

# Frequency of Metabolic Syndrome in Patients with Acute Ischemic Non-Embolic Stroke

HAFIZ ABDUL GHAFFAR NAEEM, AZFAR FAROGH\*, MUHAMMAD HASSAN\*\*

## ABSTRACT

**Aim:** To determine the frequency of metabolic syndrome in pts with ac. non-embolic ischemic stroke.

**Methods:** This study was conducted in Department of Medicine, BVH, Bahawalpur from February 2013 to August 2013. Total 288 patients of stroke with infarction on CT scan (hypodense area on CT scan) and meeting the inclusion and exclusion criteria were included in the study. Demographic data (age and gender), history of presenting illness and previous known risk factors were obtained. Physical examination was done including blood pressure and waist circumference measurement. Venous sample for HDL cholesterol, triglycerides and fasting plasma glucose were taken after 8 hour of overnight fast. CT scan/MRI was done to confirm infarction. Source of embolus ruled out by ECG, echocardiography and carotid doppler angiography.

**Results:** In this study population, 57.3% were male and 42.7% were female with mean age of 56±7 years in men and 54±7 years in females. Frequency of metabolic syndrome was 43.6% in men and 65% in women.

**Conclusion:** This study clearly shows that metabolic syndrome is an important risk factor for acute ischemic non-embolic stroke. It supports the potential for preventive efforts in persons with high risk of ischemic stroke.

**Keyword:** Metabolic syndrome, acute ischemic non-embolic stroke, Blood pressure, Obesity

---

## INTRODUCTION

Stroke is one of the top four leading causes of morbidity and mortality throughout the world<sup>1</sup>. It is an acute neurologic injury of vascular origin. A uniform definition of stroke is vital for epidemiological studies. According to World Health Organization (WHO), stroke is defined as 'rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hrs or longer, or leading to death, with no apparent cause other than that of vascular origin. This definition includes stroke due to both cerebral infarction and hemorrhage<sup>2</sup>. Thrombosis can form in the extracranial and intracranial arteries when the intima is roughened and plaque forms along the injured vessel. The endothelial injury (roughening) permits platelets to adhere and aggregate, then coagulation is activated and thrombus develops at the site of plaque. Blood flow through the extracranial and intracranial systems decreases and the collateral circulation maintains function. When the compensatory mechanisms of collateral circulation fail, perfusion is compromised, leading to decreased perfusion and cell death. During an embolic stroke, a clot travels from a distant source and lodges in cerebral vessels. Microemboli can break away from a sclerosed plaque in carotid artery

or from a cardiac source such as atrial fibrillation or a hypokinetic left ventricle<sup>3</sup>.

Pakistan is the sixth most populated country in the world, with estimated population of 167 million<sup>4</sup>. Non-communicable diseases including stroke now accounts for 41% of total disease burden of Pakistan<sup>5</sup>. In a population dense country like Pakistan, an estimated 4.8% may be suffering from stroke<sup>6</sup>; this translated to 7.2 million individuals, compared to 700,000 annually in the United States. The incidence and mortality of stroke vary greatly among different populations and has declined in several foreign studies. An estimated 94% of deaths from stroke in South Asia occur in people younger than 70 years in contrast to only 6% in countries with established economies owing to greater loss in the disability adjusted life years (DALYs)<sup>7</sup>.

## METHODOLOGY

This study was conducted in Department of Medicine, BVH, Bahawalpur from February 2013 to August 2013. Total 288 patients of stroke with infarction on CT scan (hypodense area on CT scan) and meeting the inclusion and exclusion criteria were included in the study. Inclusion criteria was: Patients of any gender and >14 years of age having acute neurological deficit with hypodense area on CT scan brain without any source of emboli on echocardiography (valvular heart disease, intra-

---

\*Assistant Professor, Medical IV, BVH, Bahawalpur

\*\*Senior Registrar, Medical IV, BVH, Bahawalpur

Correspondence to: Dr. Hafiz Abdul Ghaffar Naeem, Senior Registrar, Medical IV, BVH, Bahawalpur

cardiac thrombus and vegetations) and carotid doppler (narrowing of carotids). Patients having no established infarction on CT brain, Patients having definite source of emboli like atrial fibrillation, valvular heart disease, infective endocarditis etc, having acute myocardial infarction, having recurrent TIAs and Patients having chronic ailment like CRF, CCF, and CLD were excluded from the study. All data was entered into SPSS version 10 and analyzed. Mean and SD was calculated for numerical variables and frequencies & percentages were calculated for categorical variables.

**RESULTS**

Total 288 patients of acute ischemic stroke were included in this study. Mean age of the patients was 55.1±7.6. Metabolic syndrome was found in 52.8% patients (Fig 1). Out of 288 patients, male patients were 165(57.3%) and metabolic syndrome was found in 72(43.6%) patients. Female patients were 123(42.7%) and metabolic syndrome was found in 80(65%) female patients. Strong association was found between gender and metabolic syndrome (P <0.05). The mean triglycerides level was 150.36±17.9 mg/dl. The mean HDL level was 44.6±5.8 mg/dl . The mean fasting blood glucose level was 117.6±38.3 mg/dl.

