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ORIGINAL ARTICLE

Nine-year longitudinal study of cardiovascular risk factors in Spanish children and adolescents with type 1 diabetes☆

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Abstract

Objectives: To analyse the prevalence, evolution of cardiovascular risk factors (CVRF) and their relationship with follow-up of metabolic control in paediatric patients with Type 1 Diabetes (T1DM).

Patients and methods: A longitudinal ambispective study was conducted including 75 children and adolescents with T1DM diagnosed from 1996 to 2003 and followed-up for nine years. Family history of CVRF was registered. Data from the second, sixth and ninth year after diagnosis were analysed.

Results: Family history of CVRF was found in 46.6% of the patients. The prevalence of HbA1c > 7.5% in the second, sixth and ninth year after diagnosis was 45.3%, 53.3% and 56%, respectively. The prevalence of obesity (BMI > 2SDS) in the three visits was 5.3%, 5.3% and 6.7%, respectively. Hypertension (BP > p90) was found in 14.6%, 8% and 13.3% of the patients in the three visits, respectively. The levels of various parameters were the following: Total cholesterol > 200 mg/dL: 25.3%, 13.3% and 16%; high density cholesterol lipoprotein < 40 mg/dL: 1.3%, 1.3% and 4%; low density cholesterol lipoprotein > 100 mg/dL: 38.6%, 34.6% and 38.6%; triglyceride > 150 mg/dL: 0%, 1.3% and 2.6%, respectively. There was a significant increase in the prevalence of TG/HDL-C $\geq$ 2 between the sixth and the ninth year after diagnosis (1.3% and 9.3%, $P < 0.05$). A persistent HbA1c $\geq$ 7.5% showed a statistically significant relationship to a 0.94 decrease in HDL-C z-score between the second and the sixth year, and a persistent HbA1c < 7.5% was significantly associated with a 0.55 increase in HDL-C z-score ($P = 0.015$) in the same period.

Conclusions: A non-optimal metabolic control in the first year of DM1 is associated with a decrease in HDL-C *z*-score. TG/HDL-C ratio could be an early marker of cardiovascular risk.

Factores de riesgo cardiovascular en niños y adolescentes españoles con diabetes mellitus tipo 1: evolución a lo largo de 9 años

Resumen

Objetivos: Analizar la prevalencia, evolución de factores de riesgo cardiovascular (FRCV) y su relación con el control metabólico en pacientes pediátricos con diabetes mellitus tipo 1 (DM1).

Pacientes y métodos: Estudio longitudinal ambispectivo en 75 niños y adolescentes españoles con DM1 diagnosticados en los años 1996-2003 y seguidos durante 9 años. Analizamos los FRCV y su evolución al segundo, sexto y noveno años tras el diagnóstico, y los antecedentes familiares (AF) de FRCV.

Resultados: El 46,6% tenía AF de FRCV. En el segundo, sexto y noveno años encontramos una prevalencia de HbA1c > 7,5% del 45,3, el 53,3 y el 56%, respectivamente; de obesidad (índice de masa corporal > 2 desviaciones estándar) del 5,3, el 5,3 y el 6,7%, y de HTA (presión arterial > p90) del 14,6, el 8 y el 13,3%. Colesterol total > 200 mg/dl en el 25,3, el 13,3 y el 16%; lipoproteína de alta densidad del colesterol (HDL-c) < 40 mg/dl en el 1,3, el 1,3 y el 4%; lipoproteína de baja densidad del colesterol (LDL-c) > 100 mg/dl en el 38,6, el 34,6 y el 38,6%; triglicéridos (TG) > 150 mg/dl en el 0, el 1,3 y el 2,6%, respectivamente. Encontramos un aumento significativo en la prevalencia de TG/HDL-c $\geq$ 2 entre el sexto y el noveno años de evolución de la enfermedad (1,3% y 9,3%, p < 0,05). Una HbA1c $\geq$ 7,5% en el segundo y el sexto años se asoció de forma significativa a una disminución en el HDL-c z-score de 0,94, y una HbA1c < 7,5% durante ese mismo periodo se asoció significativamente a un aumento del HDL-c z-score del 0,55(p = 0,015).

Conclusiones: El peor control metabólico de la DM1 en los primeros años de evolución se asocia a una disminución del HDL-c *z*-score. El cociente TG/HDL-c podría ser un marcador precoz de riesgo cardiovascular.

Introduction

Cardiovascular disease (CVD) is the leading cause of death in patients with type 1 diabetes mellitus (T1DM).[1,2] It has been demonstrated[3–5] that cardiovascular risk factors (CVRFs) present in the paediatric age group progress into adulthood, and there is evidence of their association with markers of atherosclerosis[5] and/or atherosclerotic lesions in autopsies.[3,4]

In childhood and adolescence, T1DM may be associated with other CVRFs such as obesity, dyslipidaemia and hypertension (HTN). Cross-sectional studies[6,7] have shown a high prevalence of CVRFs in young patients with T1DM, but there are few longitudinal studies.[8,9] Disorders of lipid metabolism are among the most studied CVRFs in T1DM.[10,11] Di Bonito et al. proposed that a high triglyceride (TG) to high-density lipoprotein cholesterol (HDL-c) ratio could be useful in clinical practise for identifying children with poorer cardiovascular profiles,[12] but no studies on this subject have been conducted in children with T1DM.

The aim of our study was to analyse the prevalence of different CVRFs, including the TG-to-HDL-c ratio, over a period of nine years, and to assess the relationship between glycaemic control and lipid profiles in a cohort of children and adolescents less than 19 years of age with T1DM. This is the first longitudinal study conducted on a Spanish paediatric population with T1DM.

Patients and methods

We conducted an ambispective longitudinal study (retrospective analysis until 2006 and prospective analysis thereafter) with a nine-year follow-up of a cohort of 75 patients with T1DM, less than 19 years of age (57.3% male), diagnosed between 1996 and 2003, and followed up at our Diabetes Unit. The mean age at diagnosis was 6.5 ± 3.4 years. All patients were Caucasian and were being treated with a basal-bolus multiple dose insulin (MDI) regimen or with continuous subcutaneous insulin infusion (CSII). During the first visit, we excluded from the study any patients with any other systemic disease that could affect their lipid levels. We evaluated the patients every 3 months as part of their T1DM follow-up visits scheduled to adjust the insulin dosage and to provide education on diabetes. We selected