EVALUATION OF METABOLIC SYNDROME AS A RISK FACTOR FOR ACUTE CORONARY SYNDROME

Cardiology

Kurukkanparambil Sreedharan Mohanan	MD DM Additional Professor, Government medical college, Kozhikode, Kerala, India.
Sherief Sulaiman*	MD DM Government medical college, Kozhikode, Kerala, India. *Corresponding author
Poornima Karakkandy Nanu	Assistant professor, Department of pediatrics, Government TD Medical college, Alappuzha

ABSTRACT

Introduction: Metabolic Syndrome (MS) refers to co-existence of various metabolic abnormalities that predispose patients to increased cardiovascular risk. Despite the alarmingly increasing prevalence of MS in the Asian population, data on the correlation between MS and acute coronary syndromes (ACS) is limited. This study aimed to find the association between MS and ACS.

Methods: A case-control study was performed including fifty Consecutive patients of age 35 to 65 years admitted with ACS at a tertiary health care centre in South India. The control group included 50 age and sex matched individuals hospitalized with non-cardiac illness during the study period. Metabolic syndrome was diagnosed based on the International Diabetes Federation (IDF) criteria. MS was diagnosed when waist circumference was >90 cm in males and >80 cm in females plus any two of the following factors (i) Systolic blood pressure >130 mmHg and diastolic pressure >85 mmHg (ii) Fasting plasma glucose >100 mg/dl (iii) Serum triglycerides > 150 mg/dl (iv) HDL cholesterol levels <40 mg/dl in male and <50 mg/dl in female or on treatment for any of these abnormalities. The association between MS and its individual components with ACS were analysed.

Results: Study enrolled 50 cases and 50 controls (males 82, females 18). MS was diagnosed in 27(54%) of cases and 9(18%) (p<0.001) of controls. The frequencies of various MS components in the cases and controls were as follows: waist circumference >80/90 in 33 (66%) vs 17 (34%), BP >130/85 in 32(64%) vs 9(18%), Fasting Blood Sugar (FBS) >100 in 29(58%) vs 20(40%), HDL <40(male) /50(female) in 25(50%) vs 13(26%), Triglycerides >150 in 23(46%) vs 18(36%).

Conclusion: The study showed a high prevalence of metabolic syndrome in patients with acute coronary syndrome compared to age matched controls. Screening patients for MS and adequate control of the deranged metabolic parameters might prove beneficial in reducing the cardiovascular risk.

KEYWORDS

Metabolic syndrome, Acute coronary syndrome, BMI

Introduction

The co-occurrence of several cardiovascular risk factors in obese individuals led to the recognition of metabolic syndrome (MS). Despite the variations in the definition of metabolic syndrome, the criteria for the diagnosis of MS essentially include the major components of central obesity, hypertriglyceridemia, low HDL cholesterol, hyperglycemia and hypertension. The central pathophysiological process in MS is the development of insulin resistance [1]. Despite the low prevalence of obesity in the Asians compared to the western population [2], the rising incidence of MS has become a significant public health problem in Asian countries. This rise could be the result of greater prevalence of diabetes and central obesity in the Asians [3]. The world health organization (WHO) report in 2014 suggested that Asians have greater metabolic responses to central obesity than their Western counterparts at given Body Mass Indices (BMIs) [4]. Studies have shown that individuals with MS are at increased risk for Coronary artery disease (CAD) [5]. Further, the morbidity and mortality are greater in patients with MS and CAD. Patients with MS have a high incidence of acute coronary syndromes (ACS). MS is a novel risk factor that needs to be addressed for effective secondary prevention [6]. Metabolic syndrome is associated with a greater risk of atherosclerotic disease than any of its individual components. The risk of CAD is increased by 7 times in males and 10 times in females in the presence of MS [7]. The data evaluating the prevalence of MS in ACS patients is limited and scarce, especially in the Asian population.

Methods

The study was conducted over a period of 6 months starting from January 2011 in a tertiary health care academic hospital in south India. The study was carried out as a case-control study with 50 consecutive patients hospitalized with acute coronary syndrome as cases. The control group included age and sex matched patients admitted with non-cardiac illness during the study period. Patients below 35 years and above 65 years, patients with ascites, pregnancy and those who did not consent were excluded from the study.

