Section: ENT

Original Research Article

EVALUATION OF EARLY ONSET OF SUBCLINICAL HEARING LOSS IN CHILDREN WITH TYPE 1 DIABETES MELLITUS

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ABSTRACT

Background: Diabetes mellitus (DM) is a chronic disease derived from the inadequate production of insulin in the pancreas or from the ineffective use of available insulin and it is a relevant chronic degenerative disorder. The present study was conducted to evaluate early onset of subclinical hearing loss in children with type 1 diabetes mellitus.

Materials & Methods: 20 patients between age group of 6-16 years with confirmed diagnosis of Type 1 DM and average disease duration of more than 1 year were enrolled. Another set of 20 subjects which were age and gender matched were included as control group. Audiological assessment of all the subjects was done. Audiological testing was done using pure tone audiometry (PTA) and Otoacoustic emission (OAE).

Results: In the present study high frequency SNHL was seen in 10 percent of the children of diabetic group. Among these two subjects, one was male while the other was female.

Conclusion: Early identification is significant in affected children so that prompt treatment could be started.

Key words: Subclinical, Diabetic, Hearing Loss, Children.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease derived from the inadequate production of insulin in the pancreas or from the ineffective use of available insulin. It is characterized by increased blood sugar levels and is a genetically inherited disease. DM is a relevant chronic degenerative disorder. Prevalence rates vary regionally. It has been estimated that by 2025 there will be an astounding 300 million diabetic individuals in the world, twice as many as in 2000.[1,2] Late diagnosis occurs frequently, mainly among children and teens. There are four main types of DM: type 1 - results from the autoimmune destruction of the pancreatic beta-cells; type 2: insulin metabolism or secretion disorder; secondary diabetes related to genetic predisposition, drug use, unknown cause; gestational diabetes. Today the association between DM and hearing loss is being given a lot of attention. Complaints related to the auditory and vestibular systems and metabolic disorders affecting glycides and lipids have been pointed out as the main etiologic factors related to hearing loss, tinnitus, and dizziness.[3,4] Therefore, the diabetic population must be considered at risk for auditory conditions. Higher mean hearing thresholds have been reported (more hearing loss) in diabetic patients with neuropathy when compared to diabetic patients without neuropathy in all frequencies from 250 Hz to 8.000 Hz. DM-related hearing loss follows a similar pattern to that of presbycusis given the linear distribution between frequencies.[5,6] Diabetes Mellitus may lead to alterations in the eyes, kidneys, cranial nerves, peripheral nerves, ears etc.[7] Hence; the present study was conducted to evaluate early onset of subclinical hearing loss in children with type 1 diabetes mellitus.

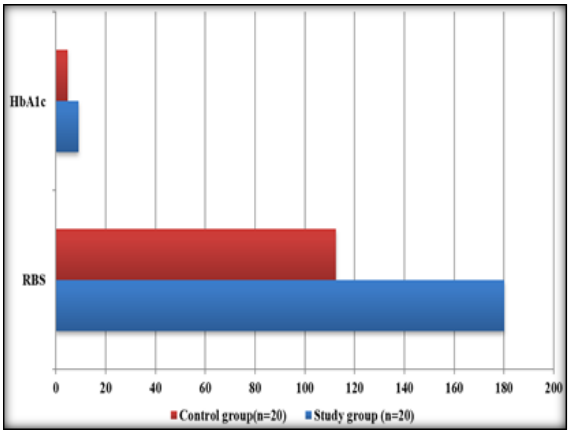
MATERIALS AND METHODS

20 patients between age group of 6-16 years with confirmed diagnosis of Type 1 DM and average

disease duration of more than 1 year were enrolled. Another set of 20 subjects which were age and gender matched were included as control group. Audiological assessment of all the subjects was done. Audiological testing was done using pure tone audiometry (PTA) and Otoacoustic emission (OAE). All the results were compiled in Microsoft excel sheet and were analysed by SPSS software. Chi-square test, Mann-Whitney U test and student t test were used for assessment of level of significance. P-value of less than 0.05 was taken as significant.

RESULTS

A total of 20 diabetic patients (study group) and 20 non-diabetic patients (control group) were analysed in the present study. 40 percent of the patients (8 patients) of the study group and 45 percent of the patients (9 patients) of the control group belonged to the age group of 10 to 12 years. In the present study high frequency SNHL was seen in 10 percent of the children of diabetic group. Among these two subjects, one was male while the other was female.



