counting with each meal as part of a strategy that enables day-to-day variations in consumption with adjustments of mealtime insulin doses according to a predetermined, patient-specific *insulin/carbohydrate ratio*. It is advisable to avoid foods that contain supplemental fructose as a sweetener because of the potential adverse effects of fructose on lipid metabolism. Alcohol consumption in moderation is acceptable (one drink or less for women and two drinks or less for men per day).

Because of the contribution of excess body weight to increased cardiovascular risk, a fundamental goal of nutritional management should be to maintain normal body weight or to achieve weight reduction in overweight or obese patients. Eating disorders including binge eating, anorexia nervosa, and bulimia are relatively common in T1DM, especially among younger female patients.

Exercise

Regular physical exercise should be encouraged for its beneficial effects on weight control, risks of long-term complications, and overall quality of life. The general recommendation of several expert panels is 30 minutes or more of moderate-intensity physical exercise on at least 5 days per week. Physical exercise burns calories in proportion to its duration and intensity and also may result in increased insulin sensitivity after exercise (sometimes lasting for many hours). It often is most effective for patients to schedule regular exercise periods with a consistent temporal relationship to meals and insulin injections. Blood glucose should be tested before and after exercise, and exercise should not be undertaken if the initial blood glucose level is low (because of increased risk of hypoglycemia) or if it is higher than 250 mg/dL (because of risk of inducing further blood glucose elevation and development of ketosis). Patients with T1DM should be encouraged to pursue age- and overall health-appropriate athletic interests, including competitive sports, but this should be done only with careful attention to blood glucose monitoring and appropriate adjustments in insulin regimen and diet.

Type 2 Diabetes

Epidemiology and Pathology

T2DM is an extraordinarily common disorder, affecting 8% to 10% of the population in the United States and with a similar prevalence in most other developed or developing countries. Many patients with T2DM are undiagnosed, and many additional individuals (approximately 6% of the U.S. population) have a prediabetic state. T2DM is characterized by varying degrees of insulin resistance and insulin deficiency, which are believed to result from the impact of environmental factors on a background of genetic risk. The principal features of T2DM, contrasted with T1DM, are summarized in Table 66-4. The prevalence of T2DM has increased more than 10-fold over the past 50 years, driven primarily by increased calorie intake, decreased exercise, and resulting obesity. More than 80% of patients with T2DM are obese. The peak incidence of T2DM occurs in the fifth and sixth decades; however, T2DM now accounts for up to 30% of childhood diabetes in some populations. The lifetime risk of developing T2DM is approximately 40% among the offspring of a single affected parent, and approximately 70% if both parents are affected. The incidence of T2DM in the United States is higher in Hispanic/Latino populations, among African Americans, and in some east Asian populations, compared to populations of northern and western European ancestry. This is thought to result in part from effects of socioeconomic and cultural factors (e.g., differences in consumption of low-cost, calorie-dense foods) but also from genetic differences among these populations. The genetic predisposition in all populations that have been studied is thought to reflect the combined influence of more than 40 genes. No single gene or small group of genes with dominant influence on diabetes risk in any population has been identified.

T2DM is typically preceded by a prolonged preclinical or prediabetic phase during which there is a gradual deterioration in glucose tolerance (Fig. 66-2). This process occurs over a decade or more on average, with marked individual variation in the rate of progression. Most patients are insulin resistant during the preclinical phase but are able to compensate by producing more insulin (hyperinsulinemia) to maintain euglycemia. With time, there is progressive deterioration in the capacity to compensate for the insulin resistance. This is associated with a decrease in beta cell mass during the preclinical phase of T2DM, but substantial residual beta cells (typically 40% to 50% of the normal complement) are still present at the time that overt hyperglycemia develops. Therefore, there is compromised function as well as a reduced number of beta cells in T2DM. As blood glucose levels rise, the hyperglycemia itself may contribute to progression of the diabetic state by further decreasing insulin secretion and insulin resistance through mechanisms that are not well understood (referred to as *glucotoxicity*).

Screening of certain high-risk populations for T2DM and prediabetes by determination of a fasting or random plasma glucose measurement is considered cost-effective. More than 30% of people with T2DM and an even higher percentage of those with prediabetes are undiagnosed. Expert panel recommendations from the ADA for screening based on age, lifestyle factors, family history, and ethnicity are summarized in Table 66-6. Because of the insidious nature of T2DM, patients have a high risk for development of complications by the time of clinical diagnosis (see later discussion).

Clinical Presentation

Many patients are asymptomatic and are diagnosed on routine blood glucose testing. Blood glucose levels that rise high enough to exceed the renal threshold for glucose reabsorption (>170 mg/dL) induce an osmotic diuresis, resulting in the typical presenting symptoms of polyuria and polydipsia, as well as blurred vision secondary to osmotic shifts in the lens. Patients may also have weight loss or bacterial urinary tract or cutaneous fungal infections at presentation. Osmotic diuresis secondary to hyperglycemia may lead to electrolyte abnormalities and even occasionally to a severe hyperosmolar state associated with clinical symptoms and signs including fatigue, weakness, and ultimately compromised mental status that can range from confusion to coma (see later discussion). This most frequently occurs in elderly patients who may have compromised baseline renal function. In contrast to patients with T1DM, those with T2DM usually have enough