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Original Research Article.

Assessment and Comparison of Hearing Loss among Diabetic and Non-Diabetic Children: A Case-Control Study

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ABSTRACT

Background: Eye, kidney, cranial nerve, peripheral nerve, ear, and vascular system disorders reside among the chronic complications of diabetes mellitus. Therefore, the diabetic population must be considered at risk for auditory conditions. Hence; the present study was undertaken for assessing and comparing hearing loss among diabetic and non-diabetic children.

Materials & Methods: A total of 20 diabetic children and 20 non-diabetic children between the age group of 8 to 17 years were enrolled. Diabetic children were categorized under the cases group while the non-diabetic children were categorized under the control group. These children were subjected to an ENT examination and audiological assessment was done. Complete demographic details of all the subjects were obtained. Hearing thresholds were assessed by pure tone audiometric test. All the results were compiled in Microsoft excel sheet and were analysed by SPSS software.

Results: Hearing loss was found to be present in 15 percent of the cases while it was absent in the control group. While correlating the frequency of hearing loss among diabetic subjects divided on the basis of duration of diabetes, non-significant results were obtained.

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

Key words: Hearing Loss, Diabetic, Children.

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INTRODUCTION

Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. The aetiology of diabetes in India is multifactorial and includes genetic factors coupled with environmental influences such as obesity associated with rising living standards, steady urban migration, and lifestyle changes. Yet despite the incidence of diabetes within India, there are no nationwide and few multi-centric studies conducted on the prevalence of diabetes and its complications.[1-3]

Eye, kidney, cranial nerve, peripheral nerve, ear, and vascular system disorders reside among the chronic complications of diabetes mellitus. In the auditory system, DM may lead to spiral ganglion atrophy, degeneration of the myelin sheath of the vestibulocochlear nerve, reduction on the number of nerve fibers in the spiral lamina, and thickening of the capillary walls of the stria vascularis and small arteries inside the ear canal.[4, 5] The diagnosis of metabolic disorder is very relevant for ENTs and their patients, once inner ear involvement may be exacerbated of popular drugs for labyrinthine conditions such as cinnarizine and flunarizine are used, as they are vasoactive drugs that increase the consumption of glucose by nerve cells and thus strengthen metabolic disorders.[6,7] 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. Therefore, the diabetic population must be considered at risk for auditory conditions.[6- 9] Hence; the present study was undertaken for assessing and comparing hearing loss among diabetic and non-diabetic children.

MATERIALS & METHODS

The present study was conducted in the Department of Paediatrics, Narayan Medical College & Hospital, Rohtas, Sasaram, Bihar (India) and it included assessment and comparison of hearing loss among diabetic and non-diabetic children. Ethical approval was obtained from institutional ethical committee and written consent was obtained from the parents/ guardians of all the patients after explaining in detail the entire research protocol.

A total of 20 diabetic children and 20 non-diabetic children between the age group of 8 to 17 years were enrolled. Diabetic children were categorized under the cases group while the non-diabetic children were categorized under the control group. These children were subjected to an ENT examination and audiological assessment was done.

Inclusion Criteria

- Patients between age group 8-17 yrs
- Diagnosed case of Type 1 diabetes mellitus.
- Disease duration of more than 1 year
- Patients with negative family history of hearing loss

Complete demographic details of all the subjects were obtained. Hearing thresholds were assessed by pure tone audiometric test. 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.

Table 1: Age-wise distribution

Age group (years)	Cases		Controls	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
8 to 9	5	25	6	30
10 to 12	7	35	6	30
13 to 17	8	40	8	40
Total	20	100	20	100

Table 2: Gender-wise distribution

Gender	Cases		Controls	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
Males	12	60	11	55
Females	8	40	9	45
Total	20	100	20	100

Table 3: Frequency of hearing loss

Hearing loss	Cases		Controls	
	Number of patients	Percentage (%)	Number of patients	Percentage (%)
Present	3	15	0	0
Absent	17	85	20	100
Total	20	100	20	100

Table 4: Correlation of hearing loss with duration of diabetes among cases

Duration of diabetes	Hearing loss present	Hearing loss absent	Chi- square value	p- value
1 to 3 years	1	9	1.85	0.392
More than 3 years	2	8		
Total	3	17		

RESULTS

In the present study, a total of 20 diabetic children and 20 non-diabetic children were enrolled in the present study. Mean age of the subjects of cases was 14.8 years and 15.2 years respectively. 40 percent of the subjects of both the cases and the controls belonged to the age group of 13 to 17 years. 60 percent of the cases and 55 percent of the controls were males while the remaining were females. In the present study, hearing loss was found to be present in 15 percent of the cases while it was absent in the control group. While correlating the frequency of hearing loss among diabetic subjects divided on the basis of duration of diabetes, non-significant results were obtained.

DISCUSSION

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. 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.[7- 9]

Hence; the present study was undertaken for assessing and comparing hearing loss among diabetic and non-diabetic children.

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Today the association between DM and hearing loss is being given a lot of attention. 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. Hypoglycemia affects the active transportation of sodium and potassium and thus produces hydro electrolytic imbalances in the endolymph. Endolymph is similar to the intracellular medium in its make-up, as it is rich in potassium and poor in sodium. Perilymph, on the other hand, is rich in sodium and poor in potassium, and is similar to the extracellular medium. As fluid are separated by a permeable membrane, potassium tends to shift from the endolymph to the perilymph, while sodium tends to go the opposite way. This passive spontaneous mechanism would lead to high sodium levels in the endolymph and to more water shifting into this compartment, causing the onset of endolymphatic hydrops and the ensuing clinical repercussions: vertigo, tinnitus, hyperacusis, and aural fullness.[7- 9]

In the present study, hearing loss was found to be present in 15 percent of the cases while it was absent in the control group. While correlating the frequency of hearing loss among diabetic subjects divided on the basis of duration of diabetes, non-significant results were obtained. Dąbrowski M et al evaluated associations between hearing and kidney function in young adult type 1 diabetic patients. 31 patients (9 women) with type 1 diabetes, aged <45, with disease duration <10 years were included. Blood and urine samples for laboratory tests and urinary albumin excretion (UAE) assessment were obtained. eGFR was calculated with CKD-EPI formula. In all patients pure-tone audiometry, transient evoked otoacoustic emissions and auditory brainstem responses were evaluated, also eye fundus was examined. Mean patients' age was 29.5 ± 7.0 years and disease duration 4.6 ± 2.6 years. All patients had eGFR > 60.0 ml/min/1.73 m2. In one case microalbuminuria and in 3 patients' early retinopathy were revealed. Linear correlation between eGFR and hearing threshold at 4, 6, 8 and 12 kHz was found. Patients with hearing impairment (n = 7) had lower eGFR 108.8 vs. 121.7 ml/min/1.73 m2, p = 0.047 compared to normal-hearing subjects. Also, patients with absence of otoacoustic emissions in at least one ear had lower eGFR, 103.1 vs. 123.3 ml/min/1.73 m2, p < 0.001, compared to the remaining group. In auditory brainstem responses we found significant linear correlation between eGFR and wave III and interval I-III latencies, and between UAE and waves III, V and interval I-III latencies. This study suggested existence of relationship between hearing and kidney function in type 1 diabetic patients.[11]

CONCLUSION

From the above results, the authors concluded that hearing evaluation might form an important part of the standard management regimen for children with the disease. However, further studies are recommended.

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