Ethical Clearance of the Institute was obtained. Informed consent was obtained from the cases and controls satisfying the inclusion criteria. Acute coronary syndromes were categorised as ST Elevation myocardial infarction (STEMI), Non-ST Elevation myocardial infarction (NSTEMI) or Unstable angina (UA) based on established standard criteria. Demographic data (age and gender), and previously known risk factors for coronary artery disease were obtained. Lifestyle factors including smoking status, physical activity were assessed. Anthropometric measurements (standing height, weight) were done. Body mass index (BMI) was calculated using Quetlet's index as weight (kg)/height (m2). Blood pressure was measured adhering to the JNC 7 (Joint National Committee 7) guidelines.

Blood glucose and lipid profile were obtained from fasting blood samples in the first 24 hours of hospitalisation. Glucose oxidase method was used to measure fasting blood sugar (FBS). Total cholesterol and triglyceride levels were measured by enzymatic methods. LDL cholesterol was calculated from the Friedewald equation. Waist circumference was measured, with the subject standing erect using a non-stretchable flexible tape at a level just above the iliac crest, at the end of normal respiration. Cases and controls were assessed for the five-component conditions of the MS.

MS was diagnosed using the criteria based on the International Diabetes Federation (IDF).

1. Waist circumference >90 cm in males and >80 cm in females.
   Plus any two of the following factors
2. Systolic blood pressure >130 mmHg and diastolic pressure >85 mmHg or on treatment for hypertension.
3. Fasting plasma glucose >100 mg/dl or on treatment for type 2 diabetes mellitus.
4. Serum triglycerides > 150 mg/dl or on specific treatment for this lipid abnormality.
5. HDL cholesterol levels   <40 mg/dl in male and <50 mg/dl in female or on treatment for this lipid abnormality.

The primary aim was to estimate the prevalence of MS in patients

presenting with ACS. Secondary analyses were also performed for other parameters such as age, sex, BMI and the findings were compared between cases and controls and patients with and without MS.

Statistical analysis

Data was analyzed using SPSS software version 17.0. Categorical variables were expressed as frequency and percentages. Continuous variables expressed as mean with standard deviation. Chi - square test was used to test the significance of association between various factors and MS. A p-value of less than 0.05 was considered statistically significant.

Results

The baseline characteristics of the study group are listed in Table 1. There were 50 cases (41 males and 9 females) and 50 controls (age and sex matched). The mean age of the cases was 56.24 ± 8.19 yrs and that of controls 54.32 ± 7.14 yrs. The study population consisted predominantly of males constituting about 82%. Mean BMI of the cases and controls were 24.51 ± 4.80 kg/m2 and 23.28 ± 3.77 kg/m^2 respectively. Of the 50 cases of ACS, 17 patients had STEMI, 16 had NSTEMI, and 17 had unstable angina. STEMI & NSTEMI was observed with similar frequency in the 35-44 age group, whereas STEMI was more common in the 45-54 age group. Unstable angina was more frequent in the 55-65 age group.

Among cases and controls, the frequency of various components of MS were observed as follows. Waist circumference >80/90 was seen in 33 (66%) vs 17 (34%), BP >130/85 in 32(64%) vs 9(18%), Fasting Blood Sugar (FBS) >100 in 29(58%) vs 20(40%), HDL <40(male) /50(female) in 25(50%) vs 13(26%), Triglycerides >150 was 23(46%) vs 18(36%). Increased waist circumference and elevated blood pressure (>130/85 mmHg) were the most common metabolic components observed. Frequency of pre-existing diabetes in cases and controls were 38% vs 18%, pre-existing hypertension was 50% vs 22%, pre-existing dyslipidemia was 22% vs 8%.

Overall frequency of MS in the studied population was 36 (36%). Among the cases, the prevalence of MS was 27(54%) and in controls 9(18%) were diagnosed to have MS. MS was observed more frequently as the age advances. Among cases, metabolic syndrome was diagnosed in 25% in the age group of 35-44 yrs, 42% in the age group of 45-54 yrs, and 61% in the age group of 55-65 yrs. The respective percentage in the control group were 5%, 17% and 32%. Metabolic syndrome was diagnosed in 54% (n=27) of ACS patients and in 18% (n= 9) of controls. Of the 27 cases of ACS with metabolic syndrome, 8 were STEMI, 8 were NSTEMI, 11 were unstable angina. Among the male patients with ACS 22(53%) had MS and 5(60%) among females with ACS were deemed to have MS. In the control group, 15% of males and 25% of females had MS.

