Prevalence of the metabolic syndrome among patients with type 2 diabetes

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Abstract

Introduction: The metabolic syndrome (MetS) consists of a cluster of risk factors that is responsible for most of the excess cardiovascular morbidity amongst persons with Type 2 diabetes mellitus (T2DM).

This study was conducted to find the prevalence of the MetS among T2DM patients attending the diabetic clinic of the main tertiary care hospital in Sri Lanka.

Materials and methods: A prospective cross sectional study was carried out between May 2012 and December 2012 in the diabetes clinic of the National hospital of Sri Lanka (NHSL). Consecutive patients with T2DM with a duration of diabetes of less than 12 months were enrolled into the study on their first visit.

Results: 391 subjects (109 males, 282 females) were included in the study. The crude prevalence of MetS according to the International Diabetes Federation (IDF) criteria was 63.7%. Significantly higher number of females had MetS when compared to males (72% vs. 42.2%). Abnormal waist circumference was the commonest abnormality and was present in 289 (73.9%), while low high density lipoprotein cholesterol (HDLC) was present in 206 (52.7%). In males, abnormal waist circumference and high blood pressure were the most prevalent risk factors while abnormal waist circumference and low HDL level were the most prevalent risk factors in females.

Conclusion: The prevalence of MetS and its individual components were high in T2DM patients among this urban population attending the diabetic clinic of NHSL. The prevalence of central obesity was high and it was a common risk factor for MetS among both males and females.

Background

The MetS refers to a clustering of cardiovascular disease (CVD) risk factors where underlying pathophysiology may be related to insulin resistance and resultant increase in body fat content (1). Main components of this syndrome include hypertension, hyperglycaemia, hypertriglyceridaemia, reduced high-density lipoprotein cholesterol (HDL-C) and abdominal obesity (1). Different criteria have been proposed to define the MetS (1).

Individuals with MetS are at increased risk for CVD and T2DM (1). Pooled data form 37 studies have shown that MetS doubled the risk of CV disease (2). Apart from CVD and T2DM, individuals with MetS has been shown to be more susceptible to variety of other medical conditions including polycystic ovary syndrome, fatty liver, cholesterol gallstones, asthma, sleep disturbances and some malignancies (1).

National prevalence of adult diabetes in Sri Lanka was found to be 10.3% and this was as high as 16.7% amongst the urban population during the 2005-2006 period (3). Overall, the prevalence of MetS in general adult population in Sri Lanka has been documented as 27.1% (4). Combination of diabetes and MetS possess a greater risk for the development of CVD than either alone and this knowledge is important for planning effective prevention strategies particularly for this high risk group for CVD. Prevalence of MetS among diabetic patients from other regions were reported to be high as 50-80% (5, 6, 7, 8). Prevalence of MetS among diabetes population in Sri Lanka is not known. This prospective cross sectional study was carried out to determine the prevalence of MetS in a limited, urban, adult type 2 diabetes population and its differences between the two sexes.

Methods

This prospective cross sectional study was carried out in the diabetes clinic of NHSL between May 2012 and December 2012. Consecutive patients attending the diabetes clinic with the diagnosis of diabetes for less than

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or equal to 12 months duration were included for the study. Data collection was carried out by a team of medical graduates and nurses who were trained in research methodology prior to commencement of data collection. Seated blood pressure was recorded on two occasions, 5 minutes apart after at least a 15-min rest, using a standard mercury sphygmomanometer. Height was measured using stadiometer, to the nearest 0.1cm according to standard methods. Body weight was measured in indoor light clothing to the nearest 0.1kg. Waist circumference was measured at midway between iliac crest and lower rib margin at the end of normal expiration using a plastic flexible tape to the nearest 0.1cm. Body Mass Index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2). An interviewer-administrated questionnaire was used to obtain socio-demographic details, details of other diagnosis and treatment, duration of diabetes diagnosis and treatment. Blood samples were collected at the central laboratory and blood sample for HbA1c was collected to K_3 EDTA bottles and blood for lipid profile was collected to plain bottles. Lipid profile was checked using POINTE 180 chemistry analyzer and HbA1c checked by a BIO RAD D-10 machine. Method used to analyze HbA1c was traceable to the diabetes control and complication trial (DCCT) method (9). The study was approved by the ethical review committee (ERC) of the faculty of medicine, university of Colombo, Sri Lanka.

Definitions

Diagnosis of diabetes was done according to American Diabetes Association (ADA) criteria (10). MetS was defined according to the International Diabetes Federation (IDF) criteria (Table 1) (11).

Table 1.

