Recognizing and Managing Diabetes-Related Emergencies

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Diabetes mellitus is a chronic metabolic disorder, characterized by hyperglycemia, that results from either absolute insulin deficiency or resistance to the action of insulin at the cellular level. Insulin, a hormone secreted by the pancreatic beta cells, is necessary for proper carbohydrate, fat, and protein metabolism. Insulin allows glucose to enter cells, where it is converted to energy or, in some cells, stored for later use. Insulin also functions as a lipogenic, antilipolytic, and protein-anabolic hormone.

Diabetes results in the inability to regulate blood glucose levels within the normal range of 70–110 mg/dl. The disease is characterized by an abnormally high blood glucose level and an inability to properly metabolize and store ingested dietary “fuels.” Chronically elevated levels of blood glucose eventually damage the body’s systems. As a result, diabetes is a disease that has long-term negative effects on the body’s renal, neurological, ocular, cardiovascular, and musculoskeletal systems. These complications are devastating and take a toll on the individual and society.

There are four etiological categories of diabetes mellitus: Type 1, Type 2, gestational, and a fourth category that includes other specific types of diabetes that can result from genetic defects of beta-cell function, infections, or the use of drugs or chemicals. The two major forms of diabetes mellitus are Type 1 and Type 2.

Type 1 Diabetes
Type 1 diabetes mellitus is characterized by absolute insulin deficiency. It is an autoimmune disorder caused by a combination of genetic and environmental factors. The autoimmune response is often triggered by an environmental event such as exposure to a virus. The target of the autoimmune response is the insulin-secreting beta cells of the pancreas. When the beta-cell mass has been reduced by approximately 80%, the pancreas does not secrete enough insulin to manage hepatic glucose output. The classic signs and symptoms of Type 1 diabetes mellitus develop rapidly and are related to decreased transportation of glucose into cells throughout the body. These signs and symptoms include fatigue, changes in vision, excessive hunger, frequent urination, weight loss, extreme thirst, and ketosis.

Type 1 diabetes mellitus occurs most commonly in children, adolescents, and young adults and accounts for approximately 10% of all diagnosed cases of diabetes mellitus. It is characterized by marked hyperglycemia and...
a strong propensity for the development of ketoacidosis. Treatment strategies for Type 1 diabetes include insulin therapy, dietary modifications, and physical activity. Unique emergencies related to Type 1 diabetes include hypoglycemia and diabetic ketoacidosis.

**Type 2 Diabetes**

Type 2 diabetes mellitus typically occurs in adults 40 years of age and older. It is characterized by insulin resistance and is usually accompanied by varying degrees of insulin deficiency. Insulin resistance is a phenomenon wherein the body might have adequate amounts of insulin available but cannot use it properly. Although the specific etiology of Type 2 diabetes mellitus is unknown, it is closely related to age and obesity. It is estimated that 18% of Americans age 65–74 years have Type 2 diabetes mellitus and that approximately 80% of these individuals are obese. Obesity itself is directly related to insulin resistance. The combined effects of insulin resistance and some degree of insulin deficiency lead to the gradual development of hyperglycemia, which in the earlier stages of the disease is frequently undetected. As a result, Type 2 diabetes mellitus often goes undiagnosed. It is estimated that approximately 50% of those with Type 2 diabetes are unaware that they have the disease. Although this form of diabetes is closely linked to middle age and obesity, there has been an increase in the number of cases of Type 2 diabetes being diagnosed in children. As our lives have become more sedentary and our nation has become more obese, the incidence of Type 2 diabetes has risen sharply, and it is now occurring in a younger population. In the 1990s the prevalence of Type 2 diabetes rose 33%, largely because of an increased prevalence in obesity (58%) seen during that time. Of most concern was an increased prevalence of Type 2 diabetes in younger age groups, including teenagers.

Type 2 diabetes is characterized by variable plasma insulin levels, hyperglycemia, and peripheral insulin resistance. Treatment strategies for Type 2 diabetes mellitus include oral hypoglycemic agents, weight loss, dietary modifications, and physical activity. Unique emergencies related to Type 2 diabetes include hypoglycemia and hyperosmolar hyperglycemic nonketotic coma.

**Hypoglycemia**

Hypoglycemia can occur in any person with Type 1 diabetes and in those with Type 2 diabetes who use oral hypoglycemic agents to control their blood glucose levels. It is the most frequently encountered acute complication of diabetes. Hypoglycemia is defined as a blood glucose level less than 70 mg/dl. It is the result of increased blood glucose uptake without an accompanying increase of blood glucose levels, either from the liver or from exogenous sources. There are several reasons that hypoglycemia might occur. First, there can be a relative excess of insulin, which inhibits hepatic glucose output and stimulates glucose disposal into insulin-sensitive tissues. Second, there can be a delay or decrease in food intake, which decreases the availability of exogenous glucose or other gluconeogenic precursors. Third, there can be an increase in physical activity level that when coupled with insulin accelerates glucose uptake by muscle. The signs and symptoms of hypoglycemia are divided into two major categories: neurogenic and neuroglycopenic. The onset of signs and symptoms vary with plasma blood glucose level and from person to person.

Neurogenic signs and symptoms typically occur first and result from activation of the autonomic nervous system and the release of epinephrine. Typical signs and symptoms include shakiness, sweating, irritability, nervousness, tachycardia, hunger, and tremors. It is important to note that an athletic trainer might observe these signs and symptoms in an athlete with poorly controlled diabetes. For example, an athlete might suddenly experience a drop in blood glucose from 200 to 100 mg/dl over a very short period of time.

Neuroglycopenic signs and symptoms are the result of low plasma blood glucose and diminished availability of glucose to the central nervous system. Glucose is the preferred fuel of the central nervous system. When hypoglycemia is of sufficient duration and degree to interfere with normal brain function, an athlete is potentially at risk for brain damage and, possibly, death. Unlike the neurogenic signs and symptoms that might occur when the blood glucose level falls from a high level to a lower level, neuroglycopenia does not occur when the plasma glucose level is within or above the normal range. Generally speaking,