test value and P-value**
		Metabolic	**Non-metabolic**	
		No. (%)	**No. (%)**	
< 126	**27**	10 (37.0%)	17 (63.0%)	**χ2 =6.225,**
≥ 126	**73**	48 (65.8%)	25 (34.2%)	**P = 0.017, S**
Total	**100**	58 (58.0%)	42 (42.0%)	
Mean ± SD		158.05 ±66.50	130.10 ±67.77	**t = 2.062,** **P = 0.042, S**

Discussion:-

This study was conducted among 100 ischaemic stroke patients. In this study higher prevalence of stroke was seen among males (67%) and in the 6th decade for both males and females (28.3% and 30.3%). In a study by Swapna etal.,[12] the highest prevalence of stroke was seen in males (75%) and in the 8th decade for males and 6th decade for females which was similar to this study. In this study prevalence of stroke was 58% which was more compared to a study by Swapna etal.,[12] and Albala ettal., [14] in which it was 46% and 44% respectively. In a study by Jia etal.,[15], it was 51.35% which was similar to this study. Smoking was present in 46% of the study subjects which was less compared to a study by Swapna etal.,[12] in which it was 69%.Risk factors like smoking and diet are significantly associated with stroke.

In this study, significant association was observed between metabolic syndrome and stroke (P<0.05). Mean values of all the components showed significant difference between metabolic and non-metabolic syndrome cases (P<0.05) which was similar to a study by Park etal[16] and Bang etal.,[17] This is also comparable to a study by Ashtari, etal.[18] concluded that the frequency of metabolic syndrome in stroke patients is higher than controls.

In a study done by Koren-Morag N et al[19], all components of the metabolic syndrome were associated with increased risk for ischemic stroke similar to this study. Impaired fasting glucose and hypertension were the strongest risk predictors in a study done by Koren-Morag N et al[19]whereas in this study, TGL is the strongest predictor. Hence metabolic syndrome can be considered as an independent risk factor for stroke.

In this study, among 73 subjects who had FBS>126, majority i.e., 48 (65.8%) presented with metabolic syndrome and among 27 subjects with FBS<126, majority i.e., 17 (63%) showed no metabolic syndrome. Hence it may be considered that FBS is also an independent risk for stroke. A study done by Najarian etal.,[20] concluded metabolic syndrome and Diabetes type-2 as independent risk factors for stroke similar to this study. Similarly, a study by Weiqi Chen etal[21] of reported that the patients with DM only or concurrent METS and DM were associated with an elevated risk of stroke among patients with minor ischemic stroke and TIA.

Conclusion:-
This study was conducted to find the association of metabolic syndrome and Diabetes mellitus type 2 with Ischaemic stroke. In this study it was found that prevalence of stroke was 58% and prevalence was more in males and in 6th decade. Smoking was significantly associated with stroke. Metabolic syndrome and Diabetes mellitus type-2 was significantly associated with stroke and hence they can be considered as independent risk factors for stroke.

Limitations:
This study did not include <40 years age group and haemorrhagic stroke cases.

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