International Journal of Endorsing
HEALTH SCIENCE RESEARCH

IJEHSR

Original Article

Frequency of Metabolic Syndrome in Patients with Type 2 Diabetes Mellitus

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Doi: 10.29052/IJEHSR.v11.i4.2023.206-211
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Received 14/03/2023
Accepted 16/09/2023
First Published 03/11/2023

OPEN ACCESS

Abstract

Background: Diabetes Mellitus (DM) is now one of the world's most common non-communicable diseases and the fourth leading cause of death in most high-income countries. It is anticipated that 380 million people will have type 2 diabetes and 418 million will have impaired glucose tolerance by 2025. The objective of the study was to assess the frequency of Metabolic Syndrome in local patients with Type 2 Diabetes Mellitus.

Methodology: A total of 257 type 2 Diabetes Mellitus patients presenting at the Department of Medicine, Post Graduate Medical Institute Hayatabad Medical Complex (PGMI-HMC), Peshawar, from February to August 2018 were enrolled in this cross-sectional study. The sample size was determined using WHO sample size determination software. After explaining the study's purpose and objectives, informed consent was obtained from each patient, and data confidentiality was maintained. All Type 2 Diabetes Mellitus patients under 60 years of age were included in the study, while those on lipid-lowering drugs in the past, with liver failure, and those taking multivitamin supplements were all excluded from the study. All patients were evaluated with a thorough history and clinical examination, followed by pertinent investigations; their blood pressure, waist circumference, fasting blood glucose, and lipid profile were measured. The presence of metabolic syndrome was indicated by the collection of three of the five components, including high waist circumference, hypertension, poor glycemic control, hypertriglyceridemia, and lowered high-density lipoprotein (HDL) (good cholesterol). The data was analyzed using SPSS version 20.0.

Results: The overall mean age of the patients was 55 ± 1.26 years, the majority being females, i.e., 139(54%). The frequency of metabolic syndrome was 68% among the enrolled diabetes patients, with poor glycemic control as the most frequent component (81.71%), followed by hypertension (75.59%) and hypertriglyceridemia (71.65%). There was no gender and age-related effect on the frequency of metabolic syndrome ($p>0.05$).

Conclusion: In conclusion, the observed frequency of metabolic syndrome among Type 2 Diabetes Mellitus patients was high, with poor glycemic control being the most prevalent component of metabolic syndrome.

Keywords

Type 2 Diabetes Mellitus, Metabolic Syndrome, NCEP ATP III.

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Introduction

Diabetes mellitus is among the world's most common non-communicable illnesses and has entered the top 10 causes of death globally[1]. Since 2000, the overall prevalence has increased by 70%. It is estimated that by 2025, there will be around 380 million diabetics and 418 million people with impaired glucose tolerance worldwide[2]. Diabetes complications, such as cardiovascular disease, stroke, neuropathy, nephropathy, and retinopathy, result in increased disability, decreased life expectancy, and enormous health costs for almost every society[3]. According to the most recent IDF Atlas 2, in Pakistan, 33 million people live with Type 2 Diabetes Mellitus, making it the third largest diabetes population in the world[4]. Dyslipidemia and increased glycated hemoglobin percentages are common observations among diabetics. Type 1 diabetics who have good glycemic control are not hyperlipidemic in general. Despite good glycemic control, patients with T2DM are typically dyslipidemic, often presenting with hypertriglyceridemia, raised bad cholesterol, and reduced good cholesterol.

Metabolic syndrome is becoming more frequent among Type 2 Diabetes Mellitus patients around the world, regardless of any abnormalities in glucose metabolism[5]. A collection of clinical and biological defects has been studied that increase the risk of diabetes, cardiovascular diseases, and liver illnesses[6]. Reaven (1988) first described the various components of MetS under the moniker syndrome X[7]. These included abdominal obesity, hypertension, poor glucose metabolism, and an abnormal lipid profile[8]. Several studies confirm that obesity and insulin resistance are the root causes of this syndrome, and central obesity, characterized by an accumulation of fat in the midsection, is strongly linked to multiple sclerosis[9]. The development of type 2 diabetes and the risk of cardiovascular illnesses may both be influenced by central obesity. Although this is still being debated, insulin resistance appears to be the underlying feature of all these abnormalities[10]. According to the Joint Scientific Declaration, which was released in 2009, the risk factors for diabetes mellitus and the cardiovascular system together make up the metabolic syndrome[9].

MetS affects an estimated 25% of the general public and up to 80% of T2DM patients globally[11]. Developed European nations have a high MS prevalence. An analysis of 8 cohorts (tot al: 8200 men and 9363 women) exploring the prevalence of MS in accordance with the WHO's criteria was conducted in this context, and the results were compared with an alternate proposed definition of MS for non-diabetics. The study found that, although both sexes experienced a progressive rise in MS prevalence that was directly proportional to advancing age, MS prevalence was frequently higher in men than in women. In men between the ages of 40 and 55, the prevalence of MS ranged from 7.0% to 36.0%, and in women, between 5.0% and 22.0%[12]. Another systematic analysis of the prevalence of MS in Brazil, published in 2013, covered ten articles from 2006 to 2012 and revealed that, depending on the MS diagnostic criteria, the average prevalence ranged from 28.9% to 29.6%. Using the NCEPATPIII (National Cholesterol Education Program Adult Treatment Panel III) criteria led to the lowest rate. The average prevalence increased from 22.0% when adjustments were made for age to 41.3% when adjustments were made for gender[13].

It is recognized that individuals with T2DM and MetS have a higher risk of developing cardiovascular diseases than those with either condition alone[14]. Characterizing MetS in the presence of diabetes is thus advantageous for cardiovascular prevention. However, the instruments used to diagnose MetS are likely to differ significantly[15]. A study found that people with MetS are more prone to cardiovascular conditions and experience heart attacks than people without MetS[16]. MetS causes 12 to 17% of all CVD and also promotes 6 to 7% of all-cause mortality[16]. MetS patients were also more likely to develop fatty liver disease, sleep disorders, cholesterol gallstones, and cancer, among other complications.

Following a thorough literature search, we discovered that the frequency of MetS among Type 2 Diabetes Mellitus subjects varied from one population to another. Hence, this study was designed to determine the MetS frequency among diabetics attending Hayatabad Medical Complex, Peshawar.

Methodology

A cross-sectional study was conducted at Post Graduate Medical Institute (PGMI)-Hayatabad Medical Complex (HMC), Peshawar, from February to August 2018 after obtaining ethical approval from the Institutional Review Committee (Ref # 01/MMW/988/22; dated 01/02/2018).

After explaining the study's purpose and objectives, informed consent was obtained from each patient, and data confidentiality was maintained. The sample size was determined using World Health Organization (WHO) sample size determination software, keeping 60% MetS prevalence in patients with DM11, 95% CI, and a 6% margin of error. The calculated sample size was 257.

All T2DM patients (with a minimum of 2 years duration) under 60 attending the study site were included in the study using a consecutive sampling technique. Patients on lipid-lowering drugs in the past, those with liver failure, and those taking multivitamin supplements were all excluded from the study.

All patients were evaluated with a thorough history and clinical examination, followed by pertinent investigations. All patients had their blood pressure and waist circumference measured, followed by fasting blood glucose and lipid profile measurement. Metabolic syndrome was defined as the presence of three of the five components of the NCEP ATP III criteria, high WC (40 inches-males and 35 inches-females), elevated FBG (> 100 mg/dl), TG (> 150 mg/dl), lowered HDL (< 40 mg/dl-males and < 50 mg/dl-females), and elevated BP (over 130/85 mmHg).

The data was analyzed using SPSS version 20.0. Continuous variables were reported as mean ± SD. Frequencies and percentages were used to display the categorical variables such as gender and MetS. The Chi-square test/Fisher Exact Test was used to compare categorical variables. At a p-value of 0.05, statistical significance was declared.

Results

The overall mean age of the patients was 55 ± 1.26 years, the majority being females, i.e., 139(54%). The majority of the enrolled patients were 51 to 60 years old (44%), 36% were between 41 to 50 years, and the remaining 20% were 30 to 40 years of age (Table 1).

Table 1: Patient baseline characteristics & frequency of metabolic syndrome (n=257).

Variables		N(%)
Gender	Female	118(46)
	Male	139(54)
Age groups	30 to 40 years	51(20)
	41 to 50 years	93(36)
	51 to 60 years	113(44)

The frequency of MetS among the enrolled patients was 68%; poor glycemic control was the most frequent MetS component (81.71%), followed by hypertension, hypertriglyceridemia, etc., as shown in Table 2. There was no significant gender-wise difference in the frequency of MetS and components based on NCEP-ATP III criteria (p>0.05).

Table 2: Frequency of MetS and components based on NCEP-ATP III criteria.

