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Assessment of metabolic syndrome in Kashmiri population with type 2 diabetes employing the standard criteria's given by WHO, NCEPATP III and IDF

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ABSTRACT

Background: Around 20–25 percent of the world's adult populations have the metabolic syndrome and they are twice as likely to die from heart attack or stroke compared with people without the syndrome. The World Health Organization proposed a definition for the metabolic syndrome in 1998 and later on NCEP ATPIII and IDF provided new definitions of this syndrome in 2001 and 2003 respectively. Very few studies have compared the different definitions to diagnose the metabolic syndrome in type two diabetics in India while as for Kashmir valley no such documented study has been carried out till date.
Objective: To study the prevalence of metabolic syndrome in type 2 Kashmir diabetics and to find out the degree of agreement between three different criteria given by WHO, NCEPATPIII and IDF for diagnosis of metabolic syndrome.
Materials and Method: A cross sectional study was conducted in one of the two tertiary care hospitals of Kashmir, India. About 1000 patients were selected and their demographic, clinical and biochemical parameters were studied after obtaining informed consent from each patient.
Results: Prevalance of metabolic syndrome was found to be highest(84.5%) while using WHO definition. Kappa statistic between WHO, ATP III and WHO, IDF definitions was 0.697 (95% CI 0.637-0.754) and 0.775 (95%CI 0.72–0.82) respectively while the degree of agreement between IDF and ATP III definitions was highest with kappa of 0.851 (95%CI 0.810–0.889).
Conclusion: Our study warrants for interventions to prevent the progression towards this syndrome among type 2 diabetics as early as the diagnosis of diabetes is made.

1. Introduction

The metabolic syndrome (sometimes also known as syndrome X or insulin resistance syndrome) has been recognized since the late 1980s. In 1988 it was Reaven who used the term syndrome X to refer to the tendency of glucose intolerance, hypertension, low high density lipoprotein (HDL) cholesterol and raised triglycerides, and hyperinsulinemia to occur in the same individual [1]. He proposed that the common feature of the syndrome is insulin resistance and that 'all other changes are likely to be secondary to this basic abnormality'. Most recently the International Diabetes Federation has proposed a new worldwide definition. The metabolic syndrome is a cluster of the most dangerous heart attack risk factors: diabetes and raised fasting plasma glucose, abdominal obesity, high cholesterol and high blood pressure [2]. It is estimated that around 20–25 percent of the world's adult population have the metabolic syndrome and they are twice as likely to die from and three times as likely to have a heart attack or stroke compared with people without the syndrome [2]. People with metabolic syndrome have a fivefold greater risk of developing type 2 diabetes adding to the 230 million people worldwide who already have diabetes, one of the most common chronic diseases worldwide and one of the leading cause of death in the developed world [3].

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The clustering of cardiovascular disease (CVD) risk factors in metabolic syndrome is now considered to be the impelling force for a new CVD epidemic. For diagnosis of metabolic syndrome various guidelines have been given by different organizations. The World Health Organization (WHO) initially proposed a definition for the metabolic syndrome in 1998. In 2001 the Third Report of the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III [ATPIII]) provided a new working definition of the metabolic syndrome. More recently IDF has added the newest definition for metabolic syndrome in 2006. These different definitions can lead to the difference in prevalence of metabolic syndrome in the same population.

The increased risk for morbidity and mortality associated with the metabolic syndrome, warrants for an understanding of the dimensions of this syndrome to prevent the community from having epidemic rise in this complex syndrome. There are differences in the prevalence of metabolic syndrome in different ethnic population due to difference in lifestyle, distribution of different risk factors, knowledge and awareness about metabolic diseases. Furthermore very few studies have compared the different definitions to diagnose the metabolic syndrome in type two diabetics [4,5]. There is more narrowing of the literature regarding this issue in India were studies regarding prevalence of metabolic syndrome in diabetics have been done by many researchers [6,7] but studies with comparison for different definitions of metabolic syndrome are very few [8,9] while as for Kashmir valley no such documented study has been carried out till date. Our study was aimed to assess the prevalence of metabolic syndrome among Kashmiri population with the type 2 diabetes using three different definitions of WHO, NCEPATPIII and IDF. Furthermore we wanted to see the difference in agreement among these definitions thus we compared them with each other (see Table 4).

2. Methodology: Materials and methods

Study Design: cross sectional hospital based study.

Study area: Shri Maharaja Hari Singh Hospital Srinagar (SMHS) which is one of the two tertiary care hospitals in the Kashmir valley with a inpatient bed capacity of about 750 beds.

Study duration: Two years (from 2010 to 2012).

2.1. Data collection

All the type 2 diabetic patients of age ≥40 years coming to the SMHS hospital for diagnosis and management of type 2 diabetes during the period of two years were taken for the study. Only those patients who were permanent residents of Kashmir and had no ancestral history of non Kashmir origin were taken for the study to include only ethnic Kashmir population. A total of 1000 patients were thus included in the study. After an informed consent from each patient a detailed interview was conducted using a semi structured questionnaire followed by clinical examination for weight, height and waist circumference. Biochemical tests for serum HDL, plasma triglycerides and urine examination for urinary albumin to creatinine ratio were also done. Socioeconomic status of study participants was measured by using modified Kuppasuami scale [10]. Weight was measured on standardized electronic weighing machine and height was measured by stadiometer. BMI was calculated using the formula weight in kg/height^2 in meters. Central or abdominal obesity was assessed by measuring the waist circumference at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest while the patient was standing upright [11]. BMI was categorized according to cut off points given by WHO and waist circumference was categorized according to NCEP ATP III [12] and IDF guidelines [13] given to define metabolic syndrome . History of hypertension and use of medications for hypertension was asked to each patient and for those having no history of hypertension blood pressure was checked to diagnose hypertension. The auscultatory method of BP measurement was used according to the guidelines of JNC7 [14]. Persons were seated quietly for at least 5 min in a chair, with feet on the floor, and arm supported at heart level. History of intake of Caffeine, exercise, and smoking at least 30 min prior to measurement was taken and patients with positive history were examined for blood pressure after 30 min. An appropriately sized cuff (cuff bladder encircling at least 80% of the arm) was used to ensure accuracy. Two measurements were made and the average blood pressure was recorded and classified according to JNC 7 guidelines for diagnosis of hypertension and according to NCEP ATP, IDF and WHO criteria for diagnosis of metabolic syndrome. HDL and serum triglycerides were measured and categorized according to levels given by WHO, NCEP ATP III and IDF criteria's. HDL levels were measured by accelerated selective detergent method and triglyceride levels were measured by glycerol phosphate oxidase method. Urinary Albumin was measured by using bromocresol green method while as Creatinine levels were measured by kinetic alkaline picrate method (see Table 2).

After getting all the above mentioned investigations, metabolic syndrome was defined in these patients by using three different diagnostic criteria given by:

1. World Health Organization (WHO) [15]
2. The third report of National Cholesterol Education Program Adult Treatment Panel
3. (NCEP: ATP III 2001) [13]
4. International diabetic federation (IDF) [2].

Table 1
Socio demographic variables of study population.

	Male: n (%)	Female: n (%)	Total
Age group			
40–49 years	104 (27.01%)	190 (30.89%)	294 (29.4%)
50–59 years	116 (30.12%)	169 (27.47%)	285 (28.5%)
60–69 years	139 (36.10%)	146 (23.7%)	285 (28.5%)
70–79 years	23 (5.9%)	92 (14.95%)	115 (11.5%)
80–89 years	3 (0.77%)	18 (2.92%)	21 (0.21%)
Total	385 (38.5%)	615 (61.5%)	1000 (100%)
Dwelling			
Urban	198 (51.4%)	345 (56.09%)	543(54.3%)
Rural	187 (48.5%)	270 (43.9%)	457(45.7%)
Socioeconomic Status			
Class I	11 (1.1%)	9 (0.9%)	20 (20%)
Class II	348 (34.8%)	352 (35.2%)	700 (70.0%)
Class III	370 (37%)	334 (33.4%)	704 (70.4%)
Class IV	271 (27.1%)	305 (30.5%)	576 (57.6%)
Duration of Diabetes			
<5 years	110 (28.57%)	180 (29.26%)	290 (29%)
5–10 years	122 (31.69%)	218 (35.44%)	340 (34%)
10–15 years	111 (28.83%)	149 (24.22%)	260 (26%)
15–20 years	29 (7.5%)	40 (6.5%)	69 (6.9%)
>20 years	13 (3.37%)	28 (4.5%)	41 (4.1%)

These are discussed below:

WHO criteria	NCEP ATP III criteria	IDF criteria
Metabolic syndrome defined by the following criteria	Presence of three or more of the following criteria defines	Metabolic syndrome identified by the following criteria
Insulin Resistance identified by one of the following: Type – 2 diabetes mellitus. Impaired fasting glucose Impaired glucose tolerancePlus any two of the following:	**metabolic syndrome:** Central Obesity: Waist circumference > 102 cm(Males), >88 cm (Females)	Waist Circumference: Men > 90cm Women > 80cmPlus two or more of the Following
Fasting Plasma Triglycerides >150 mg/dl (>1.7 mmol/L)	Fasting Plasma Triglycerides >150 mg/dl or on specific medications	Fasting plasma triglycerides ≥150 mg/dl or on specific medication
Antihypertensive medication and/or high BP (>140 mmHg systolic or >90 mmHg diastolic)	Blood pressure >130 mm systolic OR >85 mm diastolic or specific medication. Low HDL Cholesterol:	Blood pressure of ≥130 systolic or ≥85 mm diastolic or previous diagnosis or on specific medication
HDL Cholesterol < 35 mg/dl (<0.9 mmol/L) in men or <39 mg/dl (1.0 mmol/L) in women	HDL cholesterol <40 mg/dl and <50 mg/dl for males and females respectively or on Specific medication	HDL cholesterol <40 mg/dl and <50 mg/dl for men and women respectively or on specific medication
BMI >30kg/m2 and/or waist/hip ratio >0.9 (men), >0.85 (women)		
Urinary albumin excretion rate >20 mg/min or albumin/creatinine ratio >30 mg/g	Fasting plasma glucose: >110 mg/dl or specific medication or previously diagnosed type-2 diabetes	Fasting plasma glucose >100 mg/dl or previously diagnosed type-2 diabetes

After defining metabolic syndrome in the patients the prevalence of metabolic syndrome was calculated according to each criteria and degree of agreement between these criteria was assessed by calculating percent agreement and kappa statistics with 95%CI with the help of SPSS statistical software. Binary logistic regression was used to calculate the odds ratio with 95% CI to assess the predictors of metabolic syndrome in our study population. P value of <0.05 was considered to be statistically significant for all analysis.

3. Results

Our study population comprised of patients of age 40 years and above with type 2 diabetes. The mean age of participants was 57.6 ± 11.43 years. Around two third of the study subjects were females and only 38.5% were males. More than half of the study subjects belonged to urban areas (Table 1). Majority of study subjects belonged to the middle class of socioeconomic class according to modified Kuppasuami classification [10]. Maximum numbers of study participants were having diabetes since 5–10 years. Hypertension was present in about more than two third of the study subjects with about 81.8% of female diabetics having hypertension but only 65% of male diabetics having hypertension. Central obesity was present in 70% of the study subjects according to the criteria by NCEP ATP III with about 90% of female subjects having waist circumference more than 88 cm and only 41.3% males were having central obesity and this difference was statistically significant.

Table 2
Distribution of various criteria's for diagnosis of metabolic syndrome.

Variables	Male (Total 385) N (%)	Female (Total 615) N(%)	Total	P Value
Serum HDL (WHO) <35 mg/dl (M) <39 mg/dl (F)	127(32.9%)	311(50.5%)	438(43.8%)	<0.0001
Serum HDL (IDF, NCEP ATP) <40 mg/dl (M) <50 mg/dl (F)	177(45.9%)	424(68.9%)	601(60.1%)	P < 0.001
Plasma Triglycerides ≥150 mg/dl	158(41.1%)	352(57.2%)	510(51%)	p < 0.0001
Waist circumference (NCEPATP) ≥102 cm (M) ≥88 cm (F)	158(41.1%)	553(89.9%)	711(71.1%)	P < 0.0001
BMI (WHO) >30 kg/m^2	190(49.4%)	396(64.3%)	586(58.6%)	P < 0.001
Waist circumference (IDF) ≥90 cm (M) ≥80 cm (F)	165(42.8%)	584(94.9%)	749(74.9%)	P < 0.0001
Hypertension (As Per IDF, ATP)	254(65.9%)	501(81.4%)	755(75.5%)	P < 0.0001
Hypertension (as per WHO criteria)	250(64.9 %)	498(80.9%)	748(74.8%)	P < 0.0001
Urinary Albumin/Creatinine Ratio (mg/g) >30 mg/g	258(67.1%)	363(59.1%)	621(62.1%)	P = 0.007

Table 3
Prevalence of metabolic syndrome in our study population according to the three definitions.

Definition used	Metabolic syndrome present (N;%)		
	Male	Female	Total
WHO	286 (74%)	559 (90.8%)	845 (84.5%)
IDF	254 (65.9%)	541 (87.9%)	795 (79.5%)
NCEP ATP	246 (63.8%)	534 (86.8%)	780 (78%)

Table 4
Agreement between the definitions.

Criteria	Kappa statistics with 95% CI	Percent agreement
WHO AND IDF WHO AND	0.775 (0.720–0.24)	93.3%
NCEPATP	0.697 (0.637–0.754)	90.7%
NCEPATP IDF	0.851 (0.810–889)	95%

Table 5
Predictors of metabolic syndrome in our study population.

