ORIGINAL RESEARCH

Detection early onset of subclinical Hearing loss in Type 1 DM children

[1]Dr. Anupriya Hajela Shah, [2]Dr. Ruchir Varshney

[1,2]Assistant Professor, Department of ENT, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

Corresponding author
Dr. Ruchir Varshney
Assistant Professor, Department of ENT, Chirayu Medical College & Hospital, Bhopal, Madhya Pradesh, India

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ABSTRACT

Background: To detect early onset of subclinical Hearing loss in Type 1 DM children**. Materials & methods:** 100 patients between age group of 6-17 years with confirmed diagnosis of Type 1 DM and an average disease duration of more than 1 year and 100 age and sex matched healthy controls. These children were subjected to an ENT examination and Audio logical assessment was done by Pure-tone average (PTA) and Otoacoustic Emissions (OAE). All selected patients with IDDM were examined in detail, which included detailed history and ENT examination. Hearing thresholds were assessed by pure tone audiometric test. Bone and air conductions thresholds were both tested at frequencies between 250-4000 Hz and 250-8000 Hz, respectively

Results: Sensorineural hearing loss (SNHL) was seen in 10 percent of the subjects of the study group while it was absent in control group. A direct significant correlation of SNHL was seen with glycaemic profile. **Conclusion:** Hearing evaluation may form an important part of the standard management regimen for children with the disease.

Key words: Hearing loss, Subclinical, Diabetic

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 levels1 and is a genetically inherited disease.It has been reported that in patients with "diabetes in situ" (when routine workup cannot diagnose diabetes) hearing loss is usually fluctuating, as characterized in hydrops secondary to altered sodium/potassium gradients and reduced endocochlear potentials. As the disease progresses, microangiopathy and diabetic neuropathy assist in the progression of dysacusis.It has been reported that insulin resistance and hyperinsulinemia increase the rate of triglyceride production. Some authors, however, insist that hypacusis progression occurs due to central auditory pathway involvement and not because of cochlear angiopathy progression.[1-3]

Spiral ganglion neuron atrophy and demyelination of the vestibulocochlear nerve have been described in four diabetic patients. It was shown that demyelination is also the early injury to the peripheral nerves of extremities on diabetes and that traces of myelin metabolic disorder may have a relevant role in the pathogenesis of diabetic neuropathy. Genetic syndromes have also been considered by other authors, once more cases of hypacusis have been observed in diabetic individuals with diabetic mothers in an inheritance pattern connected to mitochondrial DNA.Glucose metabolism significantly affects the inner ear. Both low and high sugar levels may alter inner ear function. Patients with glucose metabolism disorders may have auditory, vestibular, or mixed symptoms as seen in diabetes.[4, 5]

The inner ear presents intense metabolic activity, but has no energy storage capability. Therefore, minor sugar level changes affect inner ear function. The relevance of aerobic glucose metabolism in maintaining endolymphatic potential has been documented. Although hair cells may use other substrates such as glutamate, pyruvate, or fumarate to maintain endolymphatic potential, none of them is as effective as glucose. Glycogen may also be detected in the stria vascularis, but this alternative source of energy cannot handle potential maintenance in the absence of glucose.[6, 7]Hence; the present study was conducted to detect early onset of subclinical Hearing loss in Type 1 DM children

MATERIALS & METHODS

100 patients between age group of 6-17 years with confirmed diagnosis of Type 1 DM and an average disease duration of more than 1 year and 100 age and sex matched healthy controls. These children were subjected to an ENT examination and Audio logical assessment was done by Pure-tone average (PTA) and Otoacoustic Emissions (OAE). All selected patients with IDDM were examined in detail, which included detailed history and ENT examination. Hearing thresholds were assessed by pure tone audiometric test. Bone and air conductions thresholds were both tested at frequencies between 250-4000 Hz and 250-8000 Hz, respectively. A Performa was made where data recorded will include age, sex, duration of diabetes, insulin dose, BMI, frequency of acute complications like diabetic ketoacidosis (DKA), and severe hypoglycemia. Incidence of hearing loss was recorded. All the results were compiled in Microsoft excel sheet and were analyzed 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

Study groups comprised of 45 percent belonging to the age group of 11 to 14 years while control group comprised of 40 percent belonging to the age group of 11 to 14 years.Mean HbA1c concentration among subjects of study group and control group was 8.96% and 5.24% respectively. Sensorineural hearing loss (SNHL) was seen in 10 percent of the subjects of the study group while it was absent in control group. A direct significant correlation of SNHL was seen with glycaemic profile.

