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Medicine

PREVALENCE OF METABOLIC SYNDROME IN TYPE 2 DIABETIC PATIENTS IN A TERTIARY CARE CENTER IN NORTHERN INDIA

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ABSTRACT

Background: Metabolic Syndrome (MetS) has been associated with increase prevalence of non-communicable disorders such as T2DM and cardiovascular diseases. The presence of MetS in patients with diabetes mellitus is reported to be associated with poor glycemic control and an increased risk of diabetic complications.

Aims and Objective: This study aimed at determining the prevalence of MetS and its individual components and the most critical predictors of MetS in T2DM patients in a tertiary care center in Northern India**.**

Materials and Methods: This cross-sectional study was conducted at Endocrine OPD of Pt. B.D. Sharma PGIMS, Rohtak, a tertiary care centre in northern India which included 410 T2DM patients. Their socio-demographic and relevant clinical variables were recorded. MetS was defined according to the International Diabetes Federation criteria.

Results: Prevalence of MetS among Indian diabetic patients was 76.17% and was 1.6 times more common in females as compared to males (78.7% vs. 48.7%). In females, central obesity followed by raised fasting blood sugar, in males raised fasting blood sugar followed by high serum triglycerides level were the most prevalent risk factors for MetS. The major predictors for MetS among patients of T2DM were age (40-60 years), female sex, BMI (25.0-29.9 Kg/m^2) and low education level (up to 10^{th} class and illiterate).

Conclusion: There was a high prevalence of MetS in patients of T2DM. The risk factors for MetS were age, female sex, obesity and low education level. Therefore, screening for MetS among T2DM patients needs to be done on regular basis, so that risk of diabetes related complications and cardiovascular morbidity associated with this syndrome can be lessened.

KEYWORDS : Metabolic Syndrome, type 2 diabetes mellitus, predictors, International Diabetes Federation criteria

INTRODUCTION

Diabetes mellitus is one of the most common chronic disease and leading cause of mortality worldwide. The global prevalence of diabetes will increase to double in the next 30 years due to population expansion, urbanization, increasing obesity, aging and physical inactivity. [1] India has the largest number of diabetic population in the world [1] and it is expected that there will be 79.4 million diabetic populations in India by 2030. [1] Moreover, Asian Indian have high rates of premature coronary artery disease. [2]

Metabolic syndrome (MetS) refers to a group of metabolic risk factors that includes central obesity, glucose intolerance, hyperinsulinemia, low HDL cholesterol, high triglycerides and hypertension.[3] It is estimated that approximately 20-25 % of the world's adult population have the MetS [4] and they have two- three times higher risk of heart attack or stroke, [5] five- fold greater risk of developing type 2 diabetes [6] and collection of metabolic abnormalities in diabetes patient is associated with development of additional cardiovascular disease risk factors. [7,8] Furthermore, it was found that the risk of the cardiovascular mortality rate is increased when more components of the MetS are evident. [9]

The prevalence of MetS in diabetic patients appears to vary by nations and there is limited data from developing countries. In a large epidemiological study from Chennai, MetS was identified 25.8% by IDF criteria, 23.2% by WHO criteria and 18.3% by ATPIII criteria in diabetic patients. [10] While in a study from Mumbai, the prevalence of MetS among urban Indian diabetic patients was 77.2% by using NCEP-ATPIII criteria and was significantly higher in women (87.71%) as compared to men (69.33%). [11] In another study, the prevalence of MetS was 41% in diabetic males and 58% in diabetic females by using NCEP-ATPIII criteria. [12] However, the prevalence of MetS among Southern Indian T1DM patients was 22.2% and was associated with increased risk of diabetic retinopathy and nephropathy. [13]

Due to varying prevalence rate of diabetes and scarce amount of data on MetS in Indian population, the exact disease burden still remains unclear. Furthermore there is limited study on MetS by using IDF criteria in Northern India. Therefore, the present study was aimed at determining the prevalence rate of MetS and risk factors of MetS in type 2 diabetic patients in Pt. B.D. Sharma, PGIMS, Rohtak, Haryana, India, a tertiary care center in Northern India using the International Diabetes Federation criteria.

