

OBSERVATIONS

Visceral Fat Accumulation Is Associated With Circadian Blood Pressure in Japanese Patients With Impaired Glucose Tolerance

A central pattern of body fat distribution is generally considered to play an important role in the metabolic syndrome, which involves insulin resistance and hypertension (1). The patients of hypertension, especially nondippers, are at increased risk of hypertension associated with cardiovascular events compared with dippers patients whose nocturnal blood pressure is reduced (2). An increased visceral fat accumulation (VFA) is also a risk factor for cardiovascular disease, however, no studies have examined a relationship between VFA and 24-h ambulatory blood pressure (ABP). In the current study, therefore, we analyzed the VFA and 24-h ABP in patients with impaired glucose tolerance (IGT).

The blood pressure monitoring program recruited 255 consecutive subjects (139 men and 116 women, aged between 48 and 66 years). Of these 255 patients, 72 patients (mean \pm SD age: 58 ± 6 years; 40 men and 32 women) with untreated essential hypertension and IGT were enrolled in the current study. Essential hypertension was defined as a mean systolic 24-h ABP (sABP) greater than 135 mmHg or a mean 24-h diastolic ABP greater than 85 mmHg. The 24-h ABP was measured by the cuff-oscillometric method using an ABP monitoring system (TM-2425; A&D, Tokyo, Japan). The mean blood pressure value was computed for the awake period (between 6:00 A.M. and 10:00 P.M.) and the sleep period (between 10:00 P.M. and 6:00 A.M.).

M-mode 2-dimensional echocardiography was obtained by means of a phase-array echo-doppler system. All subjects underwent computed tomography at the level of the umbilicus for cross-sectional measurement of abdominal visceral fat areas and were analyzed with Fat Scan version 3 software (N2 Systems, Osaka, Japan). The study protocol was approved by the ethics committee of the Oita Red Cross Hospital. The Student *t* test was used for continuous variables, and a logistic regression and stepwise multiple logistic backward regression analysis was used by a standard statistical package (JMP 6.0; SAS Institute, Cary, NC).

Univariate logistic regression analysis showed that the high VFA was associated with 24-h mean sABP, daytime sABP, nighttime sABP, nighttime heart rate, fasting plasma glucose, fasting insulin resistance index, homeostatic model assessment (HOMA) index, 30-min postload glucose, 60-min postload glucose, 120-min postload glucose, 120-min postload insulin, left ventricular internal diameter at end-diastole, interventricular septal thickness at end-diastole, posterior wall thickness at end-diastole, and left ventricular mass index (LVMI) ($P < 0.05$ for each). Finally, multivariate logistic analysis identified LVMI (odds ratio 1.51 [95% CI 1.09–2.87], $P = 0.0441$), HOMA index (4.21 [1.07–16.5], $P = 0.0392$) and nighttime sABP (1.78 [1.12–3.98], $P = 0.0422$) as significant independent risk factors for the high VFA in patients with essential hypertension.

In the current study, we have firstly demonstrated that the HOMA index and nighttime systolic ABP are independent risk factors for the high VFA in Japanese patients with IGT. Postprandial glucose levels during the oral glucose tolerance test were higher in the nondippers than in dippers (3). In addition, we have previously shown that the nondipper hypertension is related to insulin resistance (4). Contrarily, thiazolidinedione treatment shifted their circadian blood pressure rhythms from the nondipper to the dipper type in type 2 diabetic patients (5).

Taken together, our findings demonstrate that HOMA index and nighttime sABP are independent factors for the high VFA in Japanese patients with IGT.

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