ORIGINAL ARTICLE

Frequency and predictors of metabolic syndrome in adolescents /first year medical students of a public sector medical college Quetta, Pakistan

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Abstract

Objective: To determine the prevalence of metabolic syndrome in medical students.

Methods: This cross-sectional study was conducted at the Bolan Medical College, Quetta, Pakistan, from August 2015 to January 2016, and comprised healthy first-year medical students. Demographic data was assessed using a self-administered questionnaire. Height, weight and waist circumference were measured along with fasting blood sugar, high-density lipoprotein and triglycerides by using automated biochemistry analyser. SPSS 20 was used for data analysis.

Results: Of the 225 participants, 127(56.4%) were females. The overall mean age was 18.80±0.426 years. Frequency of metabolic syndrome was 32(14.2%). Increased waist circumference, fasting blood sugar and triglycerides were associated with an increased likelihood of exhibiting metabolic syndrome (p<0,05 each). Male gender and high-density lipoprotein were found to be protective against metabolic syndrome (p<0.05 each).

Conclusion: The prevalence of metabolic syndrome is increasing in our adolescent population which demands screening from childhood and early adolescence.

Keywords: Metabolic syndrome, Adolescents, Prevalence. (JPMA 67: 752; 2017)

Introduction

Metabolic syndrome (MetS) is pathophysiologically defined as a problem of energy consumption and storage. According to the International Diabetes Federation (IDF), MetS in adolescents aged more than 16 years is defined as "the presence in an individual of central obesity and any two of the following four risk factors: hypertriglyceridemia, hypertension, low high-density lipoprotein (HDL) and high fasting glucose levels.[1]

It has been reported that around 25 per cent of the world's adult population suffers from MetS. Mortality in individuals with MetS due to heart attack or stroke is twice as compared to those without MetS. Similarly, they are three times more prone to get a heart attack or stroke in contrast to people without the syndrome.[2]

The MetS is a well-recognised entity in adults. Evidence from multiple clinical studies has shown that it starts in childhood and tracks through later life. It has also been found that these components progressively cluster over time.[3] Therefore, it becomes extremely important to know the burden of MetS in adolescents in order to implement preventive strategies. In the recent past, due to the potential detrimental effects of obesity and MetS in adolescents, MetS has become the focus of interest. Researches from different parts of the world have shown that the factors of MetS, which are abnormal in early childhood and adolescence, often persist throughout adulthood.[4,5]

MetS is considered as an antecedent of type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD).[6] According to the IDF, this new generation would be the first generation where offspring may die before their parents due to diabetes and CVD.[7]

Tailor et al. estimated the prevalence of MetS in children and adolescents ranging from 1.2% to 22.6%. In the overweight and obese individuals, these rates were observed to be as high as 60%.[8]

Rizzo et al. in 2013 identified MetS in 18% of Brazilian adolescents.[9]

Ramzan et al. conducted a study on eighty-six schoolchildren in Dera Ismail Khan, Pakistan, in 2010 and found MetS in 22.5% of the obese children.[10]

Primary care physicians must be aware that risk factors for T2DM and CVD may constellate in children and adolescents, especially if they are overweight and obese. However, in children the components of MetS are not commonly recognised by physicians in their day-to-day practice. It is emphasised that early recognition of children at risk and detection of MetS at an initial age are extremely crucial for the prevention of atherosclerosis, T2DM and coronary artery disease during adolescence

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and later life.[11]

MetS is an important predictor of cerebrovascular disease and T2DM which tracks into adulthood. Therefore, early recognition of different components of MetS in childhood and adolescence is essential.[12]

Therapeutic lifestyle changes, maintenance of high levels of physical activity and normal weight are most important strategies for prevention of MetS in adolescents. Screening adolescents and young adults for MetS can prevent development of coronary artery disease, dyslipidaemia and diabetes mellitus through lifestyle modifications. The current study was planned to determine the frequency of MetS, its predictors and its individual components in adolescent first-year students.

Subjects and Methods

This cross-sectional study was conducted at the Bolan Medical College (BMC), Quetta, Pakistan, from August 2015 to January 2016, and comprised first-year medical students aged between 17 and 19 years. First-year students were selected because of convenience and limited finances.

