Metabolic syndrome in the Hong Kong community: the United Christian Nethersole Community Health Service primary healthcare programme 2001–2002

Ko G T C, Tang J S F

ABSTRACT

Introduction: With recognition of the important role of central obesity in metabolic syndrome (MES), the International Diabetes Federation (IDF) has proposed a revised definition for MES in early 2005. Information of MES in Chinese by IDF criteria is limited.

Methods: This was a cross-sectional observation survey. A sample of 7,473 subjects (2,660 men and 4,813 women) was examined. They presented voluntarily in the period between August 2001 and September 2002 for health assessment at the three health centres of the United Christian Nethersole Community Health Service.

Results: The mean age and standard deviation was 50.4 +/– 10.6 years (range 19-93 years, median 48.0 years). Among them, 30 percent had central obesity, 34 percent had low high-density lipoprotein cholesterol, 20 percent had hypertriglyceridaemia, 47 percent had high blood pressure, and 23 percent had dysglycaemia. The age-standardised percentages of MES by National Cholesterol Education Programme and IDF criteria were 18.3 and 13.9 percent, respectively.

Conclusion: MES is not uncommon among the Hong Kong Chinese community. Further studies on the management and prevention of MES are indicated.

Keywords: Hong Kong Chinese, International Diabetes Federation, metabolic syndrome, obesity, waist circumference

Singapore Med J 2007; 48(12):1111–1116

Hong Kong Institute of Diabetes and Obesity, Chinese University of Hong Kong, Department of Medicine and Therapeutics, Prince of Wales Hospital, Shatin, Hong Kong

Ko GTC, MD, FRCPI
Senior Medical Officer

United Christian Nethersole Community Health Service, 4/F Ng Wing Tong Block, United Christian Hospital, 130 Hip Wo Street, Kwun Tong, Kowloon, Hong Kong

Tang JSF, MPH, DTMH, FRACGP
Medical Director

Correspondence to:
Dr Gary TC Ko
Tel: (852) 2689 2255
Fax: (852) 2665 6436
Email: gtc_ko@yahoo.com.hk

INTRODUCTION

Obesity is reaching epidemic proportions in many developed countries.[1] It is strongly associated with most cardiovascular disease (CVD) risk factors, such as dyslipidaemia and dysglycaemia.[2] Metabolic syndrome (MES) is a medical condition with a cluster of risk factors for CVD and diabetes mellitus, and the clustering is greater than by pure chance alone.[3] Since MES is rather complicated in terms of its aetiology and pathogenetic mechanisms, its definition is not unified. There are several definitions for MES according to different authorities who have looked into MES at different angles.[4-6] The definition suggested by National Cholesterol Education Program (NCEP) Expert Panel (ATP III) in 2001 is relatively simple, and hence most widely used.[6] With recognition of the important role of central obesity in MES, the International Diabetes Federation (IDF) has proposed a revised definition for MES in early 2005.[7] In this new definition, central obesity (measured by waist circumference) is an essential component of MES. Centrally-obese subjects are defined as having MES, if they also have two or more of the following conditions: low high-density lipoprotein cholesterol (HDL-C), high triglyceride (TG), high blood pressure (BP) and abnormal glycaemic state.[7] Information on MES using this new IDF definition is limited. We studied 7,473 Chinese subjects who were recruited from the Chinese community of Hong Kong. We aimed to report the severity of the problem of MES, as defined by the new IDF criteria, in the Hong Kong Chinese community. We also compared these figures with that defined by the NCEP criteria and analysed the implications.

METHODS

United Christian Nethersole Community Health Service (UCNCHS) is a self-funded, non-profit organisation in Hong Kong with the objective of health promotion through primary healthcare and education. Participants, all Hong Kong citizens, who join our UCNCHS health-

Table I. Clinical characteristics of the 7,473 subjects.