MATERIALS AND METHODS

A cross-sectional study was conducted in Endocrine Department of Pt. B.D. Sharma PGIMS, Rohtak, Haryana, India. The study protocol was approved by the Ethics Committee of the Institute. After taking informed and written consent, a total of 410 participants were included in the study.

Inclusion criteria

Patients above 18 years of age
Patients of either sex
Patients having T2DM irrespective of their duration of illness or diabetic treatment.

Exclusion criteria

Patients with chronic medical or surgical illness other than DM
Patients on long-term treatment for other medical illness
Patients who were terminally ill
Patients having renal, neurological, or cardiovascular dysfunction who require immediate hospitalization for serious illness
Patients who were on corticosteroids or any psychotropic drug.

Measures

A semi-structured proforma was used to obtain sociodemographic variables of patients and relevant past medical history and duration of illness, treatment taken for diabetes. Anthropometric measurements including weight, waist circumference, body mass index (BMI) were recorded. Blood pressure was measured using a sphygmomanometer. Blood pressure was recorded in the sitting position in the right arm. Two readings were taken 5 minutes apart and the mean of the two was taken as blood pressure. Fasting and postprandial plasma glucose level, glycosylated hemoglobin (HbA1c) and lipid profile were done.

Metabolic Syndrome Definition

According to the new International Diabetes Federation (IDF) definition,[14] MetS is defined as when a person must have:

Central obesity (Waist Circumference with ethnicity specific value for South Asian population, Male ≥ 90 cm and Female ≥ 80 cm); **plus any two of the following four factors:**

(1) Raised triglycerides ≥ 150 mg/dL (1.7 mmol/L) or specific treatment for this lipid abnormality; (2) Reduced HDL cholesterol < 40 mg/dL (1.03 mmol/L) in males and < 50 mg/dL (1.29 mmol/L) in

females or specific treatment for this lipid abnormality; (3) Raised blood pressure systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg or treatment of previously diagnosed hypertension; and (4) Raised fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L) or previously diagnosed type 2 diabetes. If above 5.6 mmol/L or 100 mg/dL, OGTT is strongly recommended but is not necessary to define presence of the syndrome.

STATISTICALANALYSIS

The data collected during the study was entered in the Microsoft Excel format and was analyzed using SPSS version 17 version Microsoft software. A descriptive statistical analysis was done for continuous and categorical variables. Differences in characteristics between participants were tested with unpaired *t*-test for normally distributed variables and with the Chi-square test for categorical variables. Binary logistic regression model was used to examine the association between predictor variables and risk of depression. Results were expressed as odds ratio (OR) and 95% confidence intervals. The *P* values were two-tailed, and probability level of significant difference was set at <0.05.

RESULTS

Table 1 Sociodemographic and clinical profile of the participants

Variables	Total (%) 410 (100.0)	Male (%) 197 (48.0)	Female (%) 213 (52.0)	p value
Age (in years)	54.73±9.99	56.19±9.37	53.38±10.36	**0.004**
Marital status (%)				**<0.001**
Married	391 (95.4)	194 (98.5)	197 (92.5)	
Unmarried	5 (1.2)	3 (1.5)	2 (0.9)	
Widow	14 (3.4)	0	14 (6.6)	
Residential area (%)				**0.045**
Rural	131 (32.0)	72 (36.5)	59 (27.7)	
Urban	279 (68.0)	125 (63.5)	154 (72.3)	
Education level (%)				**<0.001**
Illiterate	69 (16.8)	14 (7.1)	55 (25.8)	
Literate	341 (83.2)	183 (92.9)	158 (74.2)	
Type of family (%)				0.184
Nuclear	176 (42.9)	76 (38.6)	100 (46.9)	
Joint	234 (57.1)	121 (61.4)	113 (53.1)	
Life style (%)				0.843
Sedentary	231 (56.3)	110 (55.8)	121 (56.8)	
Physically active	179 (43.7)	87 (44.2)	92 (43.2)	
Smoking (%)				**<0.001**
Yes	124 (30.2)	124 (61.9)	0	
No	286 (69.8)	73 (38.1)	213 (100.0)	
Alcohol (%)				**<0.001**
Yes	66 (16.1)	66 (33.0)	0	
No	344 (69.8)	131 (67.0)	213 (100.0)	
Waist (cm)	95.76±10.69	94.81±10.63	96.64±10.70	0.083
Height (cm)	161.32±9.93	166.80±9.28	156.26±7.53	**<0.001**
Weight (kg)	67.35±10.07	69.32±10.17	65.53±9.63	**<0.001**
BMI (kg/m^2)	25.96±3.79	24.95±3.36	26.89±3.93	**<0.001**
Systolic BP (mmHg)	134.95±19.75	133.31±18.73	136.46±20.58	0.107
Diastolic BP (mmHg)	85.96±14.13	84.95±12.42	86.89±15.52	0.166
Fasting plasma sugar (mg/dl)	157.43±52.47	153.36±53.24	161.19±51.59	0.132
Postprandial plasma Sugar (mg/dl)	230.40±62.80	225.18±65.28	235.23±60.17	0.106
Serum triglyceride(mg/dl)	201.00±62.01	199.02±63.69	202.83±60.51	0.535
Serum HDL (mg/dl)	43.21±8.63	41.92±8.00	44.40±9.04	**0.004**
HbA1c (%)	9.65±2.06	9.49±2.16	9.81±1.96	0.129
Duration of diabetes (years)	6.78±5.52	7.09±6.11	6.50±4.91	0.282
Type of therapy for diabetes (%)				0.427
Oral therapy	281 (68.5)	139 (70.6)	142 (66.7)	
Insulin therapy	129 (31.5)	58 (29.4)	71 (33.3)	
History of anti-hypertensive drugs (%)				0.156
Yes	139 (33.9)	60 (30.5)	79 (37.1)	
No	271 (66.1)	137 (69.5)	134 (62.9)	