Non-probability convenience sampling was used. Students who were not willing to participate, having hypothyroidism or using corticosteroids were excluded.

Approval was obtained from the ethics review committee of the University of Balochistan. Written consent was taken from the principal of BMC and all participants. The names of participants were kept confidential and they were assigned a computer-generated identity.

Data was collected through a self-administered questionnaire which took about 10 minutes to be filled out. A trained health worker measured the height, weight and waist circumference (WC) of all the participants. Weight was measured with clothes only using bathroom scale to the nearest 0.1kg. Height was measured without shoes, on a flat surface to the nearest 0.1cm using wall-mounted stadiometer. After measurements, body mass index (BMI) was plotted on gender-specific 'BMI for age' growth curves standardised by the World Health Organisation (WHO).[13] Central obesity was measured according to the IDF criteria for South Asians.[1,2]

Analysis of samples for fasting blood sugar (FBS), HDL and triglycerides (TG) was done by using an automated biochemistry analyser. IDF cut-offs for anthropometric measures and biochemical values to define metabolic syndrome were used.

Data was analysed using SPSS 20. Mean and standard deviation (SD) were calculated for age, FBS, TG, systolic blood pressure (SBP), diastolic blood pressure (DBP), WC and HDL. Chi-square test was applied to determine the association of MetS with gender and BMI status. Logistic regression was applied to determine the predictors of MetS. Confidence level for this study was kept at 95%. P<0.001 was considered statistically significant.

Results

Of the 255 students approached, 225(88.2%) responded. Of them, 98(43.6%) were males and 127(56.4%) females. The overall mean age was 18.80±0.4 years (range: 17-19 years). Moreover, 64(28.4%) participants were Pathans, 56(24.9%) Balochs, 46(20.4%) Urdu-speaking and 24(10.7%) Punjabis.

MetS was found in 32(14.2%) participants, including 15(46.9%) males and 17(53.1%) females (p=0.683) (Figure).

Furthermore, 48(21.3%) participants had central obesity. The components of MetS which were found to be more prevalent in females were low HDL levels (p<0.001) and high-risk WC (p<0.001), while males had significantly higher FBS levels (p=0.038), TG (p=0.000), SBP (p=0.021) and DBP (p=0.008) compared to females (Table-1).

The frequency of MetS was higher in overweight

Table-1: Gender Comparison of frequencies of each component of MetS.

Components of MetS	Male	Female	p-value
Impaired FBS	32(55.2)	26(44.8)	0.038
High TG	59(56.7)	45(43.3)	<0.001
Low HDL	39(34.5)	74(65.5)	<0.001
High risk Waist circumference	19(39.6)	29(60.4)	<0.001
High Systolic blood pressure	23(60.5)	15(39.5)	0.021
High Diastolic blood pressure	31(59.6)	21(40.4)	0.008

MetS: Metabolic syndrome
FBS: Fasting blood sugar
TG: Triglycerides
HDL: High-density lipoprotein.

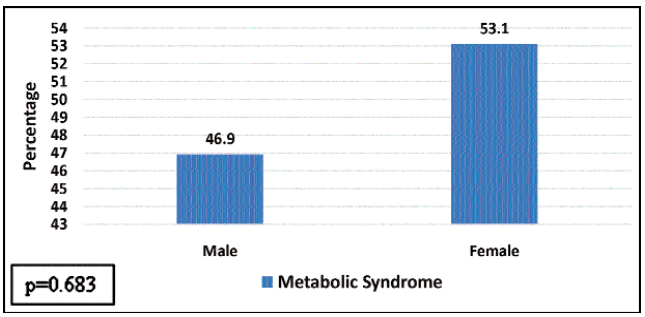

Figure: Frequency of metabolic syndrome.

Table-2: Logistic Regression predicting likelihood of MetS based on gender, anthropometric measurements, systolic blood pressure and lipid profile and fasting blood sugar.

