Letters to the Editor

Visceral fat deposition is seen in patients with insulinoma

Dear Sir,

Body fat distribution has been evaluated using computed tomography [1], and it has been reported that increased visceral fat deposition is more frequently associated with hyperinsulinaemia or glucose intolerance than subcutaneous fat deposition [2]. Furthermore, hyperinsulinaemia is considered to be the cause of complications such as hypertension and hyperlipidaemia, which carry an increased risk of coronary artery disease [3]. To clarify the role of insulin in visceral fat deposition, we examined the correlation between these two factors. Determining whether insulin acts primarily on visceral fat cells and causes visceral fat deposition, or, whether insulin is increased due to visceral fat deposition has been difficult. To address the possible role of pure, non-genetically determined hyperinsulinaemia in the development of body fat distribution, we determined fat distribution in patients with insulinoma.

Body fat distribution was evaluated as the ratio of visceral and subcutaneous fat area (V/S ratio) at the umbilical level using computed tomography, and the diagnosis of visceral fat deposition was made when the V/S ratio was 0.4 or more [4]. We examined seven patients (two male, five female; mean age: 55.3 ± 18.3 years) with insulinoma, which had been diagnosed by histological examination after surgery. All of the patients had visceral fat deposition (V/S

ratio: 1.16 ± 0.81 [0.54–3.0]). We also examined the relationship between plasma insulin level ($\mu\text{U/ml}$) $\times$ disease duration (months) and the V/S ratio. As shown in Figure 1, they revealed a close positive correlation ($r = 0.886$, $p < 0.01$).

These results suggest that visceral fat deposition may be primarily caused by a high level of plasma insulin. However, the present clinical findings did not reveal with certainty that visceral fat deposition causes insulin resistance and, in turn, increased plasma insulin levels. Recently, Pontiroli et al. [5] reported that patients with insulinoma show insulin resistance. Cusin et al. [6] reported that hyperinsulinaemia produced by prior insulin treatment in rats decreased the glucose transporter type 4 expression in muscles while increasing this expression in parametrial adipose tissue.

Considering these results, it is possible to assume that primary hyperinsulinaemia might cause visceral fat deposition and also be associated with insulin resistance. To apply this hypothesis to the development of visceral type obesity with hyperinsulinaemia, further studies on the expression of insulin receptor and glucose transporter in visceral and subcutaneous adipose tissue will be required.

Yours sincerely,

H. Inadera, S. Ito, Y. Ishikawa, M. Shinomiya, K. Shirai, Y. Saito and S. Yoshida

References

1. Enzi G, Gasparo M, Biondetti PR, Fiore D, Semisa M, Zurlo F (1986) Subcutaneous and visceral fat distribution according to sex, age, and overweight, evaluated by computed tomography. *Am J Clin Nutr* 44: 739–746
2. Fujioka S, Matsuzawa Y, Tokunaga K, Tarui S (1987) Contribution of intraabdominal fat accumulation to the impairment of glucose and lipid metabolism in human obesity. *Metabolism* 36: 54–59
3. Ferrannini E, Haffner SM, Mitchell BD, Stern MP (1991) Hyperinsulinaemia: the key feature of a cardiovascular and metabolic syndrome. *Diabetologia* 34: 416–422
4. Tokunaga K, Matsuzawa Y, Ishikawa K, Tarui S (1983) A novel technique for the determination of body fat by computed tomography. *Int J Obes* 7: 437–445
5. Pontiroli AE, Alberetto M, Pozza G (1992) Patients with insulinoma show insulin resistance in the absence of arterial hypertension. *Diabetologia* 35: 294–295 (Letter)
6. Cusin I, Terrettaz J, Jeanrenaud RF, Zarjevski N, Jeannet AF, Jeanrenaud B (1990) Hyperinsulinaemia increases the amount of GLUT4 mRNA in white adipose tissue and decreases that of muscles: a clue for increased fat depot and insulin resistance. *Endocrinology* 127: 3246–3248

Dr. Yasushi Saito
Second Department of
Internal Medicine,
Chiba University
Inohana 1-8-1, Chuo-ku
Chiba City, Chiba
Japan

Fig. 1. Correlation between plasma insulin level $\times$ disease duration (IRI $\times$ duration) and the ratio of visceral and subcutaneous fat area (V/S ratio) in seven patients with insulinoma ($y = 0.515 + 0.00073 \times$, $r = 0.886$, $p < 0.01$). Each circle represents an individual patient. IRI is the mean of three determinations. Duration of insulinoma is calculated from the first hypoglycaemic attack