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ORIGINAL RESEARCH ARTICLE

PREVALENCE OF METABOLIC SYNDROME AND ITS COMPONENTS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Introduction: The metabolic syndrome (MetS) is a cluster of risk factors that is responsible for most of the excess cardiovascular morbidity amongst patients with Type 2 Diabetes Mellitus (T2DM). Presence of MetS in T2DM markedly increases the risk for coronary heart disease, stroke and premature deaths. This study was undertaken to find the prevalence of MetS and its individual components among patients with T2DM visiting Chitwan Medical College and Teaching Hospital, Bharatpur, Nepal.

Methods: A laboratory-based descriptive cross sectional study carried out at CMC-TH between January and August, 2017. Data obtained included anthropometric indices, blood pressure and fasting serum lipid profile. National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) criteria were used for diagnosis of MetS. Data was analyzed using SPSS version 20.

Results: The overall prevalence of MetS among 150 T2DM patients (Mean age= 53.70±10.83 years, Male:Female=84:66) was 60%. The prevalence was higher in females compared to males (75.75% vs.47.62%, P<0.001). High blood pressure was the commonest MetS component. Following that, decreased HDL-c was the predominant component in females whereas raised triglyceride in the males. SBP/DBP, BMI and waist circumference were significantly associated with MetS.

Conclusion: The prevalence of MetS is high in diabetic patients, particularly in females and middle age group adults, with high blood pressure and hypertriglyceridemia as the commonest abnormalities. As MetS adds to the cardiovascular risk to the already at-risk diabetic population, timely identification and appropriate intervention is of utmost importance in reduction of disease burden in T2DM patients.

INTRODUCTION

Metabolic Syndrome (MetS) is defined as a constellation of cardio-metabolic dysfunctions characterized by raised fasting glucose, central obesity as measured by increased waist circumference, increased blood pressure and dyslipidemia (raised triglycerides and lowered high-density lipoprotein cholesterol).[1] With these traits present, the risk of cardiovascular disease (CVD), coronary heart disease (CHD) and type 2 diabetes mellitus (T2DM) increases drastically. People with MetS have a two-fold increase in the risk for CVD and five-fold increase in the risk of T2DM compares to those without the syndrome, irrespective of the gender.[2] The global prevalence of MetS varies widely (Range of reported prevalence: 7.1 % - 41.6 %) attributed to individual demographic characteristics of the population studied and variation in the definition of MetS used in the studies.[3] The most commonly used criteria are the International Diabetes Federation (IDF) and National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII)

both adopted in 2005.[4,5] An earlier study in Eastern Nepal has reported MetS prevalence of around 20% [6], quite comparable to studies from our neighboring countries.[7] One of the recent studies that analyzed the data provided by nationally represented survey (STEPS survey) in Nepal showed the overall prevalence to be 15% according to ATP III criteria, with the triad of low HDL-c, abdominal obesity and high blood pressure being the most prevalent components.[8] T2DM is a metabolic disorder characterized by hyperglycemia resulting from variable degree of insulin resistance. Abdominal obesity and/or insulin resistance have gained a lot of attention as core manifestations of MetS in recent years.[9] People with T2DM who have MetS (i.e. co-existence of T2DM and MetS) have a much higher CVD risk in terms of both morbidity and mortality than those who have only T2DM.[10] An earlier large scale study in Europe has shown the prevalence of MetS as high as 78% in T2DM patients, with low HDL-c having the highest specificity (95%) and elevated blood pressure having the highest sensitivity.[11] The present study aimed at identifying the prevalence of MetS and its components in adult Nepalese patients with T2DM utilizing NCEP ATP III criteria.

METHODS

This cross sectional study was conducted from January – August 2017. The study population consisted of 150 adult patients (>35 years of age) with diagnosed type 2 diabetes mellitus (T2DM) attending medical outpatient department of Chitwan Medical College and Teaching Hospital, Bharatpur, Chitwan. Pregnant women, patients with type 1 diabetes mellitus and other co-existing serious illness or inflammatory disorder were excluded. Ethical approval was obtained from CMC-IRC. After the written consent from the research participants, a questionnaire was administered during the outpatient visit to collect socio-demographic data and current medication list. It was followed by blood pressure and anthropometric measurements (weight, height, waist circumference) using standard protocol. The waist circumference was measured at a level midway between lower rib margin and iliac crest using the WHO guideline for waist circumference measurement.[12] A venous blood sample (3 ml) was drawn in the next morning by trained phlebotomist under aseptic conditions after 8-10 h of overnight fast. Blood samples were transported to the laboratory within one hour of collection, and centrifuged at 3000 rpm for 5 min. The serum sample, thus obtained was used for estimation of fasting blood glucose (by GOD/POD method) and lipid profile (Total cholesterol (TC), High Density Lipoprotein-cholesterol (HDL-c), Low Density Lipoprotein-cholesterol (LDL-c) and triglyceride (TG) using DIMENSION Clinical Chemistry System, SIEMENS. Diagnosis of Metabolic syndrome (MetS) was defined using Revised NCEP ATP III criteria.[5]

Revised NCEP ATPIII criteria[5]

Components	Clinical cut off values
Abdominal circumference	>102 cm for males >88 cm for females
HDL	<40 mg/dl for males <50 mg/dl for females
TG	≥150mg/dl
Arterial Pressure	≥130/85 mmHg
Fasting blood sugar	>100 mg/dl

Data was analyzed by using Statistical Package of Social Science (SPSS) software version 20. The data were expressed as mean ± SD or median (minimum-maximum) as appropriate. The mean and median comparison between two independent groups was done by student's t-test and Mann-Whitney U-test respectively. The difference in proportions was analyzed by chi-square test. p-value of < 0.05 was considered to be statistically significant.

RESULTS

The mean age of the study population (n = 150) was 53.70± 10.83 years (Range: 32- 86 years), among which 84 (56%) were males and 66 (44%) were females. Majority of the patients were under oral hypoglycemic agents (93.3%), while the remaining patients were following dietary modification with/ without medication strategy. The baseline characteristics of the study population are presented in Table 1.

Table 1: Baseline characteristics and anthropometric measurements in the study population as categorized by gender

Variables	Male (n = 84)	Female (n = 66)
Age (years)	53.87 ± 11.03	53.48 ± 10.66
Weight (kg)	68.19 ± 9.96	68.15 ± 9.79
Height (cm)	158.33 ± 6.25	152.19 ± 5.83
Body Mass Index (BMI) (kg/m^2)	27.25 ± 3.95	29.49 ± 4.61
Waist circumference (cm)	92.02 ± 10.05	92.80 ± 11.32
Systolic blood pressure (mm Hg)	131.19 ± 18.81	129.73 ± 17.33
Diastolic blood pressure (mm Hg)	87.12 ± 15.49	84.89 ± 11.63
Duration of diabetes (months)	36 (1- 180)	36 (1- 240)

The overall prevalence of metabolic syndrome (MetS) was 60 %, the prevalence being significantly higher in females compared to males (75.75% vs. 47.62%, P <0.001). The diabetic patients in the age group 41-50 years had the highest prevalence of MetS (33.33 %) followed by thee age group 51-61 years (31.11 %).

The various anthropometric variables (BMI, waist circumference and SBP or DBP) were significantly higher in the patients with MetS compares to patients without MetS. Interestingly, the duration of diabetes was not significantly different between these 2 groups (Table 2).

Table 2: Comparison of demographic and anthropometric variables between patients with and without MetS

Variables	With MetS (n =90)	Without MetS (n= 60)	P-value
Age (years)	53.70±10.94	53.70±10.77	NS
Gender (M/F)	40/50	44/16	<0.001
Height (cm)	153.55±6.18	158.75±6.47	<0.001
Weight (kg)	70.43±10.56	64.78±7.58	<0.001
BMI (kg/m^2)	29.88±4.30	25.77±3.23	<0.001
Waist circumference (cm)	96.11±10.72	86.74±7.56	<0.001
DBP (mmHg)	90.18±14.05	80.08±11.38	<0.001
SBP (mmHg)	135.44±16.00	123.27±18.76	<0.001
Duration of diabetes (months)	30 (1-144)	36 (1-240)	NS

Considering biochemical parameters, only serum triglyceride was significantly different between the 2 groups i.e. with and without MetS (Median serum TG: 186.5 mg/dl and 132.5 mg/dl respectively, P<0.001). Other biochemical parameters like fasting blood sugar (FBS), high density lipoprotein (HDL), low density lipoprotein (LDL) and total cholesterol (TC) were not statistically different.

