The criteria of metabolic syndrome and national health checkup and education system in Japan

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Abstract

Two major definitions of metabolic syndrome have been proposed. One focuses on accumulation of risk factors such as the American Heart Association (AHA) and National Heart, Lung and Blood Institute (NHLBI) criteria; and the other focuses on abdominal obesity such as the International Diabetes Federation (IDF) and Japanese criteria. The latter consider waist circumference as an obligatory component, whereas the former does not. In 2009, the IDF, NHLBI, AHA and the other organizations attempted to unify these criteria, and waist circumference is no longer an obligatory component. Nowadays, only Japanese criteria still keep waist circumference as an obligatory component.

Since 2008, new Japanese cardiovascular screening and education system, which focuses on metabolic syndrome, has launched. Screened peoples are classified in three groups according to the presence of abdominal obesity and the number of metabolic risk factors, and receive several health educational support from insurer.

This system generated some beneficial outcomes on the one hand: visibility of metabolic syndrome in population level is drastically improved (though many people confuse metabolic syndrome with simple obesity); preventive measures are directed to metabolic syndrome which is considered to increase in future young generations; and
post screening education system are established. On the other hand, several problems are pointed out on this system and now under debate.

In this review, we introduce several topics on metabolic syndrome including (1) Japanese criteria of metabolic syndrome; (2) metabolic syndrome and universal health screening and education system; and (3) recent debates on problems of Japanese metabolic syndrome criteria. (250 words/250 limits)

**Key words:** metabolic syndrome, universal health screening, health education, risk factors
Main body

Japanese criteria of metabolic syndrome

There have been many metabolic syndrome criteria worldwide, but they can be classified in two major types of criteria. One of the criteria is that from the International Diabetes Federation (IDF)[1] and the other is from American Heart Association (AHA) and National Heart, Lung and Blood Institute (NHLBI) of the United States[2] (Figure 1). The major difference is that the IDF criteria regarded central obesity as an essential component whereas the AHA criteria focus on accumulation of metabolic risk factors. The AHA criteria considers waist circumference as one of 5 risk factors and defined metabolic syndrome as presence of any 3 components of these 5. The Japanese criteria[3] was determined in 2004 and is quite similar with IDF one (Figure 1) except for cutpoint of waist circumference.

In 2009, the IDF, NHLBI, AHA and other organizations unified the criteria [4] and these newer criteria are essentially similar with AHA/NHLBI criteria (Figure 1). As a result, only Japanese criteria still keep waist circumference as an essential component.

The prevalence of metabolic syndrome among Japanese according to these criteria was compared in a community from the Circulatory Risk in Communities Study...
(Kyowa, aged 40-69 years in early 1990s) [5]; 33% based on AHA/NHLBI criteria; 27% based on IDF criteria; and 17% based on Japanese criteria.

**Metabolic syndrome and universal health screening and education system**

Before 1950s, the number 1 cause of death in Japan was tuberculosis, and main measure at that time was universal tuberculosis screening system. From 1950s to 1980s, the number 1 cause was stroke, so the national prevention strategy focused on high blood pressure screening. In 1981 cancer overtook stroke, and in 1985 heart disease, in 2011 pneumonia, also overtook stroke. Stroke is now number 4 cause of death in Japan. In these context, Japanese government has shifted the targets to metabolic syndrome. Since 2008, Japanese government launched a new cardiovascular screening and education system, focusing on detection and control for metabolic syndrome.

To figure out the background of this policy change, we should remember that there are 2 major types of arteriosclerosis [6]; one is atherosclerosis, which affects large arteries such as coronary artery and middle cerebral arteries; and the other one is arteriolosclerosis that affects small vessels such as perforating arteries of brain. Americans and Europeans are the atherosclerosis-dominant people under the background of dyslipidemia, glucose abnormality as well as metabolic syndrome,
whereas Asians are the arteriolosclerosis-dominant people mainly under the background of hypertension.

Hypertension and arteriolosclerosis are decreasing in these 50 years in Japan, and lifestyle in Asia is rapidly shifting to westernization especially for middle-aged urban male population. This is a rational for Japanese government considered changing preventive target to metabolic syndrome. Another rational is that although Japan had established the universal health screening system, the post-screening education system had not been sufficiently established. Waist circumference should be a visible marker for people to motivate their lifestyle after checkups, which also motivate government to target to metabolic syndrome.

Current system of post-screening metabolic syndrome measures is shown in Figure 2. Based on the results of screening, the participants are classified into three groups, based on the metabolic syndrome criteria. As stated above, waist circumference is an essential component and if they have two or more other risk factors, the insurer provides them an active support to change their lifestyle. If they have abdominal obesity and one risk factor, then they will be classified in motivational support group. All others will receive information service to prevent metabolic syndrome.

This system generated some beneficial outcomes on the one hand: visibility of
metabolic syndrome in population level is drastically improved (though many people confuse metabolic syndrome with simple obesity); preventive measures are directed to metabolic syndrome, which is considered to increase in future young generations; and post screening education system are established. On the other hand, several problems are pointed out on this system and now under debate.

Recent debates on problems of Japanese metabolic syndrome measures

There are some debates on this preventive system and revision is right now under consideration. Some discussion in the commission of the government are as follows:

Q1: Is metabolic syndrome really important among Japanese?

This question is raised because that many studies has shown that population attributable risk fraction (PAF) of metabolic syndrome is not as high as that of high blood pressure. For example, the Japan Public Health Center-based Study reported that the PAF of high blood pressure was 50% for men and 53% for women, whereas that of metabolic syndrome (based on IDF criteria) was 10% for men and 6% for women [7].

On the other hand, regarding increase trend (but not as steep as non-Asian) in
overweight among men (but not among women), the impact of metabolic syndrome may increase in near future especially among relatively younger men. Therefore, their answer is Yes, as one of disease managements, and as prevention for future cardiovascular diseases.

Q2: Is it appropriate to keep waist circumference as essential component?

This question is based on the fact that many studies has shown that PAF of metabolic syndrome is not as high as that of non-obese high risk population. For example, the Ibaraki Prefectural Health Study reported that the PAF of cardiovascular mortality was 10% for persons with body mass index of \( \geq 25 \text{kg/m}^2 \) and 2 or more metabolic risk factors whereas that was 15% for those with body mass index of \(<25 \text{kg/m}^2\) and 2 or more metabolic risk factors [8].

The committee pointed out that health education for non-obese high risk people must be additionally performed.

Q3: Are the Japanese waist circumference cutpoints appropriate?

The harmonized criteria of metabolic syndrome defines central obesity as race and gender specific WC cutoffs [4]. Japanese cutoffs are \( \geq 85 \text{cm} \) for men and \( \geq 90 \text{cm} \) for
women defined based on cross-sectional studies that showed that these cutpoints were equivalent to 100 cm$^2$ of visceral fat area [3]. This is sometimes criticized because only Japan set higher cutoffs for women than men. However, according to a study granted by the Ministry of Health, Labour and Welfare [9], changing waist circumference cutoffs between 80 cm to 90 cm did not virtually change the impact of metabolic syndrome on cardiovascular disease. Taken together with the fact that the incidence of cardiovascular disease is much lower in women than in men, the committee concluded that waist circumference cutpoint should be kept as it is.

Conclusions

Conclusions of this review are as follows: First, Japanese criteria of metabolic syndrome have several differences with international criteria, including waist circumference as an essential component and unique waist circumference cutpoints. Second, universal metabolic syndrome screening and education system were launched from 2008, but the epidemiological evidence was not sufficient at the start of metabolic syndrome measures. Third, revision of metabolic syndrome screening system is now under consideration, but is unlikely to be changed drastically. Fourth, considering the measures of metabolic syndrome in Asia, we should note that the etiology of
arteriosclerosis differs between Asians and Westerners.

Figure legends

Figure 1. Selected criteria of metabolic syndrome


Figure 2. Current system of post-screening metabolic syndrome measures

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References


**Figure 1**

**IDF criteria (2005)**

*Central obesity:* based on race and gender specific WC cutoffs

**PLUS**

≥2 of the following
1. Elevated TG
2. Reduced HDL
3. Elevated BP
4. Elevated FPG

**AHA/NHLBI criteria (2005)**

≥3 of the following
1. Elevated WC
2. Elevated TG
3. Reduced HDL
4. Elevated BP
5. Elevated FPG
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<tr>
<td><strong>IDF, NHLBI, AHA, WHF, IAS, IASO</strong></td>
<td><strong>Central obesity:</strong> <strong>WC at umbilical level</strong></td>
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<tr>
<td><strong>≥3 of the following</strong></td>
<td><strong>Men: ≥85cm  Women: ≥90cm</strong></td>
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<tr>
<td>1. Elevated WC</td>
<td><strong>PLUS</strong></td>
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<tr>
<td>2. Elevated TG</td>
<td><strong>≥2 of the following</strong></td>
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<tr>
<td>3. Reduced HDL</td>
<td>1. Elevated TG and/or reduced HDL</td>
</tr>
<tr>
<td>4. Elevated BP</td>
<td>2. Elevated BP</td>
</tr>
<tr>
<td>5. Elevated FPG</td>
<td>3. Elevated FPG</td>
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Figure 2

Waist circumference
- Men \(\geq 85\) cm
- Women \(\geq 90\) cm

BMI \(\geq 25\)

Additional risk factors:
① Hyperglycemia (FBS \(\geq 100\) mg/dl or HbA1c \(\geq 5.6\) %)
② Dyslipidemia (TG \(\geq 150\) mg/dl or HDL \(\leq 40\) mg/dl)
③ Hypertension (SBP \(\geq 130\) mmHg or DBP \(\geq 85\) mmHg)
④ Smoking

Active support
Motivational support
Information service

Additional risk factors:
- Including those with no risk factor

All others