Incidence of Type 2 Diabetes in Individuals With Central Obesity in a Rural Japanese Population

The Tanno and Sobetsu Study

HIROFUMI OHNISHI, MD, PHD
SHIGEYUKI SAITOH, MD, PHD
SATORU TAKAGI, MD, PHD
NOBUO KATOH, MD
YU CHIBA, MD
HIROSHI AKASAKA, MD
YOSUKE NAKAMURA, MD
KAZUAKI SHIMAMOTO, MD, PHD

According to the new International Diabetes Federation (IDF) definition of metabolic syndrome, for a person to be defined as having metabolic syndrome they must have central obesity defined by waist circumference (1). In the definition, there are some ethnic or country-specific differences in the cutoff points of waist circumference, and Japanese cutoff points have been separately established in the IDF definition (≥85 cm for men and ≥90 cm for women). The Japanese Society of Internal Medicine and eight related scientific societies have also jointly announced new Japanese criteria of metabolic syndrome using the same cutoff points of waist circumference (2). However, the impact of central obesity using the cutoff points as a risk of type 2 diabetes is not known.

In this study, we investigated the incidence of type 2 diabetes in citizens of two rural communities in Japan to determine the relationship between type 2 diabetes and central obesity, and we also investigated the independent effects of central obesity compared with those of overall obesity.

RESEARCH DESIGN AND METHODS — The subjects were 348 men and 523 women selected from 938 citizens who had undergone medical examinations in the towns of Tanno and Sobetsu, Hokkaido, both in 1994 and 2003 or 2004.

The following participants in medical examinations in 1994 were excluded: those with missing data on blood pressure or waist circumference and those with type 2 diabetes (fasting plasma glucose level ≥126 mg/dl and/or those who were on medication for diabetes).

Participants with central obesity were determined according to the new criteria announced by the IDF (1). Central obesity in Japanese is defined by the IDF as waist circumference ≥85 cm for men and ≥90 cm for women. Participants with overall obesity were defined as those with BMI ≥25.0 kg/m^2, which is the standard of the Japan Society of the Study of Obesity (3).

The participants were divided into two groups, a normal group and a central obesity group, and the measured items in the two groups were compared. We also compared the incidences of type 2 diabetes in normal and central obesity groups of subjects who were newly determined as having type 2 diabetes on the basis of data obtained from medical examinations conducted in 2003 or 2004. Moreover, we estimated the relative risk of type 2 diabetes in people with central obesity compared with those who did not have central obesity.

As another analysis, the participants were divided into two groups, a normal group and an overall obesity group, and the same assessments as those described above were made for these two groups.

The SPSS package (version 11.5J) was used for statistical analysis. The χ^2 test was used for frequency comparison. Multiple logistic regression analysis was used to estimate the relative risk for type 2 diabetes. The significance level of all analyses was set at $P < 0.05$.

RESULTS — Thirty-eight of the 654 individuals in the normal group and 27 of the 173 individuals in the central obesity group were newly defined as having type 2 diabetes in 2003 or 2004. The incidence of type 2 diabetes was significantly higher in the central obesity group than in the normal group (15.6 vs. 5.8%; $P < 0.0001$). Thirty-five of the 591 individuals in the normal group and 30 of the 236 individuals in the overall group were newly defined as having type 2 diabetes in 2003 or 2004. The incidence of type 2 diabetes was significantly higher in the overall obesity group than in the normal group (12.7 vs. 5.9%; $P < 0.0001$).

The results of logistic regression analysis showed that both central obesity and overall obesity were closely related to type 2 diabetes and that the relative risks of occurrence of type 2 diabetes adjusted for age, sex, systolic blood pressure, total cholesterol, and smoking were 2.59 for central obesity and 2.06 for overall obesity (model 2; Table 1). Central obesity maintained its significance when additionally adjusted for overall obesity, but overall obesity lost its significance when additionally adjusted for central obesity (model 3; Table 1).

CONCLUSIONS — Waist circumference is a better predictor of visceral fat (assessed using advanced techniques such as dual-energy X-ray absorptiometry and computed tomography) than BMI

From the Second Department of Internal Medicine, Sapporo Medical University, School of Medicine, Sapporo, Japan.
Address correspondence and reprint requests to Hirofumi Ohnishi, MD, PhD, 2nd Department of Internal Medicine, Sapporo Medical University, School of Medicine, S-1, W-16, Chuo-ku, Sapporo 060-8543, Japan. E-mail: hohnishi@sapmed.ac.jp.
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Abbreviations: IDF, International Diabetes Federation.
A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.
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Table 1—*Comparison of the relative risks for type 2 diabetes in central obesity and overall obesity*

	Model 1 (Adjusted for age and sex)	Model 2 (model 1 + total cholesterol, systolic blood pressure, and smoking)	Model 3* (model 2 + overall obesity or central obesity)
Central obesity	2.84 (1.54–5.25)†	2.59 (1.39–4.81)†	2.07 (1.03–4.16)‡
Overall obesity	2.30 (1.37–3.85)†	2.06 (1.20–3.54)†	1.53 (0.83–2.83)

Data are relative risk (95% CI). *Relative risk of central obesity was adjusted for overall obesity (yes/no) and that of overall obesity was adjusted for central obesity (yes/no). The results of logistic regression analysis showed that both central obesity and overall obesity were closely related to type 2 diabetes (models 1 and 2). Central obesity maintained its significance when additionally adjusted for overall obesity, but overall obesity lost its significance when additionally adjusted for central obesity (model 3). †$P < 0.01$; ‡$P < 0.05$.

and waist-to-hip ratio (4–6). There is a strong association between waist circumference and risk of developing health conditions such as cardiovascular disease and type 2 diabetes (7–11). In our study, only central obesity remained a significant predictor of risk of type 2 diabetes when central obesity and overall obesity were included in the model simultaneously.

The IDF also announced a new definition of metabolic syndrome in 2005, and according to the new definition, for a person to be defined as having metabolic syndrome he or she must have central obesity assessed by waist circumference (1). Since there are some ethnic or country-specific differences in cutoff points of waist circumference, ethnic and country-specific cutoff points have been separately established in the IDF definition on the basis of results of various epidemiological studies. Japanese cutoff points have also been independently established in the IDF definition (waist circumference ≥85 cm for men and ≥90 cm for women). The reason for the selection of these cutoff points for Japanese subjects has been described in detail by Matsuzawa et al. (3).

Controversy remains regarding the cutoff points for waist circumference that should be used in clinical practice. The influence of abdominal fatness on health risks such as risk of type 2 diabetes is a continuous one, and any cutoff point is therefore arbitrary (12). Further epidemiological data must be obtained in each country to determine the appropriate country-specific cutoff points for assessing the risk of type 2 diabetes.

In conclusion, our study suggested that the current cutoff points of waist circumference for Japanese people in the IDF definition are useful for assessing the risk of type 2 diabetes and that central obesity may be more useful than overall obesity for evaluating the risk of type 2 diabetes.

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