Results of the different components of the metabolic syndrome were also shown in table 2. The most prevalent components were hypertension and low HDL, these were positive in 167 patients (57.9%) followed by diabetes and raised triglycerides level in 135 patients (46.9%).

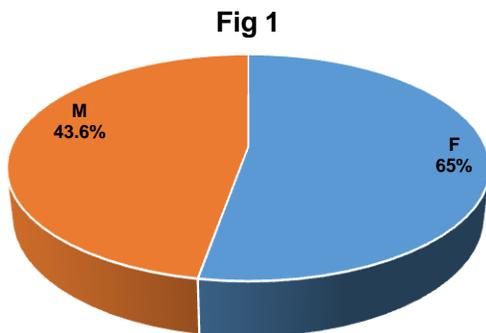


Table 1: Gender distribution

Gender	Metabolic syndrome		Total
	Yes	No	
Male	72(43.6%)	93(56.4%)	165(57.3%)
Female	80(65%)	43(35%)	123(42.7%)
Total	152(52.8%)	136(47.2%)	288(100%)

Table 2: Frequency of components of metabolic syndrome (n=288)

Variables	Male	Female	Total
Hypertension (Blood Pressure ≥ 130/85)	100	67	167(57.9%)
HDL Level ≤ 40mg/dl in males and ≤ 50mg/dl in females	65	102	167(57.9%)
Triglycerides Level ≥ 150mg/dl	93	42	135(46.9%)
Diabetes Fasting blood glucose ≥ 126mg/dl	64	51	115(39.9%)

**DISCUSSION**

The term “metabolic syndrome” consists of a constellation of metabolic abnormalities that confer increased risk of cardiovascular diseases and stroke. According to National Cholesterol Education Program (NCEP)/Adult Treatment Panel (ATP) III and International Diabetes Federation (IDF), major features of metabolic syndrome include obesity, hyper triglyceridemia, low HDL cholesterol, hyperglycemia and hypertension. Each of these factors can lead to ischemic stroke. Our study demonstrated that frequency of metabolic syndrome in acute ischemic non-embolic stroke patients was 52.8% (152 out of 288). Our observation was supported by Gorter et al who found metabolic syndrome in 40 to 50% of patients with various cerebrovascular diseases<sup>8</sup>. Metabolic syndrome was present in 56% of patients with ischemic stroke in a study conducted by Koren-Morag et al<sup>9</sup>. De Silva recorded metabolic syndrome in 61% of South Asian patients with ischemic stroke<sup>10</sup>. In Framingham offspring study, metabolic syndrome was found to be a more important risk factor for ischemic stroke as compared to diabetes mellitus<sup>11</sup>.

In our study, metabolic syndrome was found in 65% females as compared to 43.6% males. The Northern Manhattan study, which included Hispanic, African-American, and Caucasian subjects, reported an increased risk of stroke among women with metabolic syndrome compared to men<sup>12</sup>. Koren-Morag et al similarly reported that metabolic syndrome without diabetes mellitus was a significant risk factor for ischemic stroke in both sexes, but the effect was more pronounced in women<sup>9</sup>. So female sex is also a risk factor for metabolic syndrome which can lead to ischemic stroke.

Our data has shown strong association between dyslipidemia and ischemic stroke as triglyceride levels ≥150 mg /dl was present in 136 (46.9%) cases and HDL levels ≤50 mg/dl was present in 167 patients (57.9%). According to Copenhagen City Heart Study, a 47% reduction in ischemic stroke was

found for 1.0 mmol/l (39 mg/dl) rise in HDL<sup>13</sup>. Our study is also in consistence with Milionis et al, which stated that high TG levels and low HDL levels had a relationship with ischemic stroke<sup>14</sup>.

Increased waist circumference which represents abdominal obesity, has a strong association with stroke in our study as a waist circumference greater than 102 cm in men and 88 cm in female was present in 131 patients. A study by Isomma et al noticed obesity in 76% patients with normal glucose tolerance and 92% of diabetic patients with ischemic stroke<sup>15</sup>.

High blood pressure has emerged as an important component of metabolic syndrome in our patients as 167 patients (57.9%) had blood pressure  $\geq$ 130/85 mm of Hg. In one study conducted by Wang Y et al, it was concluded that frequency of hypertension was 70% among patients of ischemic stroke<sup>16</sup>. McNeill et al found high blood pressure as an important component of metabolic syndrome, which increased the risk of ischemic stroke by 1.5-2 times<sup>17</sup>.

Impaired fasting glucose and diabetes has a strong association with stroke in our study, as fasting blood sugar greater than 100 mg/dl was present in 137 (47.6%) patients. These results were supported by study conducted by Basharat et al, which concluded that the most frequent risk factor of stroke was hypertension 86.8% followed by diabetes mellitus 59.8%, dyslipidemia 59.1%, and smoking 18.1%. They also concluded that low HDL is an emerging risk factor of ischemic stroke<sup>18</sup>.