Overall, increased FBS was the most frequent metabolic abnormality (98.88 %) followed by high blood pressure (84.4 %) among patients with MetS. However, when categorized gender wise, raised TG was the most frequent abnormality (48.38 %) after high blood pressure in males whereas decreased HDL and increased waist circumference was for the females (74.60 % and 68.08 % respectively). 37 (41.11 %) of

the patients with MetS fulfilled only three criteria, 38 (42.22 %) fulfilled four criteria and only 15 (16.66 %) had all 5 criteria fulfilled (Figure 1).

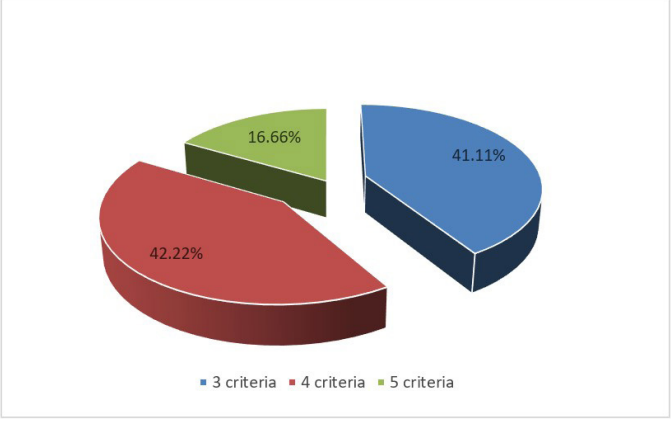

Figure 1: Distribution of patients with MetS (n =90) based on the number of NCEP ATP III criteria fulfilled

DISCUSSION

The presence of MetS is associated with a considerable increase in the number of micro/macro vascular complications in T2DM, resulting in high rates of morbidity and mortality. MetS, when present in T2DM patients has been shown to predispose these individuals to higher risk of CVDs, strokes and premature deaths, significantly reducing the 10-year survival rate in patients without known CVDs.[13,14] This has raised a useful significance for the timely detection of these highly co-existing conditions so that the consequences are minimized.

The prevalence of MetS in our study was 60 % (75.75% in females and 47.62% in females. Similar prevalence rates have been reported in other studies done elsewhere, that ranged from 58% - 66.7%.[15,16] Our study also showed that the most predominant component of MetS in T2DM was increased fasting blood sugar (FBS) followed by high blood pressure. This was different than the general adult population (i.e. without T2DM) where low HDL-c was the most common followed by high blood pressure as evidenced by a nationally representative study in Nepal. It is predictable as all the patients with T2DM would already have variable degree of insulin resistance, leading to higher occurrence of impaired FBS. Otherwise, it was remarkable that the predominant components in between genders matched perfectly, with high prevalence of abdominal obesity and low HDL-c in females and raised TG and high blood pressure in the males.[8] There are some conflicting results however; one of the studies done in Nepal has revealed central obesity and hypertension to be the most and least prevalent components of MetS.[17] It has been shown in non-diabetic adults that higher the evident number of components of MetS, higher the risk of death from all causes as well as cardiovascular diseases[18], and the same might hold true for patients with T2DM.

Many of the studies have indicated that age> 50 years, being female, having abnormal BMI and duration of years since diagnosis of T2DM have significant associations with MetS.[15] Many of these are supported by our study except for age and duration of T2DM, which had weak associations. This might have resulted from the low sample size of our study. Another limitation of our study was the lack of data on glycemic control status of the patients, which probably would have influence on MetS development. Besides, this hospital based study might not reflect the true prevalence of MetS in T2DM at population level in Nepal as utilization of health services remains poor and urban-centric.

CONCLUSION

The prevalence of MetS is very high in T2DM patients (the minimum criteria being met in most of these patients). Correct identification of this condition is warranted to detect T2DM patients at high risk of CVDs and their complications and implement integrated approach for the management of these co-existing conditions so as to reduce the high costs associated with treatment and rehabilitation. Timely lifestyle, dietary and pharmacological interventions would certainly decelerate the progression of diabetes and the various components of MetS, thus reducing the disease burden.

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