Metabolic syndrome: A risk factor for myocardial infarction and diabetes in young Britons

Farhad Motazed Kaivani, Mahantesh Urolagin, Erwin Rodrigues, Gershan Davis

The metabolic syndrome is increasingly being recognised as a major risk factor for coronary heart disease and diabetes in the young. However, there are limited published data on this phenomenon among the young British population. We conducted an observational study and showed the presence of the metabolic syndrome and type 2 diabetes in a significant proportion of young people presenting with acute myocardial infarction. With obesity reaching epidemic proportions in the UK, our findings will be particularly relevant in the primary care setting. The identification and treatment of young Britons with the metabolic syndrome will be important in the prevention of long-term morbidity and mortality.

The metabolic syndrome comprises a constellation of risk factors associated with atherosclerotic cardiovascular disease, type 2 diabetes and their complications. The major causes of the metabolic syndrome are intra-abdominal adiposity and insulin resistance.

Differences in body-fat distribution associated with an altered metabolic profile were documented in the medical literature 50 years ago and it was dubbed Syndrome X in 1988 (Grundy et al, 2004). The World Health Organization (WHO) published the first clinical definition of the metabolic syndrome in 1998 (Alberti and Zimmet, 1998), which was revised the following year (WHO, 1999). The National Cholesterol Education Programme published a revised definition in 2002 (Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults). This was followed in 2005 by the International Diabetes Federation's (IDF's) definition (Alberti et al, 2005), which was most

Article points

1. The metabolic syndrome is increasingly being recognised as a major risk factor for coronary heart disease and diabetes in the young.
2. The identification and treatment of young Britons with the metabolic syndrome will be important in the prevention of long-term morbidity and mortality.
3. The metabolic syndrome and diabetes mellitus are present in a significant proportion of young people presenting with acute myocardial infarction.

Key words

- Metabolic syndrome
- Myocardial infarction
- Central obesity
- Body mass index

Authors' details can be found at the end of this article.

recently revised in 2006 (IDF, 2006). The IDF definition stresses the presence of central obesity in diagnosing the metabolic syndrome.

As a result of current lifestyle choices and increasing obesity, the metabolic syndrome is becoming a major global health problem. Studies in the US have shown that more than one half of adults are obese or overweight (Centers for Disease Control and Prevention, 2008). It has been estimated that the metabolic syndrome will soon overtake cigarette smoking as the primary risk factor for cardiovascular disease (Eckel and Krauss, 1998). Grundy et al (2004) reported that the metabolic syndrome is an even stronger predictor of type 2 diabetes than traditional risk factors. However, there are very limited data published that examine the metabolic syndrome among the young British population.

Table 1. The International Diabetes Federation definition of the metabolic syndrome (2006).*

For a person to be defined as having the metabolic syndrome they must display **central obesity** (waist circumference ≥94cm for Europid men and ≥80cm for Europid women, with ethnicity specific values for other groups**) and any two of the following four factors:

1. Raised triglyceride level (≥8.3mmol/L, or specific treatment for this lipid abnormality)

2. Reduced HDL-cholesterol level (<2.2mmol/L in males and <2.7mmol/L in females, or specific treatment for this lipid abnormality)

3. Raised blood pressure (systolic blood pressure ≥130mmHg, or diastolic blood pressure ≥85mmHg, or treatment of previously diagnosed hypertension)

4. Raised fasting plasma glucose level (≥5.6mmol/L, or previously diagnosed type 2 diabetes. If fasting plasma glucose is above 5.5mmol/L, an oral glucose tolerance test is strongly recommended but is not necessary to determine the diagnosis of the metabolic syndrome)

*Volumes have been converted from mg/dL to mmol/L; **in the present study, BMI >28kg/m^2 has been substituted for this definition.

Methods

We conducted an observational study over a 15-month period from September 2003 to December 2004. All young people (<45 years of age) presenting to University Hospital Aintree, Liverpool with an acute myocardial infarction, both ST segment elevation and non-ST segment elevation, were examined. Our study consisted of 68 consecutive people who fell into this category.

The IDF definition (2006) was used to determine the presence of the metabolic syndrome. Central obesity was used as the primary criterion. Where two or more of the four factors listed in *Table 1* were found in addition to central obesity, the person was defined as having the metabolic syndrome. A BMI >28kg/m^2 was substituted for a waist circumference ≥94cm for Europid men and ≥80cm for Europid women in the definition of obesity. This substitution is one most observers would accept as satisfactory and

Table 2. Baseline parameters of people included in the study group.*

	With metabolic syndrome		Without metabolic syndrome	
	Mean	Median	Mean	Median
BMI	32.5	31.8	24.5	24.0
Fasting glucose (mmol/L)	6.2	5.9	5.5	5.2
HDL-cholesterol (mmol/L)	2.1	2.1	2.1	2.1
Triglyceride (mmol/L)	10.8	10.3	8.3	6.8
Total cholesterol (mmol/L)	12.0	11.8	10.5	10.5
Mean blood pressure (mmHg)	84.2	90	77	80

* Data recorded in mg/dL, here converted to mmol/L

was previously used by Ridker et al (2003) in their analysis of the metabolic syndrome in the Women's Health Study.

Results and statistical analysis

Of the 68 people included in the study, 53 had all the necessary data to determine the presence or absence of the metabolic syndrome. Of these, a significant number of people (*n*=39, 73.6%) met the IDF criteria for having the metabolic syndrome.