Family history of dyslipidemia was obtained in 11% of cases and 22% of controls with metabolic syndrome. 26% of cases and 33% of controls with metabolic syndrome were previously diagnosed to have dyslipidemia. Past history of dyslipidemia was not significantly different between cases with and without metabolic syndrome. 30% of cases and 11% of controls with metabolic syndrome had family history of hypertension while family history of diabetes was present in 30% and 22% of cases and controls with metabolic syndrome respectively. Among patients diagnosed with metabolic syndrome, diabetes mellitus was previously diagnosed in 48% and 44% of cases and controls and hypertension in 59% and 67% of cases and controls respectively. Among the ACS patients, 33 (66%) were active smokers. Of them, 15 (56%) patients had metabolic syndrome.

Among cases with metabolic syndrome, the most prevalent component, apart from waist circumference, was hypertension, whereas in controls it was hyperglycemia. Increased waist circumference was observed in 9 (53%) cases of STEMI, 9 (56%) cases of NSTEMI, and 15 (88%) cases of unstable angina. 40% of patients with ACS were overweight (BMI >25 kg/m2). 56% (p<0.05) of these overweight patients had metabolic syndrome. Among the 34% of controls who were overweight, 67% (p<0.05) had metabolic syndrome. 52% of cases with metabolic syndrome and 68% of controls with metabolic syndrome had elevated triglyceride levels (> 150mg/dl). In patients with ACS, no statistically significant difference in hypertriglyceridemia was observed between those with and without metabolic syndrome. 50% of patients with ACS had history of

antihypertensive medications. 63% (p<0.05) of these patients had metabolic syndrome. 32 (64%) patients with ACS had a blood pressure of >130/85 mmHg. Among them, 24 (89%) patients were diagnosed to have metabolic syndrome. 74% of cases with metabolic syndrome and 77% of controls with metabolic syndrome, had FBS > 100mg/dl. Table -2 shows the comparison of metabolic syndrome in cases and controls and the frequency of various components in ACS patients with/without metabolic syndrome are shown in Table -3.

Overall, 19 (23%) males and 6 (33%) females had BMI >25. 9% of the patients were obese. Among the cases, those with MS had significantly higher prevalence of overweight compared to those without MS [5 (22%) vs 15 (56%) (p<0.05)].

On univariate analysis cases with MS had significant differences than those without MS in BMI, FBS, and hypertension. Frequency of various components significantly different between the groups is shown in Table-3. By multivariate regression analysis, the odds ratio for metabolic syndrome as a risk factor for acute coronary syndrome was 1.938.

Discussion

The study was conducted in 50 cases of ACS and 50 age and sex matched controls. Overall 36 (36%) patients were found to have MS on applying the IDF criteria. Among the cases with ACS 27 (54%) were diagnosed to have MS and 9 (18%) in the control group had MS. Overall 29 patients with MS were males and 7 were females accounting for 37% of males and 33% of females. Among patients with ACS, 53% (n=24) of males and 60% (n=3) of females had MS. In the control group, 15% (n=5) of males and 25% (n=4) of females had MS. A larger proportion of females than males had MS in both cases and controls - 60% and 25% as against 53 % and 14% respectively. However the difference was not statistically significant.

The prevalence of MS in patients with Acute Coronary Syndrome (ACS) varies from 29% to 62% in various studies partly due to the employment of different MS criteria [8]. A recent study found that patients with ACS had a high prevalence of MS (50. 9%) [9]. MS has been shown to be associated with CAD in the western population [10]. The prevalence of MS in patients with ACS has not been well documented especially in South east Asian population despite a large evidence of the adverse impact of MS on cardiovascular system. In a study by Zeller M et al. 46% of STEMI patients were found to have MS [10]. Al-Aqeedi RF et al., reported a prevalence of 63% [11] and Pandey S et al. reported 26.1 % of MS in ACS patients [12]. Present study reveals high prevalence of MS in ACS patients, especially in females. Higher prevalence (73%) of MS in women with CAD was also reported by Turhan H et al. In addition women tend to have a significantly higher mean number of components of MS compared to men [13]. In a study by Zaliunas R et al. 70.2% of females were diagnosed to have metabolic syndrome. Pandey S et al., also reported higher prevalence of metabolic syndrome in females [12].