	Total (n = 7,473)	Men (n = 2,660)	Women (n = 4,813)
Age (years)	50.4 ± 10.6	51.0 ± 11.5	50.1 ± 10.0
Smokers, n (%)	759 (10.2)	587 (22.1)	172 (3.6)
Drinkers, n (%)	98 (1.3)	82 (3.1)	16 (0.3)
Systolic BP (mmHg)	124 ± 21	127 ± 20	122 ± 21
Diastolic BP (mmHg)	80 ± 12	83 ± 11	78 ± 11
Weight (kg)	60.0 ± 11.1	67.6 ± 10.5	55.8 ± 9.0
BMI (kg/m^2)	23.5 ± 3.5	24.1 ± 3.3	23.1 ± 3.6
Waist (cm)	79.1 ± 9.7	85.0 ± 8.5	75.8 ± 8.7
Triglyceride (mmol/L)	1.3 ± 1.2	1.5 ± 1.5	1.2 ± 0.9
HDL-C (mmol/L)	1.3 ± 0.3	1.2 ± 0.3	1.3 ± 0.3
LDL-C (mmol/L)	3.7 ± 1.0	3.9 ± 0.8	3.6 ± 1.1
Fasting PG (mmol/L)	5.4 ± 1.1	5.5 ± 1.3	5.3 ± 1.0
Diabetes, n (%)	356 (4.8)	158 (5.9)	198 (4.1)
MES by NCEP criteria, n (%)	1,716 (23.0)	658 (24.7)	1,058 (22.0)
MES by IDF criteria, n (%)	1,312 (17.6)	471 (17.7)	841 (17.5)

All p-values comparing men and women: < 0.001

BP: blood pressure; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; PG: plasma glucose; MES: metabolic syndrome; NCEP: National Cholesterol Education Program; IDF: International Diabetes Federation.

screening programme were notified through word of mouth, publicity via the media, community centres, hospitals, as well as public health educational and promotional activities in the community. Subjects present themselves voluntarily from different districts all over Hong Kong. A modest fee for the screening programme was charged (average HK$700, or approximately US$90). In this study, we analysed 7,473 subjects with detailed clinical information. These subjects were recruited in the period between August 2001 and September 2002.

Smokers and drinkers were defined as those currently smoking or drinking, respectively. Their socioeconomic status (SES) classification according to occupation is summarised as follows:

Occupational group 1: social classes I and II, professional or managerial.

Occupational group 2: social class III, non-manual.

Occupational group 3: social class III, manual.

Occupational group 4: social classes IV and V, unskilled.

Occupational group 5: housewife or retired.

Demographical data, including height, weight and waist circumference (WC), were documented following a standard protocol with the subject in light clothing, without shoes. Body mass index (BMI) was calculated as weight (in kg) divided by the square of height (in metres). WC (in cm) was measured midway between the lower costal edge and upper iliac crest. After sitting for at least five minutes, BP was measured in the right arm with a standard mercury sphygmomanometer. The Korotkoff sound V was taken as the diastolic BP.

Blood samples were taken after an eight-hour fast for measurement of plasma glucose (PG), TG, total cholesterol and HDL-C. Total cholesterol (enzymatic method), TG (enzymatic method) and HDL-C (analytic enzymatic method chosen based on the selective solubilising effect of proprietary detergent to the different lipoproteins) were measured on a Dimension RxL automated analyser (Dade Behring Inc, Deerfield, IL, USA) using reagent kits supplied by the manufacturer of the analyser. Low-density lipoprotein cholesterol (LDL-C) was calculated using Friedewald's formula.[8] PG was measured by a hexokinase phosphorylation method (Dimension RxL, Dade Behring Inc, Holliston, MA, USA). Both the intra-assay and inter-assay coefficients of variation for PG were 2% at 6.6 mmol/L.

The percentages of MES as defined by the NCEP and IDF criteria were reported. Percentage of diabetes mellitus was also calculated, which was defined as past history of diabetes mellitus or fasting PG ≥ 7.0 mmol/L.[9] The obesity parameter in NCEP criteria was modified according to the suggested guidelines initiated by IDF and World Health Organisation (WHO) Western Pacific Region to define central obesity.[10] The diagnostic criteria for MES are listed as follows:

1) IDF criteria[7] – WC ≥ 80 cm in women or ≥ 90 cm in men plus 2 or more of the following:

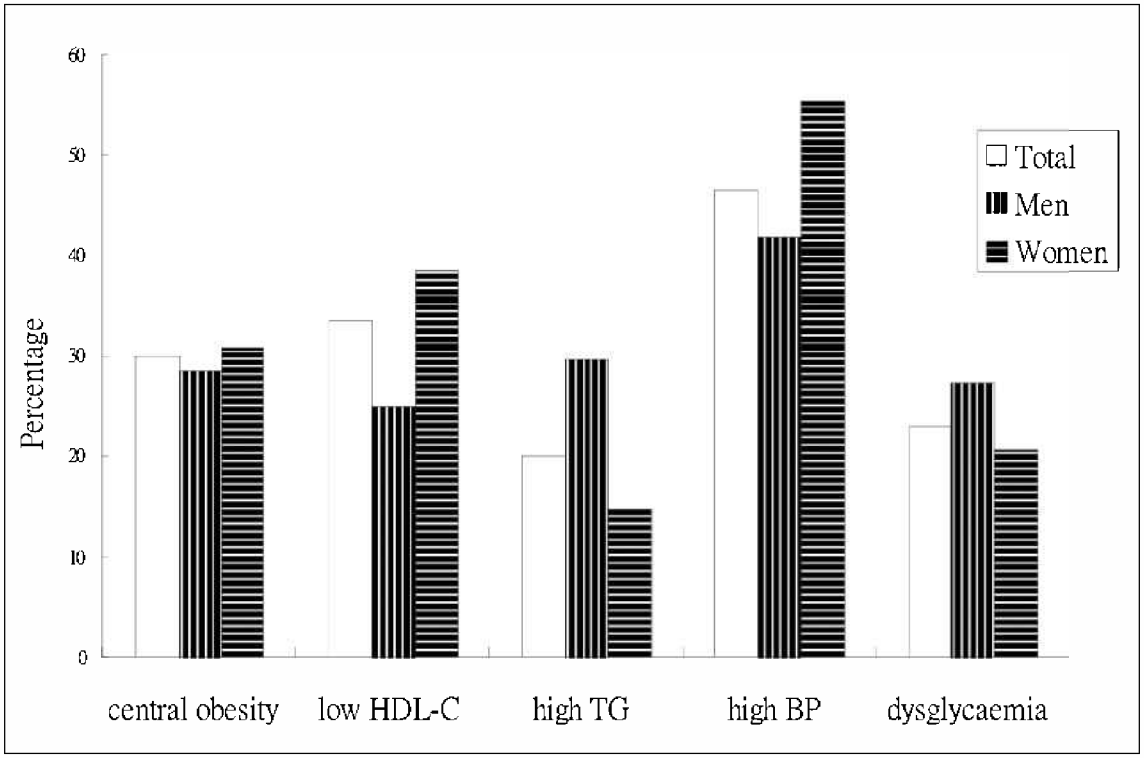

Fig. 1 Bar chart shows percentages of the individual component of metabolic syndrome in the 7,473 subjects.

a) low HDL-C = HDL-C < 1.3 mmol/L in women or < 1.0 mmol/L in men;
b) hypertriglyceridaemia = TG ≥ 1.7 mmol/L;
c) hypertension = known hypertensives or BP ≥ 130/85 mmHg;
d) dysglycaemia = fasting PG ≥ 5.6 mmol/L or known to have diabetes mellitus.

2) NCEP criteria[6] – three or more of the following conditions:
a) obesity = WC > 90 cm in men or > 80 cm in women;
b) hypertriglyceridaemia = TG ≥ 1.7 mmol/L;
c) low HDL-C = HDL-C < 1.0 mmol/L in men or < 1.3 mmol/L in women;
d) hypertension = known hypertensives or BP ≥ 130/85 mmHg;
e) dysglycaemia = fasting PG ≥ 5.6 mmol/L or known to have diabetes mellitus.

Statistical analyses were performed using the Statistical Package for Social Science version 10.0 (SPSS Inc, Chicago, IL, USA) software on an IBM compatible computer. All results were expressed as mean ± standard deviation (SD) or n (%) where appropriate. Student's *t*-test and the chi-square test were used for intergroup comparisons. A p-value < 0.05 (two-tailed) was considered to be significant. Age-standardised prevalence rates of MES were calculated using direct standardisation with the overall Hong Kong population distribution by age and sex according to the 2000–2001 Hong Kong census.[11]

RESULTS

Of the 7,473 subjects, there were 2,660 (35.6%) men and 4,813 (64.4%) women. The mean age (± SD) was 50.4 ± 10.6 years (range 19–93 years, median 48.0 years) (men: range 19–93 years, median 49.0 years; women: range 19–90 years, median 48.0 years). When broken down according to their occupation, 29.6% of the male participants and 10.3% of the female subjects hold professional or managerial positions (SES group 1); 18.0% of the men and 27.2% of the women were engaged in clerical duties (SES group 2); 18.3% of the men and 0.9% of the women were skilled manual workers (SES group 3); 60% of the men and 3.9% of the women were unskilled manual workers (SES group 4); 26.7% of the men and 56.0% of the women were retired or housewives (SES group 5); 1.4% of the men and 1.2% of the women were unemployed and 0.1% of men and women were students.

