Cardiovascular Topics

Frequency of the metabolic syndrome in screened South African corporate executives

JA KER, P RHEEDER, R VAN TONDER

Summary

***Aim*: The aim of the study was to determine the frequency of the metabolic syndrome in a specific group of people.**
***Patients and methods*: The ATP III criteria were used to identify the metabolic syndrome in a group of 1 410 corporate executives belonging to a specialist health and fitness company in South Africa.**
***Results*: Using three criteria as specified by the ATP III panel, 31% of this group of corporate executives fulfilled the criteria for the diagnosis of the metabolic syndrome. In a small subset of black executives, a similar finding was obtained. Another one-third of the executives had two criteria of the metabolic syndrome.**
***Conclusion*: The metabolic syndrome was common in a group of corporate executives.**

Cardiovasc J South Afr 2007; **18**: 30–33 www.cvjsa.co.za

The metabolic syndrome (MS), a cluster of metabolic abnormalities with insulin resistance as the underlying major characteristic, has been known by several names since 1923.[1] In 1936, Himsworth was the first to recognise that defects in the action of insulin may effect different types of blood glucose responses in diabetes mellitus.[2] In 1988 Reaven expanded on the concept of human disease secondary to insulin resistance and demonstrated that insulin resistance was the central problem resulting in a clustering of cardiovascular risk factors, including hypertension, glucose intolerance and dyslipidaemia. He named it syndrome X.[3] Central obesity has since been recognised as the fourth member of this so-called 'deadly quartet'.[4]

In 1998 the World Health Organisation proposed a unifying definition and named it the metabolic syndrome rather than syndrome X or the insulin resistance syndrome.[5] The Adult Treatment Panel III (ATP III) has recognised the importance of the metabolic syndrome as a clinical entity. They proposed criteria for the diagnosis, and deemed any three of these criteria as sufficient for diagnosis.[6] These criteria are: abdominal circumference more than 102 cm in men, and more than 88 cm in women; serum high-density lipoprotein cholesterol (HDL-C) below 1.0 mmol/l in men, and below 1.3 mmol/l in women; fasting serum triglycerides (TG) 1.70 mmol/l or above; fasting serum glucose 6.1 mmol/l or above; hypertension, defined as a blood pressure of 130/85 mmHg or above, or on anti-hypertensive therapy.

The major adverse consequences of the metabolic syndrome are an increased risk to develop cardiovascular disease and diabetes mellitus. The presence of the syndrome is associated with a three-fold increased risk of coronary heart disease, myocardial infarction and stroke.[7]

In age-adjusting estimates from the National Health and Nutrition Examination Survey III up to 1994, approximately 24% of adult Americans had three or more of the criteria of the metabolic syndrome.[8] The Botnia study from Finland and Sweden demonstrated that 10% of persons with normal glucose tolerance, 40% of those with impaired glucose tolerance and 85% of type 2 diabetics had the metabolic syndrome.[9]

Certain ethnic groups, including Hispanics and South Asians seem to be particularly susceptible to the syndrome.[10] Statistics currently available in South Africa show a prevalence of type 2 diabetes mellitus in the Indian population of 13%, in the black population 5 to 8%, and the white population 4%,[11] but there are no known prospective data on the prevalence of the metabolic syndrome.

The aim of this study was to determine the frequency of the metabolic syndrome in a group of corporate executives.

Research design

This was a quantitative, non-experimental, descriptive, observational study. To be included in the study the participant had to be within the age group 30 to 60 years and be working for a company for more than one year. Anyone with any known cardiovascular disease: hypertension, myocardial infarction,

Department of Internal Medicine, School of Medicine, University of Pretoria, Pretoria

JA KER, MMed (Int), MD
R VAN TONDER, MB ChB, MMed (Int)

Division of Clinical Epidemiology, School of Medicine, University of Pretoria, Pretoria

P RHEEDER, MB ChB, MMED (Int), FCP (SA), MSc (Clin Epidem), PhD (Utrecht)

stroke or type 2 diabetes mellitus was excluded.

Informed consent from all involved parties, namely the participants and the company, were obtained. Confidentiality and anonymity of every participant was maintained and all data were kept private. Ethical approval was obtained from the ethics committee of the University of Pretoria.

