

Original article:

Sensorineural hearing loss in diabetic patients

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Abstract:

Introduction: The purpose of our study was to determine the incidence of hearing loss or hearing impairment and possible contributing factors responsible for sensorineural hearing loss in diabetic patients.

Methodology: The study was conducted on 50 cases attending medicine & ENT department of JLN Medical College & hospital having diabetes mellitus and 25 healthy volunteers having same inclusion criteria except they are not suffering from diabetes mellitus. These volunteers attended the ENT OPD for ENT services but not for hearing problem. 15 (30%) out of 50 cases of diabetes had sensorineural hearing loss of mild to severe degree in high frequency range which was bilateral & symmetrical.

Conclusion: Thus it can be concluded that cochlear dysfunction is an important complication of diabetes mellitus.

Key words: Sensorineural hearing loss, diabetes mellitus, audiometry

Introduction : Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia & alteration in fat & protein metabolism.^{1,8} Microangiopathy is the basic lesion of diabetes mellitus & is considered to be the most important factor in long term complications of diabetes.^{1,12} Microangiopathic changes in retina, skin & renal vessels are very well documented.¹² As microangiopathy affects almost all parts of body, its affect on the vessels of inner ear which may lead to an impairment of hearing. Other factors in diabetes mellitus responsible for hearing impairment may be neuronal degeneration, degenerated glucose metabolism and hyperactivity of oxygen free radicals.¹¹ Type of deafness in diabetes is Sensorineural (cochlear type).⁷ Various clinical methods, tuning fork tests, pure tone audiometry

were used to determine the type & degree of hearing impairment.

The purpose of our study was to study the correlation of hearing loss with diabetes mellitus with the help of audiometry & other audiological tests and to study the correlation of degree of deafness with various factors in diabetes mellitus.

Material & Methods :

Study was carried out on 75 cases. