Baseline and changes in serum uric acid independently predict 11-year incidence of metabolic syndrome among community-dwelling women

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Abstract

Introduction Metabolic syndrome (MetS) is associated with an increased risk of major cardiovascular events. In women, increased serum uric acid (SUA) levels are associated with MetS and its components. However, whether baseline and changes in SUA predict incidence of MetS and its components remains unclear.

Methods The subjects comprised 407 women aged 71 ± 8 years from a rural village. We have identified participants who underwent a similar examination 11 years ago, and examined the relationship between baseline and changes in SUA, and MetS based on the modified criteria of the National Cholesterol Education Program's Adult Treatment Panel (NCEP-ATP) III report.

Results Of these subjects, 83 (20.4%) women at baseline and 190 (46.7%) women at follow-up had MetS. Multiple linear regression analysis was performed to evaluate the contribution of each confounding factor for MetS; both baseline and changes in SUA as well as history of cardiovascular disease, low-density lipoprotein cholesterol, and estimated glomerular filtration ratio (eGFR) were independently and significantly associated with the number of MetS components during an 11-year follow-up. The adjusted odds ratios (ORs) (95% confidence interval) for incident MetS across tertiles of baseline SUA and changes in SUA were 1.00, 1.47 (0.82–2.65), and 3.11 (1.66–5.83), and 1.00, 1.88 (1.03–3.40), and 2.49 (1.38–4.47), respectively. In addition, the combined effect between increased baseline and changes in SUA was also a significant and independent determinant for the accumulation of MetS components ($F = 20.29$, $p < 0.001$). The ORs for incident MetS were significant only in subjects with age ≥ 55 years, decline in eGFR, and no baseline MetS.

Conclusions These results suggested that combined assessment of baseline and changes in SUA levels provides increased information for incident MetS, independent of other confounding factors in community-dwelling women.

Keywords Serum uric acid · Metabolic syndrome · Retrospective cohort study · Women

Introduction

Metabolic syndrome (MetS), a clustering of cardiovascular risk factors such as visceral obesity, insulin resistance, hypertension, hypertriglyceridemia, and low high-density lipoprotein cholesterol (HDL-C) levels, and impaired fasting glucose, is a major worldwide public health problem. MetS increases the risk of diabetes [1] and cardiovascular disease (CVD) [2]. In Japan, incidence of MetS is 13.3% in men and 11.5% in women [3], and may become even more common with the continuous increase in the prevalence of overweight and obesity [4].

As the prevalence of increased serum uric acid (SUA) increases along with the prevalence of obesity and MetS [5], SUA is shown to be more strongly associated with MetS in women than in men [5]. Extending these observations, several cross-sectional studies have shown an association between SUA and MetS [6], although in one study the association disappeared after multivariate adjustment [7]. However, in several prospective studies it has been proposed that increased SUA may predict the development of MetS [8–15] as well as diabetes [16], hypertension [16], renal disease [17], CVD, and CVD mortality [18]. Thus, baseline hyperuricemia was a significantly independent risk determinant for MetS. These studies support the notion that SUA level cannot just be viewed as a secondary phenomenon in these pathologies. Despite a strong association between SUA level and various conditions in humans, it is instead considered as a beneficial phenomenon [19], which has a compensatory role (e.g., antioxidant in response to increased oxidative stress in conditions such as CVD) [20]. Moreover, few studies showing an association between longitudinal changes in SUA and incident MetS were found [12, 15] and remain controversial. The causal association between the phenomena remains unsolved [15].

The aim of this study was to determine the role of baseline and changes in SUA as a predictor of the MetS and its components by retrospective cohort data from Japanese community-dwelling women.

Table 3 Relationship between characteristics and number of MetS components during the 11-year follow-up

Characteristics, $N = 407$	Number of MetS components during 11-year follow-up	
	r (P value)	β (P value)[a]
Baseline		
Age (years)	0.254 (< 0.001)	0.065 (0.097)
Smoking status	− 0.118 (0.017)	− 0.003 (0.937)
Alcohol consumption	− 0.043 (0.382)	− 0.063 (0.072)
History of CVD	**0.139 (0.005)**	**0.099 (0.005)**
LDL cholesterol	**0.338 (< 0.001)**	**0.219 (< 0.001)**
eGFR	**− 0.102 (0.040)**	**0.095 (0.018)**
Serum uric acid (SUA)	**0.207 (< 0.001)**	**0.153 (< 0.001)**
Changes in SUA	**0.155 (0.002)**	**0.165 (< 0.001)**
R^2	–	**0.536 (< 0.001)**

r Pearson's correlation coefficient, β standard coefficient, R^2 multiple coefficient of determination

[a]Adjusted for baseline number of MetS. Significant values ($p < 0.05$) are presented in bold