

Should the Definition of Metabolic Syndrome be Reconsidered from the Aspect of Arterial Stiffness?

Kohji Shirai

Clinical Research Center, Seijinkai Mihama Hospital, Chiba, Japan

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In this issue, Kim *et al.* reported the effects of metabolic syndrome (MetS) and its components, including a body shape index (ABSI), on increased arterial stiffness measured using the cardio-ankle vascular index (CAVI) according to sex and age strata. They found that MetS diagnosed with ABSI instead of waist circumference (WC) was more significantly associated with the CAVI in all age–sex groups in Koreans¹. This result is consistent with the studies in Japanese reported by Nagayama *et al.*² and Sugiura *et al.*³. These results might give an important warning to the criteria of MetS used worldwide now.

MetS is proposed to be derived essentially from visceral adipose tissue⁴. Therefore, the criterion of obesity shape for MetS should have to adopt an index reflecting visceral adipose tissue mass. Originally, visceral fat area at the umbilicus level was presented as an index of visceral fat mass using abdominal CT imaging⁵, but it is not easy to take CT in daily clinical work and public health activities. Then, WC was adopted to define MetS by adjusting to the visceral fat area 100cm² in abdominal CT imaging^{4, 6, 7}. Then, WC was adopted in National Cholesterol Education Program- the third revision of the Adult Treatment Panel (NCEP-ATP III) criteria⁸ and international diabetic federation (IDF)⁹. The concept of MS has been useful and seemed to contribute to the promotion of health of people worldwide for the past thirty years. However, arguments about the meaning of MetS have been raised^{10, 11}. Prospective studies on MetS for cardiovascular events did not necessarily show positive results¹².

The target organ disease of MetS is cardiovascular disease, so-called arteriosclerosis. CAVI has nearly been established as an index of arterial stiffness

reflecting arteriosclerosis and is related to metabolic disorders^{13, 14}. However, there are several reports that CAVI is not necessarily high in MetS¹⁵⁻¹⁸. Why were those contradictory data obtained?

There existed “obesity paradox about CAVI.” CAVI was negatively related to body mass index (BMI)¹⁹, and sometimes to WC²⁰. However, CAVI positively related to visceral fat area index²⁰. Park *et al* reported that CAVI was positively related to visceral fat area and pericardial fat and negatively related to subcutaneous adipose tissue²¹. A reason why MetS is not necessarily related to the incidence of cardiovascular events and did not show high CAVI might be due to the definition of MetS itself using WC for visceral fat tissue mass.

Recently, ABSI was proposed by Krakauer *et al.*²². As stated first, Kim *et al.* reported that MetS diagnosed with a body shape index (ABSI) instead of WC was more significantly associated with CAVI in all age–sex groups in Koreans. Nagayama also reported that ABSI was much more related with CAVI than WC or BMI in Japanese urban residents²³. Sugiura also reported the same results in Japanese labor as stated above²⁰.

Nagayama recently studied the differences in age-adjusted CAVI between MetS and non-MetS subjects diagnosed by various MetS criteria using WC or ABSI among Japanese urban residents². Age-adjusted CAVI did not differ significantly between MetS subjects using WC and non-MetS subjects according to the criteria of the Japanese Committee⁷ and NCEP-ATPIII⁸. In contrast, age-adjusted CAVI was clearly higher in MetS subjects using ABSI than it was in non-MetS subjects according to both criteria. For IDF criteria only⁹, MetS subjects had higher age-adjusted CAVI than non-MetS subjects did when MetS was defined using either WC or ABSI.

As for a longitudinal study on renal function

decline, Kaplan–Meier analysis over 4 years showed a much more remarkable decrease rate in subjects with MetS using ABSI than it did in those without it; however, almost no difference between subjects with and without MetS using WC was found²⁴).

The body shape is different between races, and the meaning of various obesity indices might differ in each race. However, the coincidence between the studies from Korean and Japanese might indicate that the definition of MetS must be reconsidered as for the index of visceral adipose tissue mass. In the adoption of ABSI to the definition of MetS in place of WC might be recommended at least in Asian peoples.

In summary, Kim's paper supported the idea that ABSI might be suitable in place of WC for the definition of MetS in terms of CAVI. The definition of MetS might be better reconsidered for Asian peoples. Further studies are required to clarify this problem.

Conflict of Interest

I have nothing to declare.

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