1	Raised Triglycerides >150 mg/l (1.7 mmol/l) or specific treatment for hypertriglyceridemia.
2	Low HDL-cholesterol < 40mg/l (1.03 mmol/l) in males and < 50 mg/l (1.29 mmol/l) in females or specific treatment for low HDL-cholesterol.
3	Raised blood pressure: systolic blood pressure > 130 mmHg or diastolic blood pressure > 85 mmHg or treatment for previously diagnosed hypertension.
4	Dysglycaemia: fasting plasma glucose > 100 mg/l (5.6 mmol/l) and/or 2 h post-oral glucose tolerance test glucose >7.8 mmol/l or previously diagnosed type-2 diabetes.

Central obesity was classified as waist circumference >90 cm for males and >80cm for females. Since all the subjects recruited for the study were diagnosed patients with diabetes, the presences of central obesity together with any one of the above parameters were classified as having MetS.

Statistical analyses

Results were expressed as mean ± SD. The data were analyzed with the help of STATA IC version 12 (Stata Corporation, College Station, TX, USA) using the relevant tests of significance such as unpaired `t' test and Chi-square test. A level of $p< 0.05$ was accepted as statistically significant.

Results and Observations

Out of 430 patients recruited for the study, 391(90.9%) patients attended blood tests and were included in the final analysis. The basic characteristics are tabulated in the Table 2. The study population was categorised to 4 BMI categories and overweight and obese categories were defined as ≥ 23 kg/m^2 and ≥ 25 kg/m^2 according to the Asian cutoff points (Table 3). 48 % of the subjects had a BMI over 25 kg/m^2 and 22% had a BMI between 23-24.9 kg/m^2. Mean BMI in this population was 25.2kg/m^2. There were 147(52.1 %) female patients with BMI>25 kg/m^2, in contrast to the 41(37.6 %) male patients ($p< 0.05$).

Table 2. Basic characteristics of the study population

	Number	*Percentage*
Total sample size	391	
1. Male	109	27.9
2.Female	283	72.1
Age Category		
1. < 20 years	01	0.3
2. 21-40 years	83	21.2
3. 41-60 years	255	65.2
4. 61-80 years	52	13.3
Ethnicity		
1. Sinhalese	248	63.4
2. Sri Lankan Tamils	74	18.9
3. Sri Lankan Malay	67	17.2
4. Other	2	0.5
Mean duration of diabetes	3 months ± 2.9	

The waist circumference was above the cut-off point in 51.4% males and 81.6% females and was the commonest risk factor of MetS in both sexes. 34.9% of males and 40.8% of females had hypertension, while 31.2% of males and 61% of females had low HDL levels. Raised

triglycerides were present in 31.2% of males and 32.6% of females. Prevalence of abnormal waist circumference and low HDL level were significantly higher in female patients (Figure 1).

The crude prevalence of MetS, defined according to IDF criteria was 63.7% in the study population. 42.2% and 72.0% male and female patients had MetS respectively (p<0.001). All five components of the MetS were present in 24 (6.1%) of the subjects.

The mean age in patients with and without MetS was 50.1 years ±10.2 and 49.3years ±11.3 respectively. BMI, waist circumference, systolic blood pressure, diastolic blood pressure and serum triglyceride levels of the patients with MetS was significantly higher (P<0.001) compared to patients without MetS (Table 3). No significant difference was observed in duration of diabetes, total cholesterol and HbA1c level between patients with or without MetS (Table 4).

Discussion

MetS is a constellation of symptoms consisting of hypertension, hyperglycaemia, hypertriglyceridaemia, reduced (HDL-C) and abdominal obesity (1). The key benefit of diagnosing MetS is to identify patients at risk of CVD early and to institute aggressive lifestyle modifications, in order to reduce the future cardiovascular burden.