The mean BMI of the ACS patients was 24.51 kg/m2. In patients with ACS and MS the mean BMI was 26.6. Among patients with ACS and MS 9(33%) were overweight and 6 (22%) were obese. Obesity and overweight were significantly more prevalent in the MS patients. Similar results were obtained in previous studies. Yasmin S et al. calculated a mean BMI of 25 in males and 32 in females [14]. In a study by Prasad SP, the mean BMI was 29.7 [15]. 16.7% were found to be obese by Kumar N et al. [16]

On analyzing the individual components of MS increased waist circumference (66%) was the most common component followed by elevated blood pressure (>130/85 mmHg). FBS >100 mg% was found in 58% of cases. Yasmin S et al. found that 56% patients had FBS >110 mg%. [14]. Raised FBS was in 75% of patients in a study by Chung EH et al. [17] and in 76% of patients by Al-Aqeedi RF et al. [11].

Of the 50 ACS patients 33(66%) had waist circumference >80/90 cm. In the absence of MS, central obesity was found in 22% of ACS patients. 45% of patients had increased waist circumference in a study by Yasmin S et al. [14]. Truncal obesity was found in 54% by Gupta R et al. [18] and in 65% by Al-Aqeedi RF et al. [11]. The high prevalence of MS in ACS patients highlights the co-existence of multiple risk factors in a large number of patients and the need for effective screening and preventive measures to reduce the burden of CAD.

Conclusion

The study showed a higher prevalence of metabolic syndrome in patients with acute coronary syndrome, compared to age matched controls. The co-existence of multiple risk factors might have a synergistic effect in the progression of cardiovascular risk. Early recognition and modification of risk factors might prove beneficial in alleviating the excess risk for ACS.

Conflict of interest : None

Table – 1. Baseline characteristics of the study patients

Characteristics	Cases (%)	Controls (%)
Age	56.24 ± 8.19	54.32 ± 7.14
Males	41 (82)	41 (82)
STEMI	17 (34)	-
NSTEACS	33 (66)	-
Established DM	19 (38)	9 (18)
Systemic hypertension	25 (50)	11 (22)
Dyslipidemia	11 (22)	4 (8)
TGL >150 mg%	23 (46)	18 (36)
HDL <40/50 mg%	25 (50)	13 (26)
FBS	121 ± 51.8	109 ± 47
FBS ≥100 mg%	29 (58)	20 (40)
Waist circumference >90/80	33 (66)	17 (34)
BMI	24.51 ± 4.80	23.28 ± 3.77
BMI >25	20 (40)	17 (34)
BP >130/85 mmHg	32 (64)	9 (18)
Smoking	33 (66)	20 (40)
Statin use	8 (16)	5 (10%)

Table -2 Comparison of metabolic syndrome in cases and controls

Characteristics	MS in cases (n = 27)	MS in controls (n = 9)	Chi Square ; P value
Prevalence of MS	27 (54%)	9 (18%)	14.06 ; P <0.001
Females	60%	25%	P <0.05
Age	57.4 ± 7.52	55 ± 7.95	P >0.05
FBS	129 ± 45	137 ± 67	P >0.05
BP >130/85	24 (89%)	6 (66%)	P <0.05
Statin use	4 (15%)	3 (33%)	P >0.05

Table -3 Frequency of various components in ACS patients with/without metabolic syndrome

Characteristics	ACS with MS (n = 27)	ACS without MS (n = 23)	Chi Square ; P value
Established DM	13 (48%)	6 (26%)	2.866 ; P <0.05
Systemic HTN	16 (59%)	9 (39%)	2.715 ; P <0.05
BMI	26.6 ± 5	22 ± 3.1	P >0.05
BMI > 25	15 (56%)	5 (22%)	5.918 ; P <0.05
FBS > 100 mg%	20 (74%)	9 (39%)	6.226 ; P <0.05

