A Proposal for the Cutoff Point of Waist Circumference for the Diagnosis of Metabolic Syndrome in the Japanese Population

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Over the past 2 decades, there has been a dramatic increase in the number of subjects with the metabolic syndrome in Japan as well as in Western countries. Because subjects with the metabolic syndrome have an elevated risk of development of type 2 diabetes and cardiovascular diseases (1–3), there is an urgent need to establish strategies to prevent an epidemic of this syndrome. In particular, a practical and sensitive screening system must be established to detect the metabolic syndrome. At present, there are two internationally recognized definitions of the metabolic syndrome, namely those of the World Health Organization (4) and the National Cholesterol Education Program's Adult Treatment Panel III (NCEP III) (5). In an attempt to establish a unified definition for the metabolic syndrome, the International Diabetes Federation (IDF) has very recently announced a new definition of the metabolic syndrome that is expected to be suitable for use in clinical practice worldwide (6). The IDF defines metabolic syndrome as the presence of central obesity plus any two of the following four factors (raised triglyceride level, reduced HDL cholesterol, raised blood pressure, and raised fasting plasma glucose). The IDF recommended that the cutoff level used for the waist circumference to define central obesity should be different among different ethnic groups (7). In fact, the new IDF definition has proposed ethnicity-specific cutoff values for waist circumference, namely, 94 and 80 cm for European men and women, respectively, and 85 and 90 cm for Japanese men and women, respectively. Nonetheless, the IDF has strongly recommended that more extensive investigations should be performed before suitable cutoff levels are established for use in clinical practice (7).

In this study, we investigated the relationship between the cutoff values used for the waist circumference to define central obesity and rates of detection of subjects having multiple risk factors of the metabolic syndrome and attempted to determine the most suitable cutoff level of waist circumference for the diagnosis of metabolic syndrome in a community-based cohort.

RESEARCH DESIGN AND METHODS

— Among subjects who enrolled themselves for a routine health examination in Shibata, Niigata Prefecture, from 2000 to 2001, we invited 692 subjects ranging in age from 30 to 80 years (408 men and 284 women) to participate in this study. Well-trained interviewers recorded the histories of drug usage for hyperlipidemia, hypertension, and diabetes from all participants. The waist circumference was measured midway between the lowest rib and the iliac crest with a flexible anthropometric tape (8). The present study was approved by the ethics review committee of the University of Tokyo, and written informed consent was obtained from all of the subjects.

Definition of the state of risk-factor clustering

In this study, subjects with two or more of the following four risk factors of the criteria of the NCEP III were defined as having multiple risk factors: *1*) triglycerides ≥150 mg/dl, *2*) HDL cholesterol <40 mg/dl in men and <50 mg/dl in women, *3*) systolic blood pressure ≥130 mmHg or diastolic blood pressure ≥85 mmHg, *4*) fasting plasma glucose ≥110 mg/dl (impaired fasting glucose). Subjects with a history of hyperlipidemia, hypertension, or diabetes were deemed as having the respective risk factors, regardless of the biochemical values.

Statistical analyses

The receiver operator characteristic (ROC) curve for waist circumference to predict the presence of two or more risk factors of the metabolic syndrome, as defined by the NCEP III (except for waist circumstance), was plotted using JMP for Windows, Version 4.00 (SAS Institute, Cary, NC).

RESULTS

— The mean age of the study subjects was 52.3 ± 9.0 years for men and 53.5 ± 9.0 years for women. The mean waist circumference was 83.5 ± 7.8 cm in men and 74.3 ± 7.6 cm in women. The prevalence of high serum triglycerides was 30.4% in men and 9.9% in women. The prevalence of low serum HDL cholesterol was 6.6% in men and 9.2% in women. The prevalence of subjects with high blood pressure as defined

