Hypertension in Japanese Americans: The Seattle Japanese-American Community Diabetes Study

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SYNOPSIS

AMONG SEATTLE'S JAPANESE AMERICANS, hypertension is associated with older age, male gender (in the younger age groups), glucose intolerance (impaired glucose tolerance and diabetes), and visceral obesity (measured by computed tomography). The gender difference in prevalence of hypertension is absent in those ages 65 to 74 and in those with diabetes. In the absence of diabetes, hypertension is not associated with fasting plasma insulin levels in the older second generation, but it is in the younger third generation. The association of hypertension with plasma insulin in the third generation may be due to the association between diabetes and plasma insulin and the presence of many prediabetic individuals in this generation.

About three-fourths of Japanese Americans are aware of their hypertension, slightly more than half of hypertensive Japanese Americans are being treated with anti-hypertensive medication, and of those receiving anti-hypertensive medication, less than half have their hypertension controlled. Women tend to be less aware of hypertension, to receive anti-hypertensive medication less often, and to have their hypertension less well-controlled than men.

Japanese Americans in King County, Washington, have a prevalence of non-insulin-dependent diabetes mellitus (NIDDM) much higher than the prevalence observed in native Japanese, suggesting that migration may bring out an inherent risk for NIDDM *(1)*. In Japanese Americans, visceral adiposity measured as cross-sectional intra-abdominal fat area by computed tomography (CT), has been a prospective marker of NIDDM, in contrast to either body mass index (BMI), an estimate of overall obesity, or subscapular skinfold thickness, an estimate of truncal obesity *(2)*. Visceral adiposity also correlated with fasting plasma insulin or C-peptide in this population, and the latter may be viewed as a surrogate for insulin resistance *(3)*. Based upon these observations, we have postulated that Asians may be generally prone to develop insulin resistance and visceral adiposity when exposed to lifestyle changes associated with Westernization *(4)*.

Associated with NIDDM is an increased prevalence of hypertension. This has also been the case in Japanese Americans *(1)*. Since NIDDM is

associated with both visceral adiposity and hyperinsulinemia, and since it has been suggested that in some populations insulin resistance and hyperinsulinemia may be causally related to hypertension *(5)*, the question arises as to whether hypertension in Japanese Americans is related to visceral adiposity and fasting plasma insulin levels, independent of NIDDM.

Methods

The study sample included 420 (229 men, 191 women) second- and 238 (120 men, 118 women) third-generation Japanese Americans born and raised in the mainland United States, residing in King County, Washington, and in the age range of 34 to 75. Data were collected between 1983 and 1988.

Blood pressure measurement protocols included 1) using a mercury sphygmomanometer with the cuff applied to the non-dominant arm of supine participants, 2) recording systolic and diastolic fifth-phase blood pressures, 3) calculating the average of the second and third of three consecutive measurements, and 4) defining hypertension as systolic blood pressure (SBP) ≥140 mmHg or diastolic blood pressure (DBP) ≥90 mmHg. Participants were *hypertensive*, regardless of their blood pressure, if they were taking an anti-hypertensive medication. Hypertension was *controlled* if SBP was <140 mmHg and DBP was <90 mmHg on anti-hypertensive medication.

After a 10-hour overnight fast, participants underwent a 3-hour, 75-gram oral glucose tolerance test, which classified them as having normal glucose tolerance (NGT), impaired glucose tolerance (IGT), or NIDDM, using World Health Organization diagnostic criteria, plus any available clinical data obtained from the participant and the participant's physician. Radioimmunoassay measured plasma insulin levels at each time point (at 0, 30, 60, 120, and 180 minutes).

To calculate BMI as weight (kg)/[height (m)]^2, observers measured height to the nearest tenth of a centimeter and weight to the nearest hundredth of a kilogram with participants clothed in shorts and socks. They measured skinfold thickness at truncal (chest, abdomen, subscapula) and extremity sites (triceps, biceps, forearm, anterior thigh). CT scans were done with single slices of the chest, abdomen, and midthigh, and each slice was analyzed for cross-sectional area (cm^2) of subcutaneous fat or intra-abdominal fat *(6)*.

Results

The age distribution of the study sample, shown in Table 1, reflects the generational structure of the study sample and the population from which it was derived *(1)*. Prevalence of hypertension increased with age and was slightly higher in men.

Almost three-fourths of the participants (men, 78%; women, 70%) were aware of hypertension. Slightly more than half were taking anti-hypertensive medication (men, 62%; women, 50%), but less than half of those treated had their hypertension controlled (men, 44%; women, 39%). Distribution of the study sample by glucose tolerance status was as follows: NGT, 170 men and 151 women; IGT, 96 men and 103 women; NIDDM, 83 men and 55 women. Prevalence of hypertension was 23% in those with NGT (men, 25%; women, 21%), 41% in those with IGT (men, 50%; women, 33%), and 68% in those with NIDDM (men, 66%; women, 71%).

Table 1. Age distribution and prevalence of hypertension in study sample

	Men		Women	
Age	*n*	% Hypertensive	*n*	% Hypertensive
25–43	7	28.6	10	0
35–44	88	10.2	87	5.7
45–54	56	39.3	42	35.7
55–64	136	54.4	93	37.6
65–74	62	61.3	76	64.5
75+	0		1	
Combined	349	41.5	309	33.8

To test the association of both hyperinsulinemia and adiposity with NIDDM, observers compared fasting insulin and glucose levels as well as BMI, subscapular skinfold, and intra-abdominal fat area in the nondiabetic second- and third-generation participants. Fasting insulin and glucose levels were not significantly different between normotensive and hypertensive second-generation participants. Intra-abdominal fat area, however, was significantly greater in hypertensive second-generation men and women than in their normotensive counterparts, whereas BMI, an estimate of overall obesity, and subscapular skinfold, an estimate of truncal obesity, were not significantly different. In the third generation, fasting insulin was higher in hypertensive participants, significantly so in men. Moreover, both BMI and intra-abdominal fat area were significantly greater in hypertensive third-generation participants than in their normotensive counterparts.

Discussion

Hypertension was associated with older age, male gender, glucose intolerance, and visceral obesity in Japanese Americans. The gender difference disappeared in the oldest group and in those with diabetes.

When diabetic participants were excluded, hyperinsulinemia was not associated with hypertension in the second generation. In contrast, fasting insulin was higher in the hypertensive nondiabetic than normotensive nondiabetic third-generation participants, who also had significantly higher BMI and intra-abdominal fat.

We have previously observed that in non-obese second-generation Japanese-American men, the lipid metabolic features of the so-called insulin resistance syndrome were more strongly correlated with visceral obesity than with insulin sensitivity as assessed by the Bergman minimal model technique *(7)*. We postulated that visceral adiposity played a central role in the development of the lipid abnormalities associated with this metabolic syndrome, and that it might be more appropriate to call it the visceral adiposity syndrome. A similar situation may also hold for hypertension. In the third generation, however, although only nondiabetic participants were included for this comparison, a large proportion had IGT, suggesting that this generation includes a large number of prediabetic individuals who will develop diabetes in the future. Thus the association of hypertension with hyperinsulinemia in this third generation may still be due to the association between hyperinsulinemia and NIDDM.

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