Graph 1: Mean glucose level among study subjects

Table 1: Age distribution among study subjects

Age range (years)	Study group (n=20)	Control group(n=20)
6-9	7	6
10-12	8	9
13-16	5	5

Table 2: Mean glucose level among study subjects

Glucose Profile	Study group (n=20)	Control group(n=20)
RBS	180.12	112.4
HbA1c	8.99	4.67

Table 3: Frequency of occurrence of high frequency SNHL

High frequency SNHL	Study group (n=20)	Control group(n=20)
Number	2	0
Percentage	10	100

DISCUSSION

Diabetes mellitus is a disorder of the metabolic homeostasis controlled by insulin, resulting in abnormalities of carbohydrate and lipid metabolism. Type 1 diabetes (also called juvenile-onset diabetes mellitus and insulin-dependent diabetes mellitus) is caused by an absolute insulin deficiency, the result of a loss of the insulin-producing beta cells of the pancreas.[8] The present study was conducted to evaluate early onset of subclinical hearing loss in children with type 1 diabetes mellitus. A total of 20 diabetic patients (study group) and 20 non-diabetic patients (control group) were analyzed in the present study. 40 percent of the patients (8 patients) of the study group and 45 percent of the patients (9 patients) of the control group belonged to the age group of 10 to 12 years. AL Dajani N et al,[9] conducted audiological assessment including pure-tone audiometry, otoacoustic emission testing (OAE) and auditory brainstem response testing (ABR) among type 1 diabetes mellitus pediatric patients and revealed that diabetes control and chronicity of the disease do not impact on the auditory system except for a subclinical involvement in the apical portion of the cochlea. Elbarbary NS et al,[10] in a study detected early asymptomatic auditory impairment whether at the level of outer hair cells (OHCs), inner hair cells (IHCs) and or olivo-cochlear bundle and the relationship between these abnormalities and other variables such as diabetes duration, degree of the metabolic control, or presence of microvascular complications. 75 adolescents with type 1 DM and thirty-three healthy controls participated in the study. Duration of DM, glycated hemoglobin (HbA1c) levels, microvascular complications were analyzed. It was concluded that Cochleopathy can be detected in a relatively high proportion of subjects with type 1 diabetes in spite of a normal audiometric hearing threshold. It should be considered as early manifestation of diabetic neuropathy which is related to the degree of metabolic control and retinopathy independent of other microvascular complications. Fukuda C et al,[11] in another study analyzed the effect on the inner ear affection by diabetes mellitus in children. Thirty type I diabetic and thirty non-diabetic children with ages ranging from 7 to 12 years old, perfectly paired regarding sex, age, cultural and social-economic status, were evaluated by pure tone

audiometry, speech audiometry, high frequency audiometry and distortion product otoacoustic emissions (DPOAE). Diabetic children exhibited slightly elevated thresholds in pure tone audiometry at 250, 2,000, 3,000, 4,000, 6,000 and 8,000 Hz frequencies. No statistical difference was found between results of speech discrimination, high frequency audiometry or DPOAE.

In the present study high frequency SNHL was seen in 10 percent of the children of diabetic group. Among these two subjects, one was male while the other was female. In another study conducted by Akinpelu OV et al,[12] reviewed the available evidence on the effects of type 2 diabetes mellitus on hearing function. It was concluded that type 2 diabetic patients had significantly higher incidence for at least the mild degree of HL when compared with controls. Mean PTA thresholds were greater in diabetics for all frequencies but were more clinically relevant at 6000 and 8000 Hz. Prolonged ABR wave V latencies in the diabetic group suggest retro-cochlear involvement. Age and duration of DM play important roles in the occurrence of DM-related HL,[13] Gioacchini FM,[14] found the difficulty of carrying out studies on populations without confounding factors, new laboratory studies are strongly required to clarify which specific physiopathological mechanisms underlie the diabetic damage caused to the hearing organs and how pharmacological management may contribute to counteracting the pathophysiological effects of the diabetic condition on the auditory system.

CONCLUSION

Early detection of auditory neuropathy in children is crucial for optimizing their communication and educational outcomes. Identifying the condition at a young age enables prompt intervention, which can significantly mitigate the real-world listening difficulties associated with auditory neuropathy. Fortunately, a range of intervention options are available, including remote microphone listening systems, frequency modulation systems, and personal amplification devices. These technologies have been proven to be highly beneficial in improving speech recognition and listening abilities in children with auditory neuropathy. By providing access to clear and amplified sound, these devices can help to overcome the challenges of auditory neuropathy, enabling children to better engage with their environment, communicate with others, and participate fully in educational activities. Moreover, early intervention can also facilitate the development of compensatory strategies and skills, further enhancing the child's ability to adapt to and manage their condition.

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