A total of 410 type 2 diabetes patients were enrolled in the study. There were 213 females (52.0%) and 197 males (48.0%) in the study group.The overall mean age of the population was 54.73±9.99 years, whereas the ages of the males and females were 56.19±9.37 and 53.38±10.36 respectively, which is statistically significant (p=0.004). Similarly marital status, education level and residential area (urban) were statistically significant with p value <0.001, <0.001and 0.045 respectively. Smoking habits and alcohol intake were also found to be statistically significant with p value <0.001for both. The overall mean value of BMI was 25.96±3.79 kg/m2, and the mean BMI of females was significantly higher ($P < 0.001$) than that of males, moreover height (161.32±9.93) and weight (67.35±10.07) were statistically significant (p<0.001). Though the waist circumference of females was higher, there was no statistical significance. In general, 43.7% of the participants were physically active, 44.2% being males and 43.2% being females, which is also not statistically significant. In biochemical parameters, only HDL cholesterol (43.21±8.63) was statistical significance between the males and females (p=0.004).

Table 2 Prevalence of individual components of Mets

	Male (%) 197 (48.0)	Female (%) 213 (52.0)	Total (%) 410 (100.0)	p value
Central Obesity/ Waist Circumference (Male ≥90cm, Female ≥80cm)	133 (67.5)	207 (97.1)	340 (82.9)	**<0.001**
Fasting blood sugar (**≥100** mg/dl)	174 (88.3)	195 (91.5)	369 (90.0)	0.277
Serum triglyceride(≥150 mg/dl)	154 (78.1)	174 (81.6)	328 (80.0)	0.374
Serum HDL **(Male <40** mg/dl**, Female<50** mg/dl)	78 (39.5)	172 (80.7)	250 (60.9)	**<0.001**

Systolic BP (≥130 mmHg)	111 (56.3)	137 (64.3)	248 (60.4)	0.099
Diastolic BP (≥85 mmHg)	84 (42.6)	93 (43.6)	177 (43.1)	0.835
Mets	**96(48.7)**	**163(78.7)**	**259(76.1)**	

After applying the IDF criteria, the prevalence rate of MetS was found to be 76.1%, while prevalence rates of MetS in male and female was 48.7% and 78.7% respectively. Hence females were having higher prevalence of MetS as compared to males. Overall, raised fasting blood sugar was the commonest component (90.0%) of the MetS, followed by central obesity (82.9%) and high serum triglycerides (80.0%), while hypertension was the least prevalent component (systolic BP 60.4% and diastolic BP 43.1%). In females, central obesity was the most common component (97.1%), followed by raised fasting blood sugar (91.5%) and high serum triglycerides (81.6%). In males, raised fasting blood sugar was the commonest component (88.3%) of the MetS, followed by high serum triglycerides (78.1%) and central obesity (67.5%). Hypertension was the least prevalent component of MetS in both female and male groups. Central obesity and low HDL cholesterol were the only components that showed statistically significant difference between males and females ($p<0.001$).