For analysis of the descriptive statistics, the Epi info package was used.

Materials and methods

The participants in the study were all corporate executives of companies that were also clients of a specialist health and fitness company providing a health examination for executives as a service to various companies.

A sample of 1 410 consecutive male and female corporate executives, aged 30 to 60 years, belonging to the health and fitness company, was included in the study. No specific selection method was used. The relevant data were gathered from the data resources of the company. All the participants had fasting serum glucose, triglycerides and HDL-C levels determined.

A complete baseline physical examination was done by a physician. None of the participants was aware of any pre-existing illnesses such as type 2 diabetes mellitus (T_2DM), hypertension or increased levels of cholesterol, and none was taking any medication. Waist circumference was measured using a standard tape measure, with the participants standing upright, after gentle expiration, at a point measured midway between the lower costal margin and the upper border of the iliac crest.

Blood pressure was measured on the left arm with the relaxed participant in a sitting position, using a calibrated mercury sphygmomanometer. The blood pressure cuff was long enough to circle the upper arm. The width of the cuff covered at least two-thirds of the upper left arm. The systolic blood pressure was measured at Korotkoff I and the diastolic blood pressure at Korotkoff IV. The mean of two measurements was taken as the recorded data.

Results

The total number of participants examined was 1 410. Eighteen had some data missing and were excluded, so the total number of participants with a complete set of data was 1 392, of which 1 351 had abnormal data. Only 41 participants had no abnormality, representing only 2.9% of the entire group.

Those with only one component of the metabolic syndrome represented 30% (419 cases) of the total, and those with two components represented 36% (507 cases) of the total group. Those with three or more components of MS and therefore fulfilling the criteria for a diagnosis of the metabolic syndrome represented 31% (425 cases) of the group. Table 1 demonstrates the demographic data of the participants. There were only a few female participants and their data were therefore not analysed separately.

Table 2 demonstrates the different components of the metabolic syndrome in the total group of participants. More than 80% of the participants had an abnormally elevated serum triglyceride level. The prevalence of hypertension (diagnosed as BP ≥ 130/85 mmHg) was 29%. At least 40% of all participants had an abnormally large waist circumference.

There were 93 black participants in this study and 28 of these fulfilled the criteria for the metabolic syndrome (30% of the total group of blacks). Thirty-seven (40%) had high blood pressure (defined as ≥ 130/85 mmHg) and 39 (42%) an abnormally low HDL-C level. Abnormally large waist circumference was present in 24 blacks (26%).

Table 3 describes the role of central obesity in all of the participants.

There were 58 cases of newly diagnosed asymptomatic type 2 diabetes mellitus in the total group of participants, using the criterion fasting glucose of ≥ 7 mmol/l. Fig. 1 shows the occurrence of newly diagnosed type 2 diabetes in relation to the components of the metabolic syndrome. The majority of cases of type 2 diabetes occurred in the presence of hypertension plus large waist circumference plus abnormal lipids, ie, low HDL-C, elevated triglycerides. This occurred in 29 cases, representing 50% of the total group of diabetics.

TABLE 1. DEMOGRAPHIC DATA OF 1 392 PARTICIPANTS

	Mean (SD)
Males (*n*)	1 367
Females (*n*)	25
Blacks (*n*)	93
Age (years)	46 (± 7.9)
Systolic blood pressure (mmHg)	128.3 (± 13.8)
Diastolic blood pressure (mmHg)	80.6 (± 9.8)
Waist circumference (cm)	101.2 (± 10.7)
S-glucose (mmol/l)	5.4 (± 1.2)
S-HDL-C (mmol/l)	0.99 (± 0.12)
S-TG (mmol/l)	2.64 (± 1.3)

S-HDL-C: serum high-density lipoprotein cholesterol; S-TG: serum triglycerides.