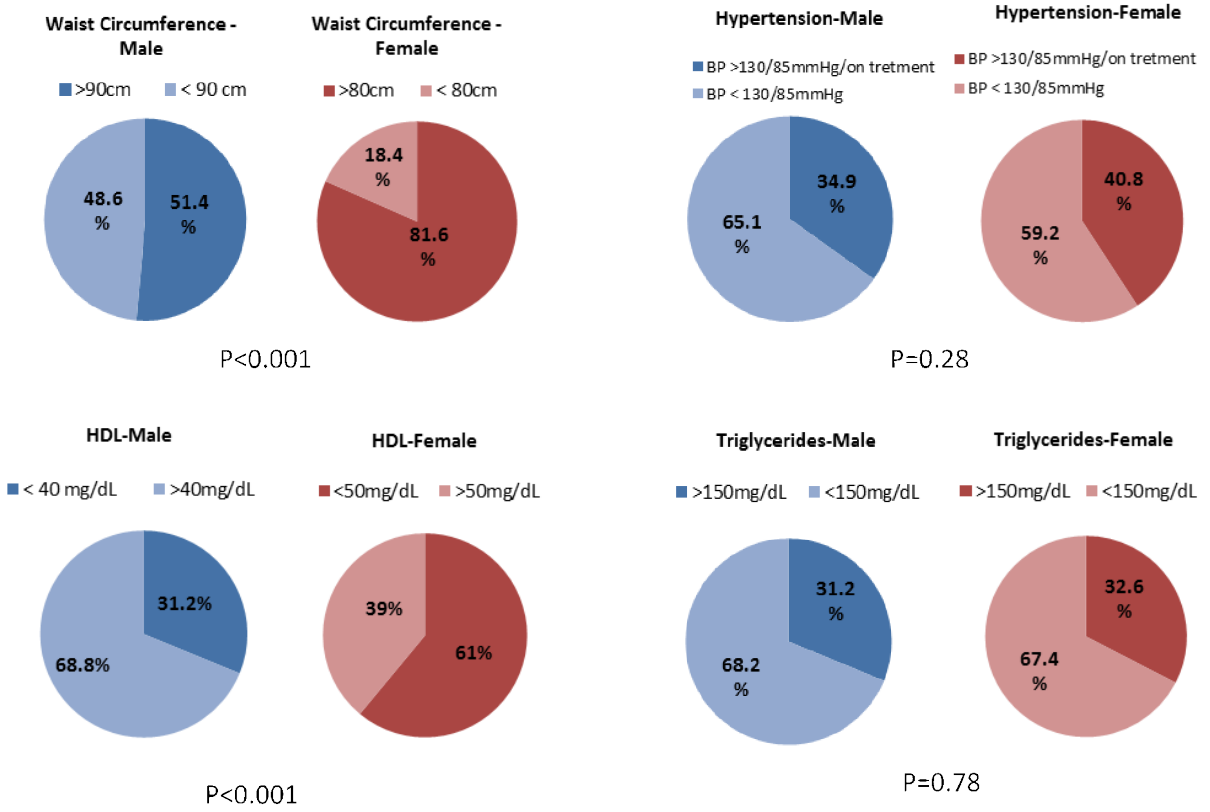

Figure 1. Components of MetS among T2DM patients according to IDF criteria according to sex

Table 3. Distribution of BMI categories

BMI Category (kg/m²)		*Male (n=109)*	*Female (n=283)*	*Total*
Underweight	(<18.5)	09 (8.2%)	09 (3.2%)	18 (4.6%)
Normal	(18.5-22.9)	32 (29.4%)	67 (23.8%)	99 (25.3%)
Overweight	(23-24.9)	27 (24.8%)	59 (20.9%)	86 (22%)
Obese	(>25)	41 (37.6%)	147 (52.1%)	188 (48.1%)

Table 4. Characteristics of patients with and without MetS

Variable	*With MetS*	*Without MetS*	*P*
Age (years)	50.1 ± 10.2	49.3 ± 11.3	0.48
BMI ($kg/m^{2)}$	26.9 ± 4.0	22.2 ± 3.9	<0.001
Duration of Diabetes (months)	2 ± 3.0	2 ± 2.8	0.37
Waist circumference (cm)	93.3 ± 8.0	82.8 ± 9.2	<0.001
Systolic BP (mmHg)	130.6 ± 19.5	122.2 ± 15.7	<0.001
Diastolic BP (mmHg)	83.7 ± 11.3	78.2 ± 7.4	<0.001
Total Cholesterol (mg/dl)	207.8 ± 43.7	205.7 ± 43	0.65
HDL (mg/dl)	45.3 ± 8.9	50.0 ± 10.6	<0.001
LDL (mg/dl)	132.7 ± 41.6	128.2 ± 42.0	0.30
Triglycerides (mg/dl)	135 ± 57.7	113.1 ± 54.7	<0.001
HbA1c %	8.2 ± 1.8	8.2 ± 1.9	0.91

Table 5. Comparison of prevalence of Mets in other regions

	Study (ref)	*Country*	*Study Type*	*Study population*	*Duration of Diabetes*	*MetS (IDF criteria)*
1	Lu B et al. (13)	China	Cross sectional study	1008 Type 2 DM	Newly diagnosed	50%
2	Cull CA et al. (5)	UK	Retrospective analysis of UKPDS study	4542 UKPDS Type 2 DM patients	Newly diagnosed	54%
3	Imam SK et al. (14)	Pakistan	Cross sectional study	233 with Type 2 DM	-	68.1%
4	M. Monami et al. (7)	Italy	Observational cohort study	882 Type 2 DM	13.1 ± 10.6 years	73.7%
5	Alshkri MM et al. (8)	Libya	Cross sectional study	99 Type 2 DM	9.4 years+7.4	80.8%
6	Nahar S et al. (6)	Bangladesh	Cross sectional study	200 Type 2 DM	Newly diagnosed	61 %
7	Present Study	Sri Lanka	Cross sectional study	391 Type 2 DM	3 months $\pm$2.9	63.7%

The crude prevalence of MetS among T2DM patients in this study was 63.7%, when IDF criteria were used to define MetS. This prevalence is nearly similar to the results of other studies from the South Asian region and other regions, which have used IDF criteria (Table 5). However, a higher prevalence of MetS was reported in some studies where the duration of diabetes is longer and this is expected as the risk factors for MetS accumulate with the duration of diabetes.

Prevalence of MetS depends on the criteria used to define it. In South Asians, central obesity has been identified as a key factor for increase prevalence of diabetes (12). When compared with NCEP-ATP III criteria (13), many studies have found that there is a lower prevalence of MetS with the IDF criteria, in diabetic patients (5, 6, 8, 14). However, some studies have found that in Caucasian diabetic patients, prevalence may be higher with IDF criteria (7). In the IDF definition of MetS, central obesity is an essential criterion in diagnosing MetS leading to lower prevalence with the IDF definition. This is a possible explanation for the difference seen between the two definitions. In this study we primarily used the IDF criteria to calculate the prevalence of MetS. In this study, IDF

criterion was chosen to define MetS, since central obesity is an essential criteria in this definition and different waist circumference thresholds have been set for different ethnic groups (11).

The prevalence of MetS was found to be significantly higher in females compared to males. The prevalence of central obesity and low HDL was also significantly higher in females and these 2 parameters have mainly contributed to overall higher prevalence of MetS seen in females. Similar findings have been noted in some other studies carried out in this group of patients (6, 16). In our study, females were more likely to have high blood pressure and high triglycerides, even though the difference was not statistically significant. Contrary to our findings, Surana et al in their study found that male patients with diabetes were more likely to have high blood pressure and high triglycerides than females in an urban population of India (16). Surana et al have also reported that the most prevalent risk factors for MetS were hypertension, followed by hypertriglyceridaemia in males and central obesity followed by hypertension, in females (16). However, in our study, high waist circumference and high blood pressure were the most prevalent risk factors in males, while high waist circumference and low HDL cholesterol level were the most prevalent risk factors in females. These differences may be due to the fact that most patients in this Indian study had diabetes for a significant time (mean 8.5 years) compared to our study (mean duration 3 months), which would have affected the MetS risk factors.

In our study, there were no differences between HbA1c level in patient with or without MetS irrespective of significantly higher mean BMI (26.9 kg/m2 with MetS vs. 22.2kg/m2 without MetS) and mean waist circumference (93.3cm with MetS vs. 82.8 cm without MetS) in the MetS group. This may be due to the fact that majority of patients in our study were in the early stage of diabetes.

Cardiovascular disease is a well-known complication of T2DM and MetS (1). The presence of MetS, in patients with T2DM, increases the risk of cardiovascular disease by fivefold and this risk is independent of age, sex, smoking status, and glycated hemoglobin level (17). However, it is not clear, whether MetS would confer any additional cardiovascular (CV) risk rather than individual risk factors it is formed of. The debate between the CV risks of MetS vs. its individual risk factors is still ongoing. It can be argued that grouping the risk factors under the umbrella of MetS and giving a separate diagnosis, draws more attention when highlighting CV risk reduction for this group of patients. The benefit of such multifactorial approach has been highlighted in the STENO-2 study (18). Therefore, an aggressive approach in managing individual risk factors / MetS is needed in order to prevent CV morbidity and mortality in patients with T2DM.

There were some limitations in this study. Since consecutive patients were included in the study, the sampling bias was not entirely excluded. The study population predominantly comprised of females patients and this may have affected the results of the study. Males are mostly employed and the overlapping of clinic hours with the working hours may have contributed to this difference in accessing health care. The study population was limited to the type 2 diabetic patients attending the diabetes clinic of national hospital and therefore, the results may not be applicable to wider diabetic population. Strengths of this study include being the first study to report MetS in relatively newly diagnosed T2DM patients in Sri Lanka and its prospective nature. In patients with diabetes, the prevalence of MetS is high with central obesity being the most common risk factor of Mets, especially among females. The prevalence of MetS is expected to rise with the duration of diabetes and also the associated CV morbidity and mortality. Therefore, aggressive interventions in lifestyle modification and pharmacological treatment to counter the individual risk factors and hence MetS, should be a priority in the managing this population of patients with diabetes.

Conclusion

The prevalence of MetS is high in patients with T2DM among the urban population of Sri Lanka. The prevalence of MetS is significantly higher in female patients with diabetes compared to males in this urban setting. A high prevalence of abnormal waist circumference was noted and it was the common risk factor for MetS among both males and females.

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