Table 3 Sociodemographic and clinical profile of the patients of Mets

Variables	**Total (%)**	**Male (%)**	**Female (%)**	**p value**
	259 (76.1)	96 (48.7)	163 (78.7)	
Age (in years)				**<0.001**
20-40	29 (11.2)	6 (6.2)	23 (14.1)	
41-60	162 (62.5)	53 (55.2)	109 (66.9)	
≥61	68 (26.3)	37 (38.5)	31 (19.0)	
Marital status (%)				**0.030**
Married	244 (94.3)	94 (97.9)	150 (92.0)	
Unmarried	4 (1.5)	2 (2.1)	2 (1.2)	
Widow	11 (4.2)	0	11 (6.8)	
Residential area (%)				**0.040**
Rural	65 (25.1)	26 (27.1)	39 (23.9)	
Urban	194 (74.9)	70 (72.9)	124 (76.1)	
Education Level (%)				**<0.001**
Illiterate	48 (18.5)	5 (5.2)	43 (26.4)	
Up To 10^{th} class	112(43.2)	38 (39.6)	74 (45.4)	
Up To 12^{th} class	32 (12.4)	15 (15.6)	17 (10.4)	
Graduate	44 (17.0)	28 (29.2)	16 (9.8)	
Post Graduate	23 (8.9)	10 (10.4)	13 (8.0)	
Type of family (%)				0.223
Nuclear	107 (41.3)	35 (36.5)	72 (44.2)	
Joint	152 (58.7)	61 (63.5)	91 (55.8)	
Life style (%)				0.634
Sedentary	157 (60.6)	60 (62.5)	97 (59.5)	
Physically active	102 (39.4)	36 (37.5)	66 (40.5)	
Smoking (%)				**<0.001**
Yes	60 (23.2)	60 (62.5)	0	
No	199 (76.8)	36 (37.5)	163 (100)	
Alcohol (%)				**<0.001**
Yes	31 (12.0)	31 (32.3)	0	
No	228 (88.0)	65 (67.7)	163 (100)	
Waist (cm)	98.51±9.55	100.04±8.37	97.61±10.11	**0.048**
Height (cm)	160.34±9.32	167.31±7.31	156.23±7.83	**<0.001**
Weight (kg)	68.20±10.23	72.39±10.08	65.74±9.52	**<0.001**
BMI (kg/m^2)				**0.018**
<18.5	0	0	0	
18.5-22.9	42 (16.2)	20 (20.8)	22 (13.5)	
23.0-24.9	46 (17.8)	24 (25.0)	22 (13.5)	
25.0-29.9	120 (46.3)	38 (39.6)	82 (50.3)	
≥30.0	51 (19.7)	14 (14.6)	37 (22.7)	
Systolic BP (mmHg)	136.45±19.06	135.17±17.77	137.21±19.79	0.406
Diastolic BP (mmHg)	87.08±14.30	87.46±12.63	86.85±15.23	0.743
History of anti-hypertensive drugs (%)				0.673
Yes	96 (37.1)	34 (35.4)	62 (38.0)	
No	163 (62.9)	62 (64.6)	101 (62.0)	
Fasting plasma sugar (mg/dl)	170.18±48.15	162.53±42.64	174.88±47.66	**0.041**
Postprandial plasma Sugar (mg/dl)	250.73±52.40	245.60±53.66	253.75±51.57	0.228
Serum triglyceride(mg/dl)	219.52±51.94	216.06±51.22	221.55±51.83	0.412
Serum HDL (mg/dl)	42.35±7.14	41.22±5.71	43.02±7.80	**0.040**
Insulin therapy for diabetes (%)			65 (39.9)	**0.046**
Yes	92 (35.5)	27 (28.1)	98 (60.1)	
No	167 (64.5)	69 (71.9)		
HbA1c (%)				0.547
<7	2 (0.8)	0	2 (1.2)	
7-9	87 (33.6)	33 (34.4)	54 (33.1)	
>9	170 (65.6)	63 (65.6)	107 (65.7)	
Duration of diabetes (years)				0.419
0-5	142 (54.9)	48 (50.0)	94 (57.7)	
6-10	62 (23.9)	24 (25.0)	38 (23.3)	
>10	55 (21.2)	24 (25.0)	31 (19.0)	