TABLE 2. PREVALENCE OF THE DIFFERENT COMPONENTS OF THE METABOLIC SYNDROME IN THE TOTAL GROUP OF PARTICIPANTS

	n *(%)*
Hypertension (≥ 130/85 mmHg)	408 (29)
Abnormal waist circumference	555 (40)
Abnormal glucose levels	169 (12)
Low HDL-C	539 (38)
Elevated TG	1137 (81)

TABLE 3. ROLE OF WAIST CIRCUMFERENCE (CENTRAL OBESITY)

	n *(%)*
Abnormally large waist circumference alone	33 (2)
Abnormal waist + elevated triglycerides	161 (11)
Abnormal waist + elevated teriglycerides + low HDL-C	130 (9)
Abnormal waist + hypertension only	12 (0.9)
Abnormal waist + low HDL-C	16 (1)

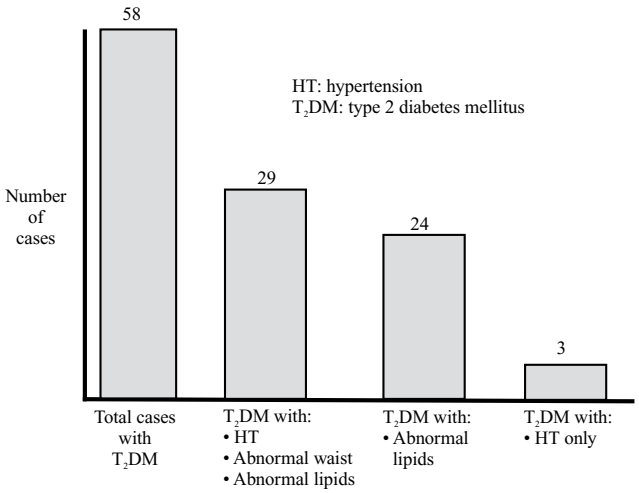

Fig. 1. Newly diagnosed diabetes mellitus in relation to components of the metabolic syndrome.

Discussion

In the current study we applied the criteria for the metabolic syndrome as proposed by the ATP III guideline. There are several proposed clinical definitions for the metabolic syndrome and these proposals have recently been harmonised in the Adult Treatment Panel III criteria[6] and the International Diabetes Federation criteria.[12] The two are not that different, with each having five virtually identical components, three of which can confer a diagnosis. They represent a simple clinical way in medical practice to identify people who are likely to have the syndrome.

The ATP III clinical criteria have a sensitivity of 52%, and 85% specificity for diagnosing true insulin resistance,[13] but these clinical criteria can help focus attention on the need for lifestyle therapies to concurrently reduce the metabolic risk factors.[14] Using the criteria in this way, the metabolic syndrome was present in 31% of the total group of participants and in 30% of the black participants, which was not significantly different from the total group. In previous studies, the prevalence of the metabolic syndrome has varied, probably due to different definitions of the syndrome or the selection of different subgroups.[15] This makes direct comparisons with studies in the literature difficult.

In our study, the 30% prevalence of the metabolic syndrome was somewhat higher than the 24% in adults published in the USA. There, however, the prevalence increased to 43.5% in the 60- to 69-year age group.[8] We could not establish a definite age-related increase in the metabolic syndrome because our group was young, with a mean age of 46 years.

The ATP III criteria for the diagnosis of the metabolic syndrome require three criteria to be present. In this study there were another 507 (36%) participants with two criteria of the metabolic syndrome. Kahn states that there is no scie ntific evidence available to explain the core syndrome's algorithm of any three of five criteria. Why were three criteria chosen for diagnosis, why not one, or two, or all five.[16] This is certainly a valid criticism of all these algorithms.

This places the 36% of people with two of the criteria in our study in context. Without any intervention, these executives with only two criteria may well advance to fulfill all the diagnostic criteria. This may occur with increasing weight and/or decreasing levels of physical activity. With another one-third of this study's participants on the brink of being diagnosed with the metabolic syndrome, we cannot be sure that they may not also have the potential for an increased risk for cardiovascular disease.

The most obvious and often the earliest sign of the metabolic syndrome is that of central obesity.[17] In this study, 40% of all participants had an abnormally large waist circumference. Only 33 participants (2.4%) had an abnormally large abdominal circumference without any other features of the metabolic syndrome. An abnormally large abdominal circumference plus a metabolic abnormality (low HDL-C or elevated TG, or a combination of low HDL-C plus elevated TG) occurred in 307 participants (22%). This emphasises the role of central obesity in the abnormal metabolic milieu of the metabolic syndrome, although it is possible for an individual to have the metabolic syndrome without central obesity.

