Rev Esp Endocrinol Pediatr 2014; 5 (Suppl)
10.3266/RevEspEndocrinolPediatr.pre2014.Apr.220

Type 1 Diabetes Mellitus in Children: A 30-Year Perspective

Joseph I. Wolfsdorf

Division of Endocrinology, Boston Children's Hospital
Department of Pediatrics, Harvard Medical School, Boston, MA, USA

Abstract

Diabetes mellitus is the most common endocrinopathy and one of the most common chronic diseases of childhood. The incidence of type 1 diabetes (T1D) varies widely among geographic regions; the highest rates occur in Finland and the lowest in areas of China and Venezuela. Secular increases in the incidence of pediatric T1D during the mid-late 20th century have been documented in North America and Western Europe at rates higher than can be explained by genetic shifts. The incidence of childhood diabetes is increasing worldwide at a rate of approximately 3% per year, with increases documented in six continents. There has also been an alarming trend towards younger age of onset, and diabetes is no longer uncommon in toddlers and preschool aged children.

Before the discovery of self-blood glucose monitoring and measurement of glycated hemoglobin (HbA1c) in the late 1970's, children were typically treated with 1 or 2 daily injections, and metabolic monitoring was performed by crude measurements of glucosuria and ketonuria. The primary goals of treatment were to promote normal growth and development, prevent symptoms of hyperglycemia, and avoid severe hypoglycemia. The Diabetes Control and Complications Trial (DCCT) and the Stockholm Diabetes Intervention Study ended the longstanding debate about whether the microvascular complications of diabetes are caused by hyperglycemia and can be prevented or ameliorated. These clinical trials and the long-term follow-up observations of the DCCT cohort unequivocally demonstrated the importance of lowering glycemia and HbA1c values to reduce the risk of development and progression of retinopathy, nephropathy, neuropathy, and macrovascular disease. Reduction of HbA1c to ~7% (about 1% above the upper limit of normal) is associated with fewer long-term micro- and macrovascular complications. The aim of modern diabetes management is to achieve specific glycemic targets by means of more physiologic and flexible insulin regimens combined with frequent self-blood glucose monitoring. Technological advances, including the development of a variety of insulin analogs, insulin pumps, rapid and accurate glucose meters and continuous glucose sensors, have drastically altered how patients manage their diabetes. However, to achieve and maintain current treatment goals is expensive, requires extensive ongoing diabetes self-management training and education provided by a diabetes team (physician, nurse educator, dietitian, mental health/behavioral specialist), encouragement and support. Despite advances in treatment only a minority of children and adolescents are meeting treatment goals. Nonetheless, observational studies of large cohorts have shown significant improvements in glycemic control as compared with the pre-DCCT era, reduced frequency of severe hypoglycemia, and a decline in rates of retinopathy and early signs of nephropathy.

While we await the ability to replace beta cells and cure T1D, encouraging progress in the development of closed-loop insulin delivery systems suggests that an "artificial pancreas" is likely to become commercially available within the next few years.