Most of the MetS patients were in the 41–60 years age group (62.5%) which was statistically significant (p<0.001), moreover female (66.9%) were more in this group as compared to male (55.2%) and 20-40 age group had the lowest prevalence (11.2%). The prevalence of MetS was significantly higher (p=0.030) for married male (97.9%) as compared to married female (92.0%). Present study also reported that the urban diabetic patients (74.9%) were having significant prevalence of MetS as compared to rural diabetic patients (25.1%) (p=0.040). Based on the education level, highest prevalence of the MetS was up to 10th class(43.2%) followed by illiterate (18.5%) which was statistically significant too (p<0.001). Smoking habits and alcohol intake were also found to be statistically significant with p value <0.001. The overall prevalence of MetS was higher in patients with BMI 25.0-29.9 kg/m2 (46.3%) as compared to normal BMI diabetic patients (16.2%) and also BMI of females were significantly higher ($P < 0.018$) than that of males, moreover height (160.34±9.32), weight (68.20±10.23) and waist (98.51±9.55) were statistically significant (p<0.001,<0.001 and 0.048 respectively). But the waist circumference of males (100.04 ±8.37) was higher than females (97.61±10.11) in patients of MetS as compared to overall study group. Patient is on insulin therapy for diabetes also found to have statistically significant prevalence of MetS (p=0.046). In biochemical profile, fasting plasma sugar (170.18± 48.15) and HDL cholesterol (42.35±7.14) were statistical significance between the males and females (p=0.041 and 0.040 respectively). Though the prevalence of MetS was higher with HbA_1c >9, but there was no statistical significance (p=0.547). Similarly five year duration of diabetes was found to be associated with high prevalence of MetS, but it is not statistically significant (p=0.419).

Table 4 Predictors of MetS in patients of diabetes mellitus (results of logistic regression analysis)

Independent variables	OR	95% CI for OR		p value
		Lower	Upper	
Sex	0.59	0.34	1.01	**0.047**
Age (in years)	0.10	0.04	0.27	**<0.001**
Education Level	0.51	0.39	0.68	**<0.001**
BMI (kg/m^2)	1.94	1.17	3.20	**0.009**

The independent risk factors for MetS among the patients of T2DM were calculated by applying binary logistic regression analysis. For MetS Odd Ratio was significantly higher for BMI with the value of 1.94, followed by 0.59 for sex and 0.51 for education level, while it was lowest for age 0.10. Obesity increased the odds of one having the MetS, as obese patients were almost 2 times [1.94 (1.17–3.20)] more likely to develop the MetS, as compared with normal weight diabetic patients.

DISCUSSION

The MetS is a set of the most hazardous cardiovascular diseases risk factors: diabetes and raised fasting plasma glucose, abdominal obesity, high triglyceride cholesterol, low HDL cholesterol and high blood pressure. [15-17] The findings of the present study suggested that prevalence of MetS was 1.6 times more common in females as compared to males (78.7% vs. 48.7%), while overall prevalence was 76.1%. A varying rate of prevalence of MetS has been found in the studies done in various parts of the world as well as in India. In an urban population based study in Mumbai which include 5088 type 2 diabetes patients (2908 men and 2180 women) by using NCEP-ATPIII criteria, the prevalence of MetS among diabetic patients was 77.2% and was significantly higher in women (87.7%) as compared to men (69.3%).[11] Another study conducted at a tertiary care center in Gwalior**,** Madhya Pradesh showed the prevalence of MetS was 45.8% based on NCEP-ATPIII criteria and the prevalence of MetS was also higher in females (58.0%) than in males (41.0%). [12] A Chennai Urban Rural Epidemiology Study (CURES) consisting of largest epidemiological study group (i.e. 26 001 diabetic patients) by Deepa et al. [10] showed the prevalence of MetS was 25.8%, 23.2% and 18.3% by IDF, WHO and ATPIII criteria respectively. In a study on 451 type 1 diabetes patients attending a tertiary diabetes centre in Chennai, South India, prevalence of MetS was 22.2%. [13] The total age adjusted prevalence rates of MetS among 1061 Nepalese type 2 diabetic patients were 80.3%, 73.9%, 69.9% and 66.8% according to Harmonized, NCEP-ATPIII, WHO and IDF definitions respectively and significantly higher in females as compared to males according to all four definitions. [18] A study from Pakistan by Imam et al. [19] reported 79.7% prevalence of MetS in diabetic patients. Results of the Singapore National Health Survey showed a higher prevalence of MetS among the Asian Indians (28.8%) compared to Malays (24.2%) and Chinese (14.8%).[20] While study from USA by Bruno et al. [21] showed prevalence of 75.6% and Foucan et al. [22] found a 77.0% prevalence of MetS in diabetic Indian immigrants in the USA. In a study by AlSaraj et al. [23] from Ireland, prevalence of MetS was 61% and T2DM (69.5%) had more prevalence of MetS as compared to TIDM (22.2%). However, studies from various African countries reported the prevalence of MetS varying from 24.0% to 62.5%, which also showed female preponderance in prevalence of MetS. [24-27] The varying rates of prevalence may be accounted for methodological differences that were used in studies such as Harmonized, NCEP-ATPIII, WHO and IDF definitions of MetS. Female preponderance in prevalence of MetS may be due a relatively sedentary lifestyle, low education level, high BMI, lack of awareness and self-determination about their own health status.