The clinical characteristics are summarised in Table I. In particular, the crude percentages of MES calculated by using NCEP and IDF criteria were 23.0% and 17.6%, respectively. The crude percentage of diabetes mellitus was 4.8% (men vs. women:

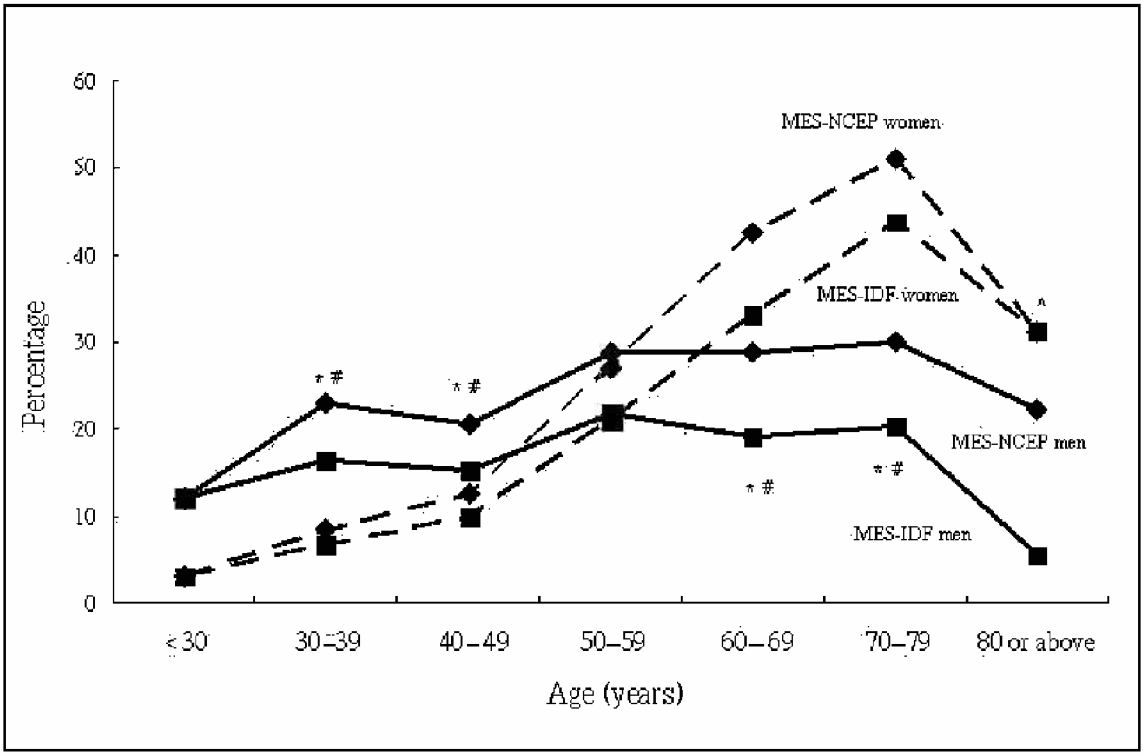

Fig. 2 Graph shows the prevalence of metabolic syndrome in the 7,473 subjects according to their age and gender. p-values comparing men and women: * < 0.001 and ^ < 0.05 for IDF criteria, # < 0.001 for NCEP criteria.

Table II. Age-standardised prevalence of MES according to NCEP or IDF criteria.

	Total	Men	Women
NCEP criteria (%)	18.32	21.29	16.24
IDF criteria (%)	13.90	15.99	13.39

5.9% vs. 4.1%, p < 0.001). The percentages of the individual components of MES are summarised in Fig. 1. Of the 7,473 subjects, 30% had central obesity, 34% had low HDL-C, 20% had high TG, 47% had high BP and 23% had dysglycaemia. The MES percentages of the 7,473 subjects, according to their age and gender, are shown in Fig. 2. In particular, the percentage of MES was higher in men aged < 40 years and higher in women in the older age group (> 60 years). Otherwise, the MES peaked at age 70–79 years in both men and women. On the average, the percentage of MES defined by the NCEP criteria was 4% higher than that defined by the IDF criteria. Based on the 2000–2001 Hong Kong census statistics of the overall Hong Kong population data, the age-standardised percentages of MES as defined by the NCEP or IDF criteria are summarised in Table II. The age-standardised percentages of MES by the NCEP and IDF criteria were 18.3% and 13.9%, respectively.

DISCUSSION

MES was defined systemically for the first time by WHO in 1998.[4] The European Group for the Study of Insulin Resistance (EGIR) also proposed a similar definition in 1999.[5] Both of these criteria involve the measurement of insulin resistance (IR) while in the WHO criteria, albuminuria is one of the potential components of MES. In real practice, IR and albuminuria are not routinely measured. So, both WHO and EGIR criteria for MES are not that useful clinically. The NCEP expert panel in 2001 proposed a definition for MES using simple clinical measurements including WC, fasting PG, TG, HDL-C and BP.[6]

By using the NCEP criteria, a high rate of MES has been reported in various parts of the world. The National Health and Nutrition Examination Survey (NHANES) (1988–1994) reported an age-adjusted prevalence of 23.7% of MES in the US adult population, affecting 47 million subjects.[12] Based on the WHO (1998), EGIR and NCEP criteria, we reported, among the working Hong Kong Chinese population (median age 37.0 years, range 18–66 years), a prevalence of MES which varied from 8.9%

to 13.4%.[13] Using the same cohort, we found little difference in the clinical characteristics among subjects with MES defined by these three criteria, suggesting the inclusion of IR and albuminuria by the WHO and EGIR definitions did not always imply an increase in the discriminative value, at least in a community-based cohort of young adults.[13]

While the new IDF criteria for MES was based on the same parameters used in the NCEP criteria, the former identified central obesity as an essential component for MES. The relative merits of these two criteria have yet to be fully investigated. With the NHANES (1999–2002) database, Ford reported the prevalence of MES in 3,601 American adults to be 34.5% and 39.0% based on the NCEP and IDF criteria, respectively.[14] The increase in the prevalence by the IDF criteria is simply due to a reduction in the definition of central obesity with WC from 102 cm for men and 88 cm for women (NCEP criteria) to 94 cm and 80 cm respectively (IDF criteria, for Caucasians). Among Chinese, if we use a unified definition for central obesity (i.e. 90 cm for men and 80 cm for women in waist measurement) for both NCEP and IDF criteria, the rate of MES by the IDF criteria should always be less than that by the NCEP criteria. This is because the variation of percentages in the NCEP criteria stems from a combination of three out of five parameters, while it only affects two out of four parameters specified by the IDF criteria (central obesity is prefixed in the IDF criteria). The disparity between the percentages calculated using the NCEP and IDF criteria may be attributed to the group of subjects who present with three or more of the medical conditions listed other than central obesity; namely, low HDL-C, high TG, high BP and dysglycaemia. In our study, the occurrence of subjects exhibiting these conditions is relatively common in men, especially in the elderly, but is uncommon in women. They probably represent people who have coexisting lipid abnormalities, glycaemic abnormalities and/or high BP due to incidental coexistence, or other non-obesity or "non-metabolic" related causes, such as ageing and mental stress.[15-18]

The crude percentage of MES (by NCEP criteria) in the Hong Kong Chinese in this cohort is 23.0%. Among those aged between 19 and < 70 years, the crude percentage was 7.1%–37.1%. From a study conducted by our team in the early 1990s among subjects aged 18–66 years,[13] the crude percentage of MES in the working-age group in Hong Kong was 9.6%. Although the present study is not directly comparable to this cohort, the marked difference in the two percentages of MES (up to three-fold increase in ten years) is alarming. This figure suggests a rapid upsurge in the numbers of people suffering from MES in Hong Kong. In accordance to this theory, the NHANES reported a rise of 10.8% (from 23.7% to 34.5%) in the prevalence of MES in the U.S. from the years 1988–1994 to 1999–2002.[12,14]

Data of the present study has to be interpreted with caution since it is a description of a self-selected population. Due to limitations of the local healthcare system, systematic randomised cross-sectional representative sampling is difficult to obtain. Our study is also limited by the voluntary basis of our subjects. Volunteers are usually more health conscious and may not be completely representative of the overall population. Nevertheless, our subjects were community-based, of a reasonable large sample size and covered a large range of people at different ages. We believe the study results can provide us useful insight into the problem of MES in Hong Kong. In conclusion, the age-standardised percentage of MES defined by the IDF criteria in Hong Kong Chinese was 16.0% in men and 13.4% in women, which was approximately 4% less than that defined by the NCEP criteria. There appears to be an upsurge of MES in Hong Kong. Further studies on the management and prevention of MES are urgently needed to ameliorate this trend.

ACKNOWLEDGEMENTS

We thank all medical and nursing staff of the United Christian Nethersole Community Health Service for recruiting and managing these patients. This study was partially supported by a Research Grant kindly donated by the Hong Kong Association for the Study of Obesity.

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