patient performance variables probably played the major role.

Therefore, we conclude that a system such as the One Touch, which eliminates the need for the operator to start and time the test and remove blood, results in an improvement in precision and accuracy, relative to the YSI, of blood glucose monitoring by patients.

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Recommendation for Strict Control of Plasma Triglyceride in Diabetic Subjects

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Atherosclerosis is the most common complication of diabetes. Hyperlipidemia or dyslipoproteinemia may account for the increased risk of atherosclerosis in diabetic patients (1). However, diabetic patients are still at a higher risk of developing atherosclerosis, even if they are normolipidemic (2,3). There is increasing agreement about the atherogenicity of intermediate-density lipoprotein (IDL) (4). Our previous work demonstrated an increased cholesterol concentration level in the Sf20–60 (IDL_1) fraction of normolipidemic, non-insulin-dependent diabetic patients (3). This study looked for clinical parameters that correlate with IDL_1 cholesterol concentration. Correlation analyses were performed between the cholesterol in IDL_1 and plasma lipids. Identification of a close relationship between IDL_1 cholesterol and plasma triglyceride enabled us to propose new guidelines for management of mild hypertriglyceridemia in diabetic subjects.

SUBJECTS AND METHODS

We examined 106 diabetic patients (63 men, 43 women) whose mean ± SD ages were 55 ± 12 yr and 41 healthy volunteers. None of the subjects received drugs that would affect lipid metabolism or had a significant impairment in renal, hepatic, or thyroid function assessed by monitoring serum enzymes. Patients with familial hypercholesterolemia were excluded. The subjects were divided into three groups according to treatment: insulin injection (group I, $n = 31$), sulfonylurea (group S, $n = 32$), or diet alone (group D, $n = 43$). All patients were brought into this study after stabilizing their blood glucose control levels and limiting their plasma cholesterol and triglyceride levels <250 mg/dl. The patients from group S were treated with glyburide, except for 7 treated with gliclazide. Nonobese age-matched healthy and normolipidemic (plasma cholesterol and triglyceride <250 and <150 mg/dl, respectively) subjects served as controls (group C, $n = 41$).

The procedures of blood sampling, lipoprotein separation, cholesterol and triglyceride assay, and statistical analysis were the same as described previously (3).

RESULTS AND DISCUSSION

Because the data on 82 of 106 patients were presented previously, the patient characteristics from this study were

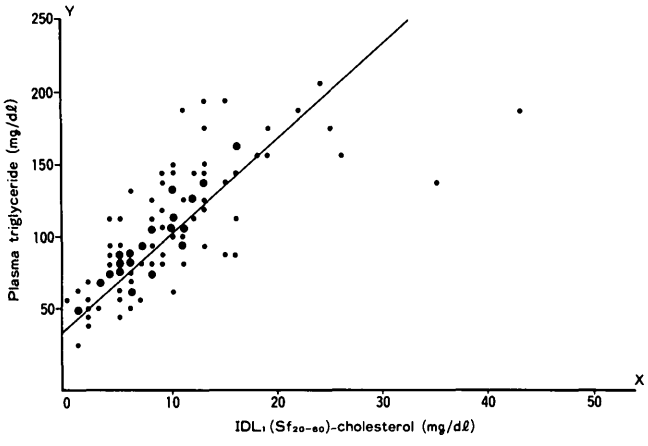

FIG. 1. Pearson correlation coefficients between intermediate-density lipoprotein (IDL_1) cholesterol and plasma triglyceride levels of all diabetic subjects. *Larger circles* indicate multiple patients. When subjects' IDL_1 cholesterol values were within 5.1 ± 6.8 mg/dl (mean ± 2SD) of normolipidemic (plasma cholesterol and triglyceride <250 and <150 mg/dl, respectively) healthy controls, their plasma triglyceride should be lower than ~115 mg/dl. $y = 6.54x + 36.7$; $r = .71$; $P = .001$.

similar to those of the previous report (3). The mean age and body mass index of the diabetic and control groups were comparable. Fasting blood glucose (FBG) and HbA_{1c} were significantly elevated in the three diabetic groups compared with control subjects, but there were no significant differences in the two clinical parameters between the three diabetic groups.

Correlation analyses were performed between IDL_1 cholesterol and other lipid parameters in the four groups. IDL_1 cholesterol correlated well with plasma triglyceride in all groups. A significant correlation was also found between IDL_1 and plasma cholesterol or low-density lipoprotein cholesterol in group D.

However, there were no significant correlations between IDL_1 cholesterol and high-density lipoprotein cholesterol, FBG, or HbA_{1c} in any group. The regression line between IDL_1 cholesterol and plasma triglyceride levels in the three diabetic groups is shown in Fig. 1.

Recent studies have focused on the atherogenicity of the IDL fraction. Type III hyperlipoproteinemia is often associated with severe atherosclerosis of coronary arteries and has an abnormally high concentration of IDL. Several reports indicate that IDL (Sf12–20 or 20–60) may be one of the risk factors associated with atherosclerosis (5). Our previous study demonstrated an increased cholesterol concentration in the IDL_1 (Sf20–60) fraction of normolipidemic diabetic subjects treated with sulfonylurea or diet alone (3). This implies that diabetic individuals are at a higher risk for atherosclerosis even if they are normolipidemic, and it may be one explanation for the increased risk of cardiovascular disease in diabetic patients.

The significant correlation between IDL_1 cholesterol and plasma triglyceride in diabetic subjects was a unique finding (Fig. 1). The precise atherogenicity of plasma triglyceride is a matter of debate. It is well recognized that high plasma triglyceride levels are an independent risk factor for coronary heart disease only in women. In the Framingham population, high triglyceride levels were a risk factor in diabetic subjects (6).

According to a calculated formula, patients' plasma triglyceride levels should be lower than ~115 mg/dl if their IDL_1 cholesterol levels are within 5.1 ± 6.8 mg/dl (mean ± 2 SD; 3) of normolipidemic healthy control subjects. Therefore, we recommend a new guideline for plasma triglyceride levels in diabetic patients, i.e., <115 mg/dl, if normotriglyceridemia is defined as <150 mg/dl. Further study is necessary to determine whether suppression of plasma triglyceride by diet and/or drug treatment can lower IDL_1 cholesterol proportionally.

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