The prevalence rate of MetS was significantly higher in diabetic patients with age group 41-60 years (62.5%) as compared to ≥61 years (26.3%) and 20-40 years (11.2%). Thus present study showed that the prevalence of MetS increases with age (40-60 years) and deceases after 61 years of age. Pokharel et al. [18] in their Nepalese study on T2DM patients had been observed similar association by using IDF criteria. Similar results were also reported in studies by Nsiah et al. [25] and Unadike et al. [27] But Adediran et al. [28] in their study found that the majority of those with MetS were over 60 years with a mean age of 59 ±12 years, while in the Saudi Arabian study, the mean age of MetS patient was 60 ±13 years. [29] These studies reported the fact that MetS is more common amongst the elderly which was not similar to our findings. This is expected because diabetic patients of age group 40-60 years are having relatively sedentary life style, poor adherence to specific dietary guidelines and stressful work environment. Also there are age related processes that favor increase predisposition of MetS such as gradual decrease in the basal metabolic rate, decreased growth hormone secretion, hypogonadism, stress induced hypercortisolism, abdominal fat deposition and concomitant insulin resistance. [30] On the other hand, the sharp decline of the prevalence at high age group might be due to increased frequency of death of diabetic patients who were most susceptible to obesity related mortality such as coronary artery diseases and cerebrovascular accidents. [10,31]

This study showed the prevalence of MetS was significantly higher in diabetic patients with low education level (43.2% for up to 10th class and 18.5% for illiterate) as compared to graduation (17.0%), up to 12th class (12.4%) and post graduation (8.9%). These findings were consistent with a previous study by Nsiah et al. [25] which found that the diabetic patient those who were in junior high school (56.3%) and with primary school education (14.9%) had higher prevalence as compared to tertiary level education (12.6%) and senior high school (3.4%). Similar association was also reported by Moebus et al. [32] in their study. This could be due to their ignorance of good dietary habits, like eating a large amount of high carbohydrate diet, saturated fatty foods and low fiber diet as well as irregular exercising and sedentary life style in diabetic patients with low education level.

In this study we also found the prevalence rate of MetS significantly higher in diabetic patients with BMI 25.0-29.9 kg/m2 (46.3%) as compared to normal BMI (18.5-22.9 kg/m2) diabetic patients (16.2%) and furthermore MetS was more prevalent in obese diabetic females than that of obese males. Similar association of high BMI and development of MetS in the diabetic population had already been observed in their study by Nsiah et al. [25] They found a high prevalence of MetS in obese diabetic patients (40.23%) and obese persons were 5 times more likely to have MetS, compared to normal weight persons as well. [25] Pokharel et al. [18] also reported similar results in their study on Nepalese population. This may be because South Asians, including Indian people, are having greater amount of visceral fat, high waist circumference, dyslipidemia and insulin resistance even at younger age as compared to their Western counterpart which predisposes them to very high risk of MetS, T2DM and cardiovascular diseases than any other population in the world. [33]