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Abbreviations: IDF, International Diabetes Federation; NCEP III, National Cholesterol Education Program's Adult Treatment Panel III; ROC, receiver operator characteristic.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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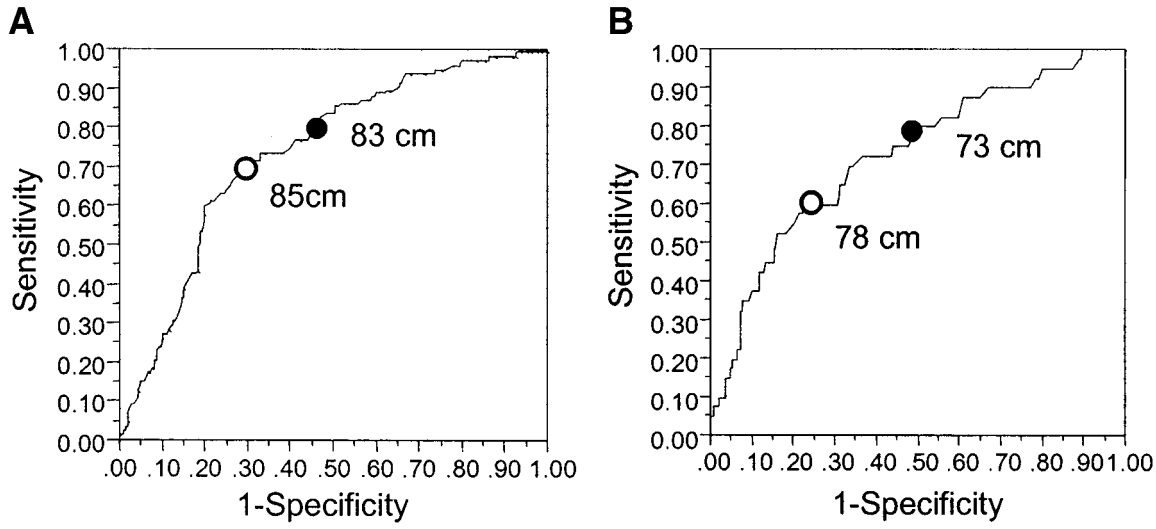

Figure 1—*The ROC curves for waist circumference to predict the presence of two or more risk factors of the metabolic syndrome, as defined by the NCEP III except for waist circumstance, in men* (A) *and women* (B). ○*, cutoff waist circumference yielding the maximal sensitivity plus specificity for predicting the presence of multiple risk factors.* ●*, cutoff waist circumference yielding at least 80% sensitivity for predicting the presence of multiple risk factors.*

by the NCEP III was 43.9% in men and 34.5% in women. The prevalence of impaired fasting glucose was 24.8% in men and 10.9% in women. The prevalence of multiple risk factors was 28.7% in men and 14.1% in women.

We plotted the ROC curve to determine the cutoff values of waist circumference in relation to the detection of multiple risk factors for the Japanese population (Fig. 1). According to the ROC curve, the cutoff level yielding the maximal sensitivity plus specificity for predicting the presence of multiple risk factors was 85 cm in men and 78 cm in women. The sensitivity and specificity using these cutoff values were 70.9 and 69.8%, respectively, in men and 60.0 and 77.1%, respectively, in women. Alternatively, given that waist circumference criteria is used for the first screening of subjects as a prerequisite for the diagnosis of metabolic syndrome, setting a cutoff level to obtain a high sensitivity of at least 80% may be justified, even if it possibly considerably decreases specificity. According to the ROC curve in this study, an optimal cutoff value for waist circumference to detect multiple risk factors was 83 cm in men and 73 cm in women, with a corresponding specificity of 54.0 and 47.1%, respectively (Fig. 1).

CONCLUSIONS — In the present study, we proposed an optimal cutoff point of waist circumference for the diagnosis of metabolic syndrome in the Japanese population: 85 cm in men and 78 cm in women, yielding the maximal sensitivity plus specificity, or 83 cm in men and 73 cm in women, yielding at least 80% sensitivity for predicting the presence of multiple risk factors. It apparently seems that the cutoff point of waist circumference described in the present study is much shorter than that recently proposed by the IDF, especially in women. However, it should be taken into consideration that there was a difference in the method of measuring waist circumference between this study and in the criteria outlined by the IDF; we measured waist circumference at the "mid" level and the IDF measured at the umbilical level. Waist circumference at the umbilical level is thought to be several centimeters longer than that measured at the "mid" level in women, whereas values measured at the "mid" and umbilical levels tend to be very similar in men. Thus, appropriate cutoff points for waist circumference at the umbilical level would be ~80 cm in women and ~85 cm in men. Further studies must be performed to elucidate the most suitable method of measuring waist circumference and its most appropriate cutoff point.

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