



ORIGINAL ARTICLE

## Prevalence of sensorineural hearing loss in children and adolescents with diabetes mellitus



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### KEYWORDS

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Insulin-dependent diabetes;  
Sensorineural hearing loss;  
Deafness;  
Children

### Abstract

**Objective:** To establish the prevalence of sensorineural hearing loss (SNHL), as well as the predisposing risk factors, in children and adolescents with type 1 diabetes mellitus (T1DM) attending the Service of Endocrino-Pediatrics and Otolaryngology Department of the "Dr. José Eleuterio González" University Hospital and the Materno-Infantil Hospital, from January 2011 to December 2012.

**Material and methods:** A total of 84 children with T1DM, with ages between 6 and 18 years old, were studied. Values of glycated hemoglobin (HbA1c) were assessed and Tonal audiometry and Speech audiometry tests were performed.

**Results:** A total of 84 patients with a diagnosis of T1DM were studied, out of which 12 (14.3%) presented SNHL. Fifty percent of patients with hearing loss were in the age range of 10–13 years old. Regarding time of evolution with the disease (T1DM), 33% of patients with more than 5 years with T1DM presented SNHL, and nearly 88.9% of the patients with less than 5 years with T1DM presented normal hearing ( $p=0.011$ ). Moreover, 65.47% of the patients presented complications due to poor glycemic control at some point in the evolution of their disease. All (100%) diabetic patients with SNHL and 91% of the patients without SNHL had HbA1c values greater than 6%. In patients with hearing impairments, 83.3% suffered mild and 16.4% suffered moderate hearing loss. Most presented bilateral hearing loss, with the right ear dominating. Acute frequencies, mainly 8000 kHz, were the most affected.

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**Conclusion:** SNHL prevalence among our diabetic population was 14.3%, which indicates that a sixth of our diabetic type 1 population will develop SNHL. According to the results obtained, SNHL is more frequent among patients who have had T1DM for more than 5 years. Nevertheless, more studies are required to confirm that there is a relation between time spent with the disease and SNHL.

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## Introduction

The World Health Organization (WHO) defines diabetes mellitus (DM) as a multiple-etiology metabolic disorder, characterized by chronic hyperglycemia and other metabolic abnormalities, which result in absolute or relative insulin deficiency. It is the most frequent endocrine-metabolic disorder in children and adolescents, and has remained the main type of diabetes in children.<sup>1-4</sup>

Type 1 diabetes mellitus (T1DM) is a disease with an etiology of intervening environmental factors which interact with a genetic-predisposition component; it is considered a chronic autoimmune disease which causes the destruction of the pancreatic  $\beta$  cells which produce insulin.<sup>5</sup>

The average age of the onset of the disease is between 7 and 15 years of age; however, it may occur at any age.<sup>6</sup> Values of the HbA1c > 6% higher than the normal range (5–6%) have been considered a risk of developing micro- and macroangiopathic complications. The affection of the blood vessels which supply the inner ear and the vascular stria have been reported by different authors as a physiopathological cause of SNHL in T1DM patients.<sup>3,7</sup> Treatment with insulin, maintaining on average HbA1c of 7.2%, reduces the onset and progression of microangiopathic complications, atrophy, and demyelination of the spiral ganglion by up to 76%.<sup>8,9,13</sup>

Sensorineural hearing loss (SNHL) is a loss of hearing at any frequency more than 25 dB, with conductive and sensorineural gaps lower than 20 dB, and affecting the patient's ability to communicate, his or her education, job prospects and social relationships, and also causes stigmatization.<sup>11,12</sup>

The reported prevalence of SNHL is up to 33% in children with T1DM versus 0.3–0.5% in healthy children. In Mexico there is a lack of sufficient epidemiologic information which defines the hearing condition prevailing in our population.<sup>12</sup>

## Materials and methods

A prospective longitudinal, analytic, comparative study was conducted on a total of 87 patients of both sexes, ages 6–18, with a T1DM diagnosis, from the Service of Endocrinology and Otolaryngology Department of the "Dr. José Eleuterio González" University Hospital and the Materno-Infantil Hospital, from January 2011 to December 2012.

We included patients who agreed to participate in the protocol through a signed informed consent, signed by their parents and/or guardians and/or the patient. We excluded patients with noise exposure, a family history of deafness, use of ototoxic medications, otitis media, a history of

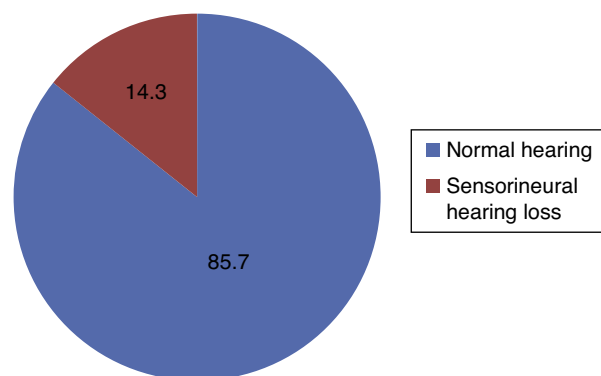
previous ear surgery (except ventilation tube insertion) and DM type 2.

All subjects in this study were given a questionnaire, which included family, prenatal, natal and personal pathological and non-pathological history. Patients underwent basic otorhinolaryngological exploration, tone audiometry and oral audiometry using an audiometer AUDIOTEST 259b, manufactured for Interacustics, Type 2 Tone Audiometer, Type B-E-T speech audiometer in a soundproof cabin Acoustics Systems, Model RE-142, Serial #21413<sup>a</sup>, made in USA. The study was approved by the Ethics and Research Committee of the School of Medicine of the Universidad Autónoma de Nuevo León (UANL by its Spanish acronym) with the registration key OT12-002.

The information obtained was gathered in a database using Excel, performing statistical analysis using SPSS 20.0. We obtained the traditional statistics in the quantitative and qualitative variables, looking to establish differences between both groups through hypothesis tests for means and proportions, to establish the absence or presence of association and correlation using chi square, Pearson or Spearman, with a confidence and reliability of 95%.

## Results

Out of the 87 recruited patients with a T1DM diagnosis, we excluded a patient with a history of chronic otitis media of the right ear, one with otitis media with bilateral effusion and a patient with a final diagnosis of T2DM. The remaining 84 patients were divided into 3 groups based on age: 6–9, 10–13, and 14–18 years old. We observed that 72 patients with a T1DM diagnosis showed normal hearing while 12 T1DM patients showed sensorineural hearing loss (Fig. 1).



**Figure 1** Average of patients with type 1 diabetes with normal hearing and sensorineural hearing loss.

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