Our study also addressed the prevalence of individual component of MetS (Table 2). In the present study, raised fasting blood sugar was found to be the commonest component of MetS in the entire type 2 diabetes study population, followed by central obesity and raised serum triglycerides, while hypertension was found to be the least prevalent component of MetS in diabetic patients. These results are not similar to other Indian studies by Surana et al.[11] and Yadav et al. [12] which reported hypertension as the commonest component of MetS in their

study. While in Nepalese study results were found to be different, as central obesity was the most prevalent component according to WHO and IDF criteria and low HDL cholesterol according to NCEP ATPIII and Harmonized criteria and on the other hand, hypertension was found to be the least prevalent component according to all four criteria.[18] Nsiah et al. [25] and Unadike et al. [27] in their studies from Africa were also found hypertension as major component of MetS. In females, central obesity was the most common component followed by raised fasting blood sugar and high serum triglycerides, whereas hypertension was the least common component of the MetS. These findings were consistent with previous studies, where central obesity was found to be the most frequent component of the MetS in the diabetic study group. [11, 12, 18, 25] This could be due to less participation of women in physical activities, sedentary lifestyle, regular intake of high fat diet and refined carbohydrates, low education level and lack of concern about their own health. Moreover, in males the most prevalent component of MetS was raised fasting blood sugar, followed by high triglycerides levels and then central obesity, yet hypertension was the least common component. In contrast to this study, previous studies were reported the hypertension as the most prevalent component of MetS [12,25,26] that was followed by high triglycerides levels. [25,26] This may be attributed to increase of family responsibilities, stressful work environment, smoking habits, alcohol intake and most importantly managing the chronic illness like diabetes which adds to their financial as well as emotional burden, which ultimately leads to poorly controlled blood sugar levels.

Further, in our study, only two components of Mets, central obesity and lowered HDL cholesterol were showed statistically significant prevalence in T2DM patients (table 2). Similar results had been shown by Nsiah et al. [25] in their study. It is a well known fact that low HDL cholesterol levels are associated with higher risk of coronary heart diseases or cardiovascular diseases. [34] In fact, each individual component of MetS are high risk factors for cardiovascular morbidity and mortality. Moreover, adults with T2DM, the presence of MetS is associated with fivefold increase in CV risk independent of age, sex, smoking status and HbA1c. [35] Therefore, it is essential that assertive therapy be aimed at controlling hyperglycemia, dyslipidemia, and hypertension is required. Significant benefits of such a multifactorial intervention have been already documented by the Steno-2 study on T2DM patients. [36]

On the whole, there was a high prevalence of MetS among T2DM by using IDF criteria that was similar to the study of Pokharel et al. [18] While Deepa et al. [10] showed a low prevalence as compared to our study. Through logistic regression analysis, our study has shown that four factors; BMI, sex, education level and age have odd ratios of 1.94, 0.59, 0.51 and 0.10, respectively in the causation of MetS. It was also found that the obese patients were almost twofold more likely to develop the MetS, as compared with normal weight diabetic patients. BMI and low education level are the two modifiable risk factors among type 2 diabetics study group. Therefore, precise information regarding the commonest risk factors of MetS will provide guidance for prevention and treatment of T2DM and its fulminant complications in the near future.

CONCLUSION

The study revealed a high prevalence of MetS in patients with T2DM. The presence of risk factors for MetS among patients of diabetes predicts a causal relationship and deserves attention from clinicians. Therefore, screening for MetS among diabetic patients needs to be done at each clinical contact, particularly in obese, middle and older age, female sex and those with low education status. Efforts should be intensified in educating patients about lifestyle modifications and treatment offered to these patients help to reduce insulin resistance and eventually this will lessen the cardiovascular morbidity and mortality associated with this syndrome.

LIMITATIONS

The present study shows prospective clinical inference but there are certain limitations. This was a cross-sectional study and hence, cannot be used to establish long-term conclusions. Due to small sample size and single-cited study; the results cannot be generalized to general population setting. Therefore, multicentral and longitudinal studies in different geographical areas need to be considered to establish causal relationship between MetS and T2DM. Notwithstanding these limitations, this preliminary study was able to reveal important aspects of MetS among diabetic patients.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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