In this group, 522 participants (38%) had an abnormally large waist circumference together with another component of the metabolic syndrome. A challenge for future research on the metabolic syndrome is the identification of features of obesity or adiposity that could predict the risk of developing the metabolic syndrome.[18] For instance, in this study, can the risk of developing the metabolic syndrome be predicted in the 33 individuals with large waists currently without the metabolic syndrome? It certainly can be prevented by weight loss and other lifestyle changes.

This study did not address the management of this group of patients, nor did it seek to evaluate the merit of the metabolic syndrome as diagnosed by the ATP III guideline. It also did not attempt to risk stratify these people for developing cardiovascular disease using the criteria of the metabolic syndrome.

In conclusion, this study demonstrated that the metabolic syndrome, appearing as a cluster of cardiovascular risk factors, was common in a group of South African corporate executives, occurring in 31% of the group.

References

1. Kylin E. Studien ueber das hypertonie-hyperglykämie-hyperurikämie syndrom. *Zentralblatt Fuer Innere Med* 1923; **44**: 105–127.
2. Himsworth HP. Diabetes mellitus – its differentiation into insulin sensitive and insulin insensitive types. *Lancet* 1936; **1**: 127–130.
3. Reaven GM. Bunting lecture 1988. Role of insulin resistance in human disease. *Diabetes* 1988; **37**: 1595–1607.
4. Kaplan NM. The deadly quartet: upper-body obesity, glucose intolerance, hypertriglyceridemia and hypertension. *Arch Intern Med* 1989; **149**: 1514–1520.
5. Alberti K, Zimmet P. Definition, diagnosis and classification of diabetes mellitus and its complications. *Diabet Med* 1998; **15**: 539–553.
6. Grundy SM, Cleeman JL, Daniels SR, *et al*. Diagnosis and management of the metabolic syndrome: a statement for health care professionals: an American Heart Association/National Heart, Lung and Blood Institute Scientific Statement. *Circulation* 2005; **112**: 2735–2752.
7. Isomaa B, Almgren P, Tuomi T, *et al*. Cardiovascular morbidity and mortality associated with the metabolic syndrome. *Diabet Care* 2001; **24**: 683–689.

8. Ford ES, Giles WJ, Dietz WH. Prevalence of the metabolic syndrome among US adults: findings from the third National Health and Nutrition Examination Survey. *J Am Med Assoc* 2002; **287**: 356–359.
9. Grep L, Forsblom C, *et al*. Metabolic consequences of a family history of NIDDM (the Botnia study). *Diabetes* 1996; **45**: 1585–1593.
10. Grundy SM, Hansen B, Smith SC, *et al*. Clinical management of metabolic syndrome. *Circulation* 2004; **109**: 551–556.
11. Huddle KRL, Kalk WJ, eds. *Practical Diabetes Management*, 3rd edn. Johannesburg: Wits Diabetes Group, 1994.
12. Alberti KGMM, Zimmet P, Shaw J, the IDF Epidemiology Task Force consensus group. Metabolic syndrome: a new worldwide definition. *Lancet* 2005; **366**: 1059–1062.
13. McLoughlin T, Abbasi F, Cheal K, *et al*. Use of metabolic markers to identify overweight individuals who are insulin resistant. *Ann Intern Med* 2003; **139**: 802–809.
14. Gundy SM. Does the metabolic syndrome exist? *Diabet Care* 2006; **29**: 1689–1692.
15. Rantala AO, Kauma H, *et al*. Prevalence of the metabolic syndrome in drug-treated hypertensive patients and control subjects. *J Intern Med* 1999; **245**: 163–174.
16. Kahn R. The metabolic syndrome (emperor) wears no clothes. *Diabet Care* 2006; **29**: 1693–1696.
17. Després JP, Lemieux I, Prud'homme D. Treatment of obesity: need to focus on high-risk abdominally obese patients. *Br Med J* 2001; **322**: 716–722.
18. Reilly MP, Rader DJ. The metabolic syndrome. More than the sum of its parts? *Circulation* 2003; **108**: 1546–1551.