three possibilities: (1) Only severe, long-standing diabetes leads to congestive failure. (2) Only insulin-dependent diabetes promotes cardiomyopathy. (3) The insulin treatment itself is damaging to the myocardium. The lack of *any* discernible increased risk of congestive heart failure in the group treated with tolbutamide or diet tends to exclude severity or duration of diabetes as the sole mechanism since an intermediate risk would be expected in this group under this hypothesis. Insulin in itself would not seem to be the culprit since in the patient with keto-resistant diabetes of adult onset endogenous insulin levels are often high either spontaneously or as a result of stimulation by orally administered hypoglycemic agents. Thus, the most tenable hypothesis is the difference in the kind of diabetes, implicating insulin-dependent, ketotic insulinopenic diabetes of early onset as the promoter of cardiac decompensation.

It is hard to exclude duration of diabetes or its severity from consideration. Congestive heart failure could be primarily a function of either factor and hence exhibit a particular relation to insulin-treated diabetes. Data are too scarce in this cohort to assess the effect of the type of treatment required or used versus the duration or severity of diabetes, and these aspects are difficult to disentangle without conducting a controlled experiment. It would be expected that the insulin-treated group would have more small vessel disease such as nephropathy and retinopathy (and perhaps in the heart as well). We cannot tell from our data.

Role of large and small vessel coronary disease: The excess occurrence of heart failure in patients with diabetes could be a result of either large or small vessel disease in the coronary arterial circulation. Such disease, particularly of the small vessels, is more apt to be severe in the insulin-dependent diabetic patient than in the patient not treated with insulin. The ischemic myocardium, which is more dependent on glucose and insulin for energy, would be especially vulnerable. All diabetic subjects should have difficulty in coping with an ischemic myocardial episode in view of the dependence of the hypoxic heart for energy on the glycolytic metabolic pathway, which is impaired regardless of the type of diabetes. And, indeed, once coronary disease develops, the diabetic subject fares worse than the nondiabetic subject in relation not only to congestive failure, but also to recurrence of infarction, myocardial rupture and survival.[12]

Accelerated coronary atherosclerosis has been noted in diabetic subjects, and these patients seem to have more myocardial infarctions, especially silent infarctions.[13] The latter observation suggests some difference in pathogenetic mechanism from that of the nondiabetic infarction. Myocardial and small vessel abnormalities have been studied less extensively than large vessel disease in the diabetic patient.[6] Myocardial hypertrophy and diffuse, patchy fibrosis have been reported more frequently than macroscopic myocardial infarction.[6] Microangiopathy has been well described in the skin, kidney, retina and skeletal muscle, but has not been well documented in the heart.[6] More systematic studies of the diabetic myocardium and its small vessels such as those of Blumenthal and co-workers[13] are urgently needed. These investigators reported more proliferative lesions of arterial branches of all sizes and of venules as well. They also found arteriosclerotic-appearing lesions in the small arteries and arterioles at least twice as frequently in diabetic as in nondiabetic patients with coronary disease.[14]

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