Parameter	Odds ratio	P value
Low HDL	2.4 (1.321–4.3)	0.004
High serum triglycerides	2.89 (1.680–4.9)	<0.001
Hypertension	6.16 (3.547–10.7)	<0.001
BMI $\geq$ 30	3.76 (1.8–7.6)	<0.001
Urinary albumin to creatinine ratio	4.12 (2.67–6.54)	<0.001

Obesity as per the WHO criteria (BMI $\geq$ 30) was present in about more than 50% of subjects with about more than two third of females being obese and only around half of the males being obese. Regarding biochemical parameters we found that both HDL and serum triglycerides, were deranged in around half the patients with both of them being deranged in more female patients than males and the difference was highly statistically significant.

While assessing the prevalence of metabolic syndrome according to different definitions we also found the difference in gender distribution for the prevalence as shown in Table 3 and this difference was statistically significant in all the three criteria's. NCEPATP III patients of type 2 diabetes having 2 or more criteria for diagnosis of Metabolic Syndrome were 780 (78%) out of which 246 (31.5%) were male and 534 (68.46%) were females. with statistically significant difference between the two ($p < 0.0001$). The prevalence of metabolic Syndrome as per WHO criteria in studied patients was 84.5% (74.2% in males and 90.89% in females) with statistically significant difference between the two genders ($p < 0.0001$) but as per IDF criteria the prevalence was 79.5% (65.97% for males and 87.96% for females) with statistically significant difference between the two genders ($p < 0.0001$).

The degree of agreement (kappa statistic) between WHO, ATP III and WHO, IDF definitions as shown in Table 4 was found to be highest between IDF and ATP III definitions.

We found among low HDL, high triglycerides, obesity and hypertension the strongest predictor for metabolic syndrome was hypertension with odds ratio of 6.16 with 95% CI of 3.547-10.7 followed by obesity with odds ratio of 3.76 (Table 5).

4. Discussion

Our study was specifically designed for ethnic Kashmir type 2 diabetics to find the prevalence of metabolic syndrome in them and to understand the difference in agreement between three definitions of metabolic syndrome given by WHO, NCEP ATPIII and IDF in our population. We found a substantially high frequency of metabolic syndrome in people with type 2 diabetes using all the three definitions with highest prevalence found by WHO criteria. The reason for WHO criteria being more sensitive for metabolic syndrome could be because of our population having raised BMI at a high frequency and requirement of only two of the five criteria in addition to type 2 diabetes. Like most of the studies our study also found higher prevalence of metabolic syndrome in females [16,17]. Hypertension and obesity were the strongest predictors of metabolic syndrome in our study population while comparing the predictors given in WHO criteria, supporting our results studies suggest that metabolic syndrome is found in about one third of patients having primary hypertension without diabetes [18,19]. The prevalence of metabolic syndrome found in our study is quite comparable to other studies done among Indian and Asian population. Similar level of prevalence of metabolic syndrome has also been found by studies done in other continents with Several studies showing prevalence ranging from as low as 25% to as high as more than 90% in type 2 diabetes patients [20–22]. Our study found the maximum agreement between IDF and NCEP criteria with kappa being in the range of almost perfect agreement where as there was a substantial agreement between the WHO and NCEP; WHO and IDF criteria. Studies in Asia have found different results regarding this with some studies favoring our results [17,23] and few studies giving results different to ours [24]. The reasons could be difference in the distribution of parameter used to assess the prevalence of metabolic syndrome in different ethnogeographic populations. In a study done by Asma Ahmed et al. [17] in Pakistan similar results were found as in our study, they found maximum agreement between the IDF and NCEP criteria. In another study done by SP Spurna et al. [25] in India they found almost similar prevalence of metabolic syndrome in type 2 diabetics using the NCEP criteria. Many other international studies have found very good agreement between the two definitions of IDF and NCEP [22,26–28]. Such a high prevalence of metabolic syndrome in our study population of type 2 diabetics is of great concern as the cardiovascular, cerebrovascular and other mortalities increase with the presence of metabolic syndrome in type two diabetics. Furthermore highest prevalence of metabolic syndrome in our population was found by using WHO criteria.

5. Conclusion

Metabolic syndrome is associated with increased morbidity and mortality especially in diabetic's. Our study population had a high prevalence of this syndrome especially in women and maximum agreement was between the definition given by IDF and NCEP but highest prevalence was obtained by WHO criteria. Our study warrants for interventions to prevent the progression towards this syndrome among type 2 diabetics as early as the diagnosis of diabetes is done.

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