	B	S.E.	Wald	df	p-value	Odds Ratio	95% C.I. for Odds Ratio	
							Lower	Upper
Male	-5.435	1.890	8.265	1	0.004	0.004*	0.000	0.177
Height	-0.182	0.098	3.464	1	0.063	0.833	0.688	1.010
Weight	-0.137	0.074	3.425	1	0.064	0.872	0.754	1.008
WC	0.754	0.189	15.870	1	0.000	2.126*	1.467	3.081
SBP	0.005	0.047	0.013	1	0.910	1.005	0.917	1.102
DBP	-0.047	0.070	0.451	1	0.502	0.954	0.831	1.095
FBS	0.217	0.071	9.215	1	0.002	1.242*	1.080	1.429
TG	0.030	0.010	8.263	1	0.004	1.030*	1.010	1.051
HDL	-0.105	0.043	5.982	1	0.014	0.901*	0.828	0.979

SBP: Systolic blood pressure. DBP: Diastolic blood pressure. FBS: Fasting blood sugar. TG: Triglyceride. HDL: High-density lipoprotein. MetS: Metabolic syndrome. B: Exponential Beta.
SE: Standard Error. Df: Difference. CI: Confidence interval.

53(23.5%) and obese 175(77.8%) classes of BMI.

Logistic regression model was statistically significant (p<0.0005). The model explained 83.8% variance in MetS and correctly classified 217(96.4%) of the cases. Sensitivity was 87.7%, specificity was 97.9%, positive predictive value (PPV) was 85.2% and negative predictive value (NPV) was 92%. Of the nine predictor variables, 5(55.6%) were statistically significant, including male gender, WC, FBS, TG and HDL. Increased WC had 2.1 times higher odds to exhibit MetS. Similarly, high FBS levels (odds ratio [OR]=1.2) and high TG levels and BMI in obese range (OR=1.4) were associated with an increased likelihood of exhibiting MetS. Male gender (OR=0.0) and high HDL (OR=0.9) had decreased likelihood of exhibiting MetS.

Discussion

MetS is diagnosed with a constellation of clinical and anthropometric tests. The current study was planned to determine the frequency of MetS, its components and predictors in adolescents. The frequency of MetS in our study was 14.2%, which was similar to the results of a study conducted in the United States estimating a prevalence of 12.9% in Mexican-Americans and 13.4% in Hispanics.[14] In contrast, an Indian study by Singh R. et al. reported the prevalence of MetS at 4.2%.[15] Other studies from different regions of the world showed a prevalence of 6 to 11%.[16-19] This difference could be due to the difference in ethnicity, dietary and physical activity patterns in different regions of the world.

The most common abnormal component of MetS in our study was low HDL (50%) followed by high TG (46.2%), FBS (25.2%), DBP (23.1%), WC (21.3%) and SBP (16.9%). These findings were consistent with those from a study conducted in Lahore in 2011 which again reported low HDL (87.6%) as the most common abnormality followed by SBP (23.8%), WC (23.8%) and DBP (15%). In contrast to our study, high FBS and TG levels were found to be least prevalent.[20]

A regression analysis of our study showed high risk WC as the strongest predictor of MetS followed by impaired FBS and high TG. A cross-sectional survey from Iran found that WC was the superior body measurement parameter as compared to BMI and waist-hip ratio in determining MetS among healthy individuals.[21] A study from Cyprus also reported WC as a significant predictor for all the risk factors for cardiovascular disease.[22] As a result of correlation between WC and abdominal adiposity, WC has now taken over BMI in predicting cardiovascular risks.[23-25] A possible explanation for this limitation of BMI is that despite having similar BMI, children and adolescents differ largely in their total body fat composition and percentage body fat.

Fasting TG level was also found to be an independent predictor of MetS which was comparable with the findings of Hobkirk JP et al.[26]

FBS was also strongly associated with MetS in our study reinforcing the results of studies from different parts of the world. The importance of impaired FBS is that it has been positively associated with cardiovascular events.[27]

According to the results of this study, SBP and DBP were not identified as predictors of MetS, which is in marked contrast to results of an earlier study which stated that high SBP was the strongest predictor of MetS followed by WC and FBS.[28]

Conclusion

The prevalence of MetS was high. Early screening, identification and lifestyle interventions can help decrease the morbidity from chronic illnesses like

coronary artery disease and diabetes mellitus.

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