Table 1: Age-wise distribution

Age group (years)	Study group (n=100)		Control group (n=100)	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
6 to 10	21	21	25	25
11 to 14	45	45	40	40
15 to 17	34	34	35	35
Total	100	100	100	100

Table 2: Blood glucose profile

Mean Glucose profile	Study group (n=50)	Control group (n=50)
RBS	183.12	114.68
HbA1c	8.96	5.24

Table 3: Frequency of occurrence of high frequency SNHL

High frequency SNHL	Study group (n=100)		Control group (n=100)	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
Absent	90	90	100	100
Present	10	10	0	0
Total	50	100	100	100

Table 4: Correlation of high frequency SNHL with HbA1c levels

HbA1c levels (%)	Patients with high frequency SNHL	Patients without high frequency SNHL	t-statistic	p- value
Mean	9.84	8.11	-2.121	0.000 (Significant)

DISCUSSION

Hearing enriches our life. Hearing is integral part of speech. Hearing impairment will hamper a child's cognitive skills in a child apart from his personal and social life and hence quality of life. The sense of hearing, the perception of sound and its biological purposes is not therefore, a trivial consideration that cannot be lightly dismissed.[6- 8]Diabetes mellitus is a common non-communicable metabolic disease that causes various impairments of the body systems. As diabetes mellitus occurs most commonly in general population, the effects caused by it on various organs of our body assume greater importance. Prevalence of diabetes mellitus is increasing worldwide and it is more pronounced in India. The incidence of IDDM peaks between the ages of 10 and 14 years during puberty. The increasing incidence of IDDM throughout the world is especially marked in young children. The prevalence of T1DM in children is 1, 11, 500 according to a World Health Organization report of the International Diabetes Federation for the South-East Asian Region.[8- 10]Hence; the present study was conducted to detect early onset of subclinical Hearing loss in Type 1 DM children

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Soha M. Abd El Dayem, Somaya M. Abd El Ghany, Amal E. Beshr, Amal G. Hassan, Mona S (2014) evaluated auditory function in a group of Egyptian type 1 diabetic children. This was a cross sectional observational study, which included 40 patients with type 1 diabetes and 40 controls. HbA1, urinary albumin/creatinine ratio, and auditory assessments (including dizziness questionnaire, pure tone audiometry, speech audiometry, tympanometry, and auto-acoustic cochlear emission) were completed for all patients and controls. Mann-Whitney U-test, $\chi 2$-test and Spearman's correlation were used for statistical analyses. Assessment of pure tone audiometry revealed that the diabetics had a significantly higher reading in high frequency at 8000 Hz, 16,000 Hz, 17,000 Hz, and 18,000 Hz on the right side and at 4000 Hz, 8000 Hz, 16,000 Hz, 17,000 Hz, and 18,000 Hz on the left side. There was a significantly lower level in speech reception threshold, repetition of words, and masking level of diabetics on the left side. Evaluation of transient otoacoustic emission revealed that diabetics recorded significantly lower signal to noise ratio at 4000 Hz on the right side and at 1000, 1500, 4000, and all Hz on left side. There was significant lower emission amplitude in the right side of the diabetics group at 1500 and 4000 Hz and at 1000, 1500, and 4000 Hz on the left side. Patients with failed otoacoustic emission were significantly higher in disease duration >10 years. It was concluded that type 1 diabetes is associated with high/extended high frequency hearing loss, more prominent on the left side and with longer disease duration.[11]

In another study conducted by Hou Y et al, authors evaluated the auditory function of 50 type 1 diabetics and 50 healthy subjects. Clinical indexes were measured along with analyzing their relation of auditory function. Type 1 diabetic patients demonstrated a deficit with elevated thresholds at right ear and left ear when compared to healthy controls. The elevated auditory threshold was significantly related with HDL-cholesterol, diabetes duration, and systemic blood pressure. Moreover, latencies of right ear (wave III, V and interwave I-V) and left ear (wave III, V and interwave I-III, I-V) in diabetic group significantly increased compared to those in control subjects. Auditory brainstem response was significantly related with GHbA1C and microalbuminuria. Only triglyceride was positively correlated to the hearing impairment defined by DPOAE. There was no significance of transient evoked otoacoustic emissions (TEOAE) between groups. TEOAE was associated with age and GHbA1C. It was concluded that type 1 diabetics exerted higher auditory threshold, slower auditory conduction time and cochlear impairment. HDL-cholesterol, diabetes duration, systemic blood pressure, microalbuminuria, GHbA1C, triglyceride, and age may affect the auditory function of type 1 diabetics.[12]

CONCLUSION

Hearing evaluation may form an important part of the standard management regimen for children with the disease.

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