The Prevalence of Metabolic Syndrome and Associated Microvascular and Macrovascular Complication in Type 2 Diabetes Mellitus

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Abstract

Methods
Across sectional study was carried out in AL Kuwait University Hospital consultation clinic in the period of June 2022 to May 2023. A total of 380 randomly selected adult patients with type 2-DM were included in the study. The diagnosis of diabetes was based on ADA criteria, while the diagnosis of MS was based on ATP 111 criteria. The patients were divided into two groups with and without metabolic syndrome (MS) and there clinical and laboratory parameters where studied and analyzed

Results
About 308 (81%) of patients had MS according to ATP111 criteria female were equally affected as male. there was significant difference between patients with and without MS regarding central obesity, hypertension, low HDL and high LDL. Patients with MS had higher prevalence of retinopathy (29.2 % vs 16.6%), DSN || (23.3% vs 20.8%), DNP (40.5 VS 31.9%), coronary artery diseases (27.5% vs 16.6 %) and stroke (7.4 % vs 2.7%).

Conclusion
These data suggest MS in this population of Yemeni type – 2 diabetic patients is common and with estimated prevalence of 81% MS clearly poses a formidable health threat to Yemeni diabetic patients. Life style intervention in type 2 diabetic subjects are needed in Yemen to halt the burden of micro and macrovascular complication in type 2 DM Keywords; Metabolic Syndrome, Coronary Artery Diseases, Distal Sensory Neuropathy, Diabetic Nephropathy

Introduction

Diabetes mellitus is frequently reported as a major chronic disease, characterized by abnormal glucose homeostasis leading to hyperglycemia. The prevalence of this disease is increasing dramatically. According to the World Organization of Health (WHO), the number of people with diabetes worldwide has quadrupled over the past 27 years and reached more than 451 million (8.4%) people in 2017, 91% of whom have type 2 diabetes mellitus (T2DM) [1,2]. This number is predicted to increase to 693 million by 2045 [2]. In Morocco, the prevalence of diabetes is estimated at 12.4% among adults and constitutes a serious public health problem [2]. Regarding the mortality of this disease, 2.2 million deaths worldwide were caused directly by higher blood sugar levels in 2012 and around 1.5 million deaths in 2016, of which more than 80% occurred only in countries of low and middle income [2]. WHO estimates that diabetes will be the 7th leading cause of morbidity and mortality in the world by 2030 (2).

The Metabolic Syndrome (MS) is a constellation of central obesity, glucose intolerance, hyperinsulinemia, low high-density lipoprotein, high triglycerides and hypertension [3]. It is associated with a high risk of coronary heart disease (CHD) and premature mortality [4]. Besides resulting in macrovascular complications, there is growing evidence that MS, like diabetes mellitus, causes microvascular complications in patients with type 2 diabetes mellitus [5-7]. Nearly 70-80% of the population with diabetes mellitus is diagnosed with MS [8-10]. The correlation between MS and macro- and microvascular complications, in patients with diabetes mellitus, has been shown previously in American and European subjects [11,12]. The data in the Asian population is scanty and controversial. In Japan, the Fungate Study observed that MS, using the definition of the International Diabetes Federation (IDF), was associated with microvascular changes in the retina [13,14]. However, Iwasaki et al found that neither the presence of MS (as defined by the IDF guideline nor an increased waist circumference increased the risk of micro- or macrovascular complications in Japanese patients with type 2 diabetes mellitus.

The Asian population is somewhat different from the Caucasian population [15].

The incidence of CHD and the absolute risk of death from CHD, at the same level of blood pressure, is lower in Asians, more so in populations with diabetes [15,16]. The prevalence of obesity and its impact on cardiovascular disease is also different in Asians, compared to Caucasians [17,18]. The present population-based study aims to find out the prevalence of MS in the Yemeni population with type 2 diabetes mellitus in relation to gender, duration of diabetes, and to evaluate the influence of MS and its individual components on microvascular and macrovascular complications such as diabetic retinopathy (DR), diabetic nephropathy and diabetic neuropathy, stroke and coronary artery disease

Methods

This cross-sectional study involved 380 randomly selected adult patients with type 2 DM attending Al-Kuwait University Hospital during the period between June 2022 to May 2023. The patients were interviewed and examined by the author. clinical examination including the age, sex, duration of DM, drugs therapy, any history of hypertension, dyslipidemia, diabetic retinopathy, nephropathy, stroke and coronary artery diseases Waist circumference was measured with tap measure mid-way between lower rib margin and the iliac crest. Blood pressure was measured by standard mercury sphygmomanometer in sitting position after 10-15 min rest. Each subject had two measurement of blood pressure at five-minute interval.

