Obesity and Type 2 Diabetes in Our Youth: A Recipe for Cardiovascular Disease

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ABSTRACT

Cardiovascular disease continues to be the leading cause of death worldwide. According to the American Heart Association, at least 68% of the population with diabetes will die from some form of heart disease. Type 2 diabetes is steadily increasing in children and adolescents, creating a detrimental impact on health. The combination of diabetes and heart disease greatly reduces quality of life and life expectancy. According to current data, nurse practitioners are twice as likely to monitor A1C levels, and 37% more likely to meet cholesterol level guidelines. The nurse practitioner's role is to provide high-quality care to children and adolescents with type 2 diabetes to improve health and prevent complications.

Keywords: adolescents, cardiovascular disease, children, type 2 diabetes

Cardiovascular disease (CVD) continues to be the leading cause of death worldwide, contributing to 635,000 deaths in the United States each year.[1] According to the American Heart Association, at least 68% of the population with diabetes will die from some form of heart disease.[2] Despite numerous studies on type 2 diabetes (T2D), researchers are still debating the intricate associations between childhood obesity, impaired glucose tolerance, insulin sensitivity, insulin resistance, and CVD. What is known is that the combination of diabetes and heart disease greatly reduces quality of life and life expectancy.[3] Studies indicate that health care providers are knowledgeable about the risks of T2D in adults, but many do not consider the risks in children.[4] Reducing the incidence of obesity and T2D in children and adolescents may not only prolong life expectancy but also decrease the incidence of cardiovascular disease.[5] Delayed screening can reduce the opportunity for detecting T2D and preventing CVD.

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EPIDEMIOLOGY

T2D in children and adolescents has become a major concern because of its rapid increase in the younger population. Approximately 8.3% of the population is currently living with diabetes, with approximately 19,000 cases of T2D in children and adolescents.[6] Sedentary behavior and obesity are now being considered contributing factors for T2D. In the US, approximately 17% (12.7 million) of children and adolescents 2 to 19 years of age are overweight or obese with a body mass index above the 95th percentile on the Centers for Disease Control and Prevention growth chart.[7] Obesity and T2D form a reciprocal relationship as the body mass index increases above the 95th percentile.[7] A higher incidence of obesity was noted in females compared with males.[7] As the number of children and adolescents with obesity increases, the incidence of early-onset T2D and CVD will grow.[8]

As the number of children and adolescents diagnosed with T2D increases, the debate continues as to whether the incidence has really increased or screening has improved. Thirty years ago, T2D was rarely considered as a potential diagnosis when treating children. With the growing epidemic of

obesity, T2D has become a significant threat to the health of children and young adults.[8] T2D continues to disproportionately affect overweight minority groups such as Native Americans, Hispanics/Latinos, and blacks.[9]

Obesity is not the only reason children and adolescents develop T2D. The pathophysiological phenomena seems to be that the beta cells of the pancreas in some obese children continue to produce insulin to control blood glucose levels but at a lower rate.[9] Researchers also found that target fat cells in the abdomen secrete chemicals that result in an inflammatory response.[9] This inflammatory response contributes to increased fat in the liver, which is a risk factor for insulin resistance.[9] This is a major precursor to the development of T2D and CVD.

It has been substantiated across multiple studies that diabetes is associated with an increased incidence of CVD.[2,8,10] In recent years, the American Diabetes Association (ADA) and the American Heart Association have released statements that diabetes is now considered a coronary artery disease risk equivalent rather than a risk factor.[11] Results from The Framingham Heart Study indicated that patients with T2D have a 2- to 3-fold increase in heart disease.[12] The provider and patient must develop a strong working relationship in order to reduce the incidence of both chronic illnesses.

BACKGROUND

The criteria for the diagnosis of T2D released by the ADA are the same for children, adolescents, and adults. Diagnosis focuses on blood glucose concentrations (A1C $\geq$ 6.5%, fasting plasma glucose [FPG] $\geq$ 126 mg/dL, 2-hour plasma glucose [PG] $\geq$ 200 mg/dL, or random plasma glucose $\geq$ 200 mg/dL) in the presence of key symptoms including polydipsia, polyphagia, polyuria, blurred vision, glucosuria, and ketonuria.[9] Visceral fat or central obesity has unique metabolic effects on insulin sensitivity, with visceral fat having a greater influence on fasting insulin levels.[9] Children who are born in the 90th percentile for weight on the growth chart continue to be at greater risk for developing diabetes at an earlier age.[9] The risk of developing T2D is higher if a close family member has the disease or if the child is above the 95th percentile for weight.[6]

Childhood obesity has been associated with the development of CVD because of its detrimental effects on lipids and blood pressure levels.[8] Hypertension (140/90 or higher) places an individual at greater risk, as does a high cholesterol level, a high-density lipoprotein level below 35 mg/dL, or a triglyceride level above 250 mg/dL.[8,13] Weight loss can improve cardiovascular risk and increase insulin sensitivity.[8]

Acanthosis nigricans, a condition that is associated with insulin resistance characterized by a dark velvety rash around the neck or under arm, is a visual marker for suspecting endocrine dysfunction.[9] The identification of acanthosis nigricans in a younger person warrants screening for insulin resistance. Acanthosis nigricans usually improves with treatment.

T2D is considered a preventable disease with well-established guidelines and recommendations for providers. Despite this knowledge, diabetes prevalence is steadily increasing with future estimates that 1 in 3 will develop diabetes by 2050.[14] In the SEARCH for Diabetes in Youth Study, researchers found an increase in the number of cases of T2D in children.[15] From 2001 to 2009, there was an increased incidence of T2D in the 10- to 19-year age group.[15] Unfortunately, obesity rates in children (< 18 years of age) has quadrupled in the past 30 years.[15] This trend is placing more Americans at risk of developing T2D and CVD at an earlier age.[15]

The prevalence of T2D has become more evident among specific ethnic groups including blacks, Hispanic/Latinos, Pacific Islanders, and American Indians. Non-Hispanic whites have the lowest rates of T2D.[9] Black children were shown to have higher total cholesterol levels, low-density lipoprotein (LDL) levels and high-density lipoprotein levels, than non-Hispanic whites and Hispanic children.[8] Black children also have higher blood pressure levels, placing them at higher risk of developing CVD.[8,9] Eliminating ethnic disparities will be needed in order to reduce the incidence of T2D.

PATHOPHYSIOLOGY

Prediabetes is defined as impaired plasma glucose level, impaired glucose tolerance, or an elevated glycosylated hemoglobin (A1C) level.[16] The 2 basic problems in prediabetes is insulin resistance and