Differences were found in the mean blood pressure, BMI, and fasting glucose, total cholesterol and triglyceride levels between those with and without the metabolic syndrome (*Table 2*). Among those with the metabolic syndrome (*n*=39), three (7.7%) had a history of diabetes and a further nine (23.1%) were diagnosed with diabetes at the time of presentation. Among those without the metabolic syndrome (*n*=14), one (7.1%) had a history of diabetes and one (7.1%) was diagnosed with diabetes at the time of presentation (*Figure 1*). In total, the prevalence of diabetes was more than double in those with the metabolic syndrome (30.8%) as compared to those without the metabolic syndrome (14.3%). Analysing the between group difference yielded a chi-squared value of 0.48 with a 95% confidence interval of 0.31–0.65. As the confidence interval does not contain zero, the difference between the groups is statistically significant (*Table 3*).

Discussion

This pilot observational study in our institution demonstrates that a significant proportion of young people with the metabolic syndrome are at high risk of acute myocardial infarction and type 2 diabetes. In the UK healthcare system, this association will have particular relevance in the primary care setting; these high-risk individuals need to be identified and treated to avoid increased risk for the associated complications. Grundy et al (2004), in their report for the American Heart Association and the National Heart, Lung and Blood Institute, state that "because of a documented high relative risk for atherosclerotic coronary vascular disease events and type 2 diabetes, the metabolic syndrome undoubtedly carries a relatively high lifetime risk for these disorders even when short term (10 years) risk is in the low to moderate range."

Grundy et al (2005) reported that the risk for atherosclerotic coronary vascular disease associated with the metabolic syndrome is greater than the sum of its risk factors and the risk rises geometrically, not linearly. Further, they suggested that management of the metabolic syndrome is a secondary target for reducing cardiovascular events, while smoking cessation, lowering LDL-cholesterol levels and blood-pressure management are the primary targets for risk reduction. Lifestyle interventions to mitigate the modifiable risk factors, such as obesity, physical inactivity and atherogenic

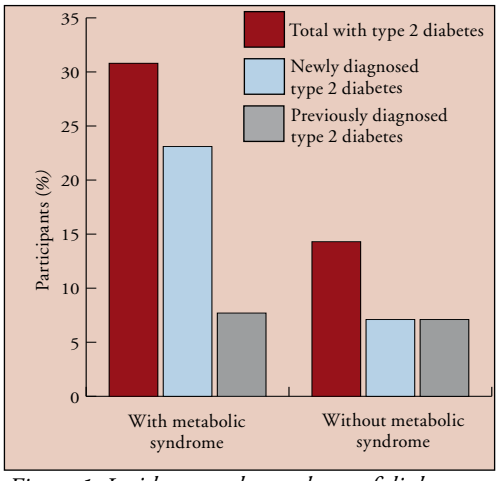

Figure 1. Incidence and prevalence of diabetes among those with the metabolic syndrome.

Page points

1. This pilot observational study demonstrates that a significant proportion of young people with the metabolic syndrome are at high risk of acute myocardial infarction.
2. Lifestyle interventions to mitigate the modifiable risk factors such as obesity, physical inactivity and atherogenic diet are the initial therapies recommended.

Table 3. Diabetes diagnoses among the study group.

		Diabetes diagnoses type		
		Previously diagnosed *n* (%)	Newly diagnosed *n* (%)	**Total *n* (%)**
Group*	With MS	3 (7.7)	9 (23.1)	12 (30.8)
	Without MS	1 (7.1)	1 (7.1)	2 (14.3)

*The between group difference was found to be statistically significant (chi-squared=0.48, 95% confidence interval [0.31, 0.65]); MS, metabolic syndrome.

Page points

1. If lifestyle changes are not sufficient to manage the risks associated with the metabolic syndrome, drug therapies for abnormalities of the individual risk factors may be necessary.
2. Identifying young people at high risk of the metabolic syndrome in our communities is becoming increasingly important.
3. Identifying these young people will allow healthcare professionals to initiate lifestyle interventions and therapies with the aim of decreasing long-term morbidity and mortality.

diet, are the initial therapies recommended for treatment of the metabolic syndrome (Grundy et al, 2005). The current available evidence suggests that individuals with the metabolic syndrome may benefit from behavioural therapy targeted towards weight loss and exercise. Knowler et al (2002) and Tuomilehto et al (2001) have both demonstrated that such lifestyle measures can reduce the risk of diabetes by up to 58%.

If lifestyle changes are not sufficient to manage the risks associated with the metabolic syndrome, drug therapies for abnormalities of the individual risk factors may be necessary. Promisingly, more recent therapies have been developed that target the possible underlying cause of the metabolic syndrome (intra-abdominal adiposity).

Our study is limited by the small number of people involved. All of the people studied were British Caucasians, and lived in the same geographical area. Reproducing this study with a larger sample size, and the involvement of a number of geographical regions, would provide valuable data on the metabolic syndrome as a risk factor for myocardial infarction and diabetes in the wider population of people aged <45 years.

Identifying young people at high risk of the metabolic syndrome in our communities is becoming increasingly important. Identifying these young people will allow healthcare professionals to initiate lifestyle interventions and therapies with the aim of decreasing long-term morbidity and mortality. ■

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