Variables	Gender [n(%)]		Total (N=257)	p-value
	Male (n=118)	Female (n=139)		
High waist circumference	87(73.73)	95(68.35)	182(70.87)	0.542
Elevated FBS	118(100.0)	92(66.19)	210(81.71)	0.482
Elevated TG	75(63.56)	109(78.42)	184(71.65)	0.872
Lowered HDL	65(55.08)	58(41.73)	123(48.03)	0.523
Elevated BP	104(88.14)	90(64.75)	194(75.59)	0.932
Metabolic Syndrome	81(68.64)	94(67.63)	175(68)	0.644

Table 3 shows the factors affecting MetS frequency among type 2 diabetes patients. It was found that age and gender had no significant effect on the frequency of metabolic syndrome among these patients (Table 3).

Table 3: Factors affecting the frequency of MetS in T2DM patients.

Variables		Metabolic Syndrome [n(%)]		Total (n=257)	p-value
		Yes (n=175)	No (n=82)		
Gender	Male	81(46.28)	37(45.12)	118(45.91)	0.861
	Female	94(53.71)	45(54.87)	139(54.08)	
Age Group	30 to 40 years	35(20.0)	16(19.51)	51(19.84)	0.994
	40 to 50 years	63(36.0)	30(36.58)	93(36.18)	
	51 to 60 years	77(44.0)	36(43.90)	113(43.96)	

Discussion

A high frequency of MetS was found in the enrolled T2DM patients (68%). It was consistent with another study that discovered MetS in 59.4% of diabetics. A systematic review with studies from Sub-Saharan Africa, Ghana, and Urban India reported MetS frequency among T2DM patients as 60.4%, 58%, and 71.9%, respectively[17]. Another previous study found a high frequency of MetS in Nepalese (73.9% and 66.8%) in T2DM patients, using NCEP ATP III and IDF criteria[18]. These differences could be attributed to variations in hospital level, population characteristics, study period, and sample size.

All five criteria for metabolic syndrome were present in 23.6% of patients. The prevalence of different MetS components has been studied in patients of both genders. Elevated FBS (81.71%) was the most frequent component of MetS, followed by high systolic BP (75.59%), hypertriglyceridemia (71.65%), and abdominal obesity (70.87%), while low HDL (48.03%) was the least prevalent component of MetS. In the Ethiopian population, central obesity and hypertriglyceridemia were the most frequent MetS components[19]. Similarly, a Nepali study also identified central obesity as the most frequent MetS component, followed by hypertension, not hypertriglyceridemia[20]. Furthermore, central obesity was the prevalent risk factor in North-Central Nigeria[21]. Obesity is becoming more common around the world, which is increasing the MetS frequency.

The gender-wise distribution showed no statistically significant difference in the frequency of MetS in the two genders; males had a slightly higher prevalence of MetS, i.e., 68.64% vs. 67.63% in females. In contrast, Zerga et al. reported that Females were more likely to have MetS than males[15]; this could be due to physiological factors such as menopause-related hormonal changes, which can cause metabolic impairment in women[19].

Consistent with our outcomes, a study from Amman, Jordan, found no gender-based variation in the MetS frequency[22]. In the United States, MetS is more common in white males than females, while American blacks, Mexican Americans, Korean, Irani, Indian, and Kinmen women had a higher prevalence of MetS than men[23].

It is said that age significantly impacts the MetS frequency. Our study also found the highest frequency of MetS in patients aged (51 to 60 years), but the difference wasn't statistically significant. Zerga et al.[15] and many other investigators24 found that the odds of MetS increased with age. Physical activity levels are known to decrease with increasing age. Furthermore, with age, dependency increases, ultimately increasing exposure to multiple psychological conditions such as anxiety, depression, etc. In contrast to these studies and our results, an Australian study reported a negative association between age and MetS, possibly due to the death of patients in older age groups[25].

There are certain limitations of this study that must be taken into account. Firstly, the study was cross-sectional and conducted at a single healthcare facility. As a result, our findings do not represent a larger population of diabetics in the community. Secondly, only the effect of age and gender on the frequency of MetS in the enrolled diabetes patients were assessed, while there could also be many other significant factors contributing to the high frequency of MetS.

Conclusion

It is concluded from the study results that there is a high frequency of MetS among diabetics. Poor glycemic control was the most frequent MetS component, followed by hypertension, hypertriglyceridemia, and central obesity. There was no measurable change in the frequency of MetS concerning age or gender.

Conflicts of Interest

The author(s) have no conflicts of interest.

Acknowledgement

The authors would like to acknowledge the Medical Affairs department of Getz Pharma for their technical support and assistance in the publication process.

Funding

None.

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