REFERNCES

1. Ito H. Nakasuga K, Ohshima A, Maruyama T, Kaji Y, Harada M, et al. Detection [1]of cardiovascular risk factors by indices of obesity obtained from anthropometry and dual-energy X-ray absorptiometry in Japanese individuals. Int J Obest Relat Metab Disord. 2003;27:232-37.
2. Mendis S. Global Status Report on Noncommunicable Diseases 2014. The [2]World Health Organization: 2014.
3. Koh KK, Han SH, Quon MJ. Inflammatory markers and the metabolic syndrome: insights from therapeutic interventions. J Am Coll Cardiol 2005; 46(11): 1978-85.
4. Pan WH, Yeh WT. Epidemiology of metabolic syndrome in Asia. Asia Pac J Clin [3]Nutr. 2008;17(S1):37-42.
5. St-Onge MP, Janssen I, Heymsfield SB. Metabolic syndrome in normal-weight Americans: new definition of the metabolically obese, normal-weight individual. Diabetes Care 2004; 27(9): 2222-8.
6. Isomaa B, Almgren P, Tuomi T, Forsén B, Lahti K, Nissén M, et al. Cardiovascular [5]morbidity and mortality associated with the metabolic syndrome. Diabetes Care. 2001;24:683–89.
7. Chaudhary GM. Metabolic syndrome X in diabetic patients experience in [8]3275 diabetic patients at Jinnah Hospital, Lahore. J Coll Physicians Surg Pak. 2000;10:278-80.
8. Al-Aqeedi RF1, Abdullatef WK, Dabdoob W, Bener A, Albinali HA, Gehani A. The prevalence of metabolic syndrome components, individually and in combination, in male patients admitted with acute coronary syndrome, without previous diagnosis of diabetes mellitus. Libyan J Med. 2013,8:20185.
9. Jover A, Corbella E, Muñoz A, Millán J, Pintó X, Mangas A et al. Prevalence of metabolic syndrome and its components in patients with acute coronary syndrome. Rev Esp Cardiol. 2011 Jul;64(7):579-86.
10. Zeller M, Steg PG, Ravisy J, Laurent Y, Janin-Manifacat L, L'Huillier I, , et al. Prevalence and impact of metabolic syndrome on hospital outcomes in acute myocardial infarction. Arch Intern Med. 2005;165:1192-98.
11. Al-Aqeedi RF1, Abdullatef WK, Dabdoob W, Bener A, Albinali HA, Gehani A. The prevalence of metabolic syndrome components, individually and in combination, in male patients admitted with acute coronary syndrome, without previous diagnosis of diabetes mellitus. Libyan J Med. 2013,8:20185.
12. Pandey S, Baral N, Majhi S, Acharya P, Karki P, Shrestha S, et al. Prevalence of the metabolic syndrome in acute myocardial infarction and its impact on hospital outcomes. Int J Diabetes Dev Ctries. 2009;29(2):52–55.
13. Turhan H, Yasar AS, Basar N, Bicer A, Erbay AR, Yetkin E. Inonu University Medical Faculty, Department of Cardiology, Malatya, Turkey. High prevalence of metabolic syndrome among young women with premature coronary artery disease. Coron Artery Dis.2005;16(1):37-40.
14. Yasmin S, Mallick NH, Naveed T, Ali M, Noman A, Shakoor T. Metabolic syndrome in patients with ischemic heart disease. Journal of the College of Physicians and Surgeons Pakistan. 2008;18(10):605-07.
15. Prasad SB, Fahrtash F, Malaiapan Y, Meredith IT, Cameron J. Prevalence, [19] detection, and management of the metabolic syndrome in patients with acute myocardial infarction: Role of an Obesity-Centric Definition. Cardiology Research and Practice. 2010;2010:814561, 7 pages. doi:10.4061/2010/814561.
16. Kumar N, Sharma S, Mohan B, Beri A, Aslam N, Sood N, et al. Clinical and [20] angiographic profile of patients presenting with first acute myocardial infarction in a tertiary care center in northern India. Indian Heart J. 2008;60(3):210-14.
17. Chung EH, Curran PJ, Sivasankaran S, Chauhan MS, Gossman DE, Pyne CT, et al. Prevalence of metabolic syndrome in patients <45 years of age with acute myocardial infarction having percutaneous coronary intervention. Am J Cardiol. 2007; 100:1052–55.
18. Gupta R, Gupta VP, Sarna M, Prakash H, Rastogi S, Gupta KD. Monilek Hospital and Research Centre, Jaipur, 302004. Serial epidemiological surveys in an urban Indian population demonstrate increasing coronary risk factors among the lower socioeconomic strata. J .Assoc Physicians India 2003;51:470-77.