## CONCLUSION

This study clearly shows that metabolic syndrome is an important risk factor for acute ischemic non-embolic stroke. Frequency of metabolic syndrome in ischemic stroke was higher in female patients as compared to males. Hypertension and low HDL levels were more frequent components of metabolic syndrome in our study

## REFERENCES

1. Khan J, Attique-ur-Rehman, Shah AA, Jielani A. Frequency of hypertension in stroke patients presenting at Ayub Teaching Hospital. *J Ayub Med Coll Abbott.* 2006;18(1):59-61.
2. The World Health Organization MONICA Project (monitoring trends and determinants in cardiovascular disease): a major international collaboration. WHO MONICA Project Principal Investigators. *J Clin Epidemiol.* 1988; 41(2):105-14.
3. Adams HP, Adams R, Brott T, Zoppo GJ, Furlan AJ, Goldstein LB, et al. Guidelines for the early management of patients with ischemic stroke. 2003;34(4):1056-1083.
4. Alam AY, Iqbal A, Mohamud KB, Laporte RE, Ahmed A, Nishtar S, et al. Investigating socio-economic-demographic determinants of tobacco use in Rawalpindi, Pakistan. *BMC Public Health.* 2008; 8:50.
5. Nishtar S. The national action plan for the prevention and control of non-communicable diseases and health promotion in Pakistan--prelude and finale. *J Pak Med Assoc.* 2004; 5(4):S1-8.
6. Jafar TH. Blood pressure, diabetes and increased dietary salt associated with stroke-results from a community-based study in Pakistan. *J Hum Hypertens.* 2006;20(1):83-85.
7. Strong K, Mathers C, Bonita R. Preventing stroke: Saving lives around the world. *Lancet Neurol.* 2007; 6(2):182-187.
8. Gorter PM, Olijhoek JK, van-der-Graaf Y, Algra A, Rabelink TJ, Visseren FL. Prevalence of the metabolic syndrome in patients with coronary heart disease, cerebrovascular disease, peripheral arterial disease or abdominal aortic aneurysm. *Atherosclerosis.* 2004; 173(2):363-9.
9. Koren-Morag N, Goldbourt U, Tanne D. Relation between the metabolic syndrome and ischemic stroke or transient ischemic attack: a prospective cohort study in patients with atherosclerotic cardiovascular disease. *Stroke.* 2005; 36(7):1366-71.
10. De Silva DA, Woon FP, Xie XY, Li Hsian Chen C, Chang HM, Wong MC. Metabolic syndrome among ethnic South Asian patients with ischemic stroke and comparison with ethnic Chinese patients: the Singapore General Hospital experience. *J Stroke Cerebrovasc Dis.* 2007; 16(3):119-21.
11. Najarian RM, Sullivan LM, Kannel WB, Wilson PW, D'Agostino RB, Wolf PA. Metabolic syndrome compared with type 2 diabetes mellitus as a risk factor for stroke: the Framingham Offspring Study. *Arch Intern Med.* 2006; 166(1):106-11.
12. Rincon F, Sacco RL, Kranwinkel G, Xu Q, Paik MC, Boden-Albala B, Elkind MS. Incidence and risk factors of intracranial atherosclerotic stroke: the Northern Manhattan Stroke Study. *Cerebrovasc Dis.* 2009; 28(1):65-71.
13. Lindenstrøm E, Boysen G, Nyboe J. Influence of total cholesterol, high density lipoprotein cholesterol, and triglycerides on risk of cerebrovascular disease: the Copenhagen City Heart Study. *BMJ.* 1994; 309(6946):11-5.
14. Milionis HJ, Rizos E, Goudevenos J, Seferiadis K, Mikhailidis DP, Elisaf MS. Components of the metabolic syndrome and risk for first-ever acute ischemic nonembolic stroke in elderly subjects. *Stroke.* 2005; 36(7):1372-6.
15. Isomaa B, Almgren P, Tuomi T, Forsén B, Lahti K, Nissén M, et al. Cardiovascular morbidity and mortality associated with the metabolic syndrome. *Diabetes Care.* 2001;24(4):683-9.
16. Wang Y, Xu J, Zhao X, Wang D, Wang C, Liu L, et al. Association of Hypertension With Stroke Recurrence Depends on Ischemic Stroke Subtype. *Stroke.* 2013 Feb 26.
17. McNeill AM, Katz R, Girman CJ, Rosamond WD, Wagenknecht LE, Barzilay JI, et al. Metabolic syndrome and cardiovascular disease in older people: The cardiovascular health study. *J Am Geriatr Soc.* 2006; 54(9):1317-24.
18. Basharat Z, Mumtaz S, Rashid F, Rashid S, Mallam SA, Diljan A, et al. Prevalence of risk factors of ischemic stroke in a local Pakistani population. High-density lipoproteins, an emerging risk factor. *Neurosciences (Riyadh).* 2012; 17(4):357-62.