Hypertension was defined as systolic blood pressure ≥130mmHG and or diastolic blood pressure ≥85mmHg or patients on antihypertensive drugs Retinopathy was diagnosed by examination of the retina of the eyes by fundoscopy. The patients were screened for distal sensory neuropathy by using the 10-g Semmes - Wein stein monofilament over 10 area of the feet. Ankle reflexes and vibration perception over the great toe and ankle. A standard neuropathy disability score (SNDS) well be measured and over 6 shows the neuropathy is present. The occurrence of ischemic heart

diseases and stroke were taken from clinical history and previous documents or as an acute event. For diagnosis of micro and macroalbuminuria an early morning urine specimen where taken for all eligible subjects. Albumin in urine sample was determined by immune – turbidimetric assay. lipid profile was checked 9-12 hours after overnight fasting.

Metabolic syndrome was diagnosed according to the NCEP ATP 111 as the presence of three of the following 5 criteria [19].

Waist circumference ≥102 cm in male or ≥88 cm in female

Blood pressure ≥130/ 85 mmHg

Triglyceride ≥150 mg / dl

High density lipoprotein (HDL) ≤40mg/dl in male and ≤50 mg/dl in female Fasting blood sugar ≤110mg/dl

The results were expressed as mean ±SD. tactical analysis was performed using the tactical package for the social science (window version 11.0; SPSSinc, ChicagoILUSA), Difference between two groups were tested statically using the chi square test. Data were considered statically significant when the P- value was less than 0.05.

Results

About 380 type 2 diabetic patients was included in this study; 193 (50.7%) were males and 174 (45.7%) were females. 308 (81,1%) of type 2 diabetic patients had metabolic syndrome according to ATP 111 criteria, 144 (46.7%) for them were males and 164 (53.2%) were females. Table 1 shows the clinical and laboratory characteristics of type 2 diabetes with and without MS. There was no difference between males and females regarding the prevalence of MS. Patients with MS are older, has long duration of DM than those without MS (P- value less than 0.05) patients with MS are more frequently obese, hypertensive and had low HDL and high serum LDL than those without MS

Factors	All subjects 380	With MS 308	Without MS (72)	P- value
Age	51±58	53±63	51±58	0.001
Male sex %	193 (50.7%)	144 (46.7 %)	49 (68%)	0.05
Duration of DM	8.5 ±7.1	9.9 ±6.1	7.9±1.5	0.0001
Waist circumference	185 (48.6%)	166 (53.8%)	19 (26.3%)	0.0002
Hypertension%	210 (55.2%)	190 (61.6%)	20 (27.7%)	0.0002
High TG %	153 (40.2%)	130 (42.2%)	23 (31.9%)	0.1
Low HDL %	159 (41.8%)	145 (47 %)	14 (19.4%)	0.0001
High LDL %	121 (31.8%)	111(36%)	10 (13.8 %)	0.00002

Table 1: Clinical and Laboratory Characteristics of Type 2- Diabetes with And Without MS

Type 2 diabetic patients with MS had more prevalent microvascular complications in the form diabetic nephropathy (40.5% vs 31.9%), distal sensory neuropathy (23.3% vs 20.8%) and retinopathy (29.2% vs 16 .6%) than those without MS P- value less than 0.05.

While the prevalence of macrovascular complications was more frequently higher in type 2 diabetic with MS than those without MS (27.5% with MS had CAD vs 16.6 % without and 7.4% with MS had stroke vs 2.7% without MS respectively) (table 2)

Factors	All subjects (380)	With MS (308)	Without MS (72)	P-value
Diabetic nephron	148 (38.9%)	125(40.5%)	23 (31.9%)	0.001
DSN	87 (22.8%)	72 (23.3%)	15 (20.8%)	0.0001
Retinopathy	102 (26.8%)	90 (29.2%)	12(16.6%)	0.0001
CAD	98 (25.7%)	85 (27.5%)	12 (16.6%)	0.05
Stroke	25 (6.5%)	23 (7.4%)	2 (2.7%)	0.001

Table 2: Shows the Prevalence of Micro and Macrovascular Complication in Type 2 Diabetes with And Without MS

Discussion

An array of metabolic, hemodynamic and renal abnormalities constitutes the cardio metabolic syndrome. A hall mark of this syndrome is visceral obesity and associated insulin resistance (18). The syndrome was also associated with essential hypertension, dyslipidemia, hypercoagulability , hyperuricemia , endothelial dysfunction, inflammation microalbuminuria , all these are associated with increased risk of both micro and macrovascular complications of type 2 DM, because of the harmful effect of MS in increased the prevalence of both micro and macrovascular complications of type 2 DM, so it's essential to establish the prevalence of this condition in type 2 diabetic patients in Yemen. The prevalence of MS in type 2 DM in this study was 81% which is similar to the world-wide prevalence, which is varying between 45.8% and 96.3% according to the revised NCEP ATP 111 criterion [20-23].

The prevalence of MS that obtained in this study is comparable to the studies done in Brazil (80%) and Basrah (86%), but significantly higher than the prevalence in Pakistan (46%) (26) and lower than in Bengh- Lybia (92%) [24-27]. The prevalence of individual comorbidities of type 2 DM with MS was higher than those without MS [28]. Patients with MS had high blood pressure, were more centrally obese and had low level of serum HDL and high level of LDL than patients without MS (P= 0.0001) [17,28]. In our T2D with MS, hypertension was the parameter most often observed (61.6%). It was mentioned as the most determining element in the prevalence of MS in studies conducted in Burkina Faso [29]. In our T2D patients with MS. Diabetic nephropathy was the most frequent of the microvascular complications, with a frequency of 40.5% versus 31.9% of the T2D without MS (p<0.05). similar to the findings reported by Lee et al. (40.8%) [30]. Retinopathy was found in 29.2 % of patients similar to than this objected Southern Taiwan (37.9%) while the prevalence of distal sensory neuropathy was 23.3% in type 2 diabetic with MS which is less comparable to studies by Thomas et al. at 13% and Hsu et al. at 12.6% [31-33]. Regarding macroangiopathy, ischemic heart disease was the most frequently observed with a prevalence of 27.5% against 16.6% in patients without MS (p <0.05). This frequency is close to that shown in Brazil (24) and Pakistan [26].

These results support data from the literature which demonstrated that T2D who presented with MS had a cardiovascular risk, three to five times that of the non-diabetic population [34].

Stroke was found in 7.4% of cases, this rate is similar than those reported by Jing et al [33]. (10.8%), and by Lee et al (5.5%) Science the release of NCEP guideline for metabolic syndrome in 2001 numerous published studies have established that people with MS are twice are likely to develop CAD and are at over risk of mortality [35]. there are multiple risk factors involved in type 2 DM which are obesity, hypertension and dyslipidemia. Among the studied patient's hypertension proved to be the highest risk factors in this study followed by obesity and dyslipidemia metabolic syndrome is closely linked to generalized metabolic disorders called insulin resistance in which the normal action of insulin is impaired [36]. Factors that promote insulin resistance include genetic, sedentary life style, obesity. MS is associated with increased prevalence of hypertension, dyslipidemia and obesity in patients with type 2 DM which is associated with increased prevalence of mice and macrovascular complication of type 2 DM which is supported by our study and by other study done in this field So we recommended that aggressive control of hypertension , obesity ,and dyslipidemia in type 2 DM well decrease the prevalence of both microvascular and macrovascular complication of type 2 DM with or without MS [37,38].

Conclusion

Our study demonstrates an alarming high prevalence of MS among type 2 diabetic Yemeni patients that increases the burden on overstrained Yemeni health system with uprising CVDs and other MS related health problems e.g. CVD. As obesity is the main modifiable risk factor for MS, raising community awareness and promotion of healthy lifestyle together with organizing training course for health educators are highly recommended. There is also an urgent need to develop strategies for prevention, detection, and treatment of MS in type 2 diabetic patients that could contribute to decreasing the incidence of grave consequences such microvascular and macrovascular diseases. Meanwhile, it is also vital that we obtain reliable prevalence among the whole population, which is currently lacking, in order to obtain more precise estimates of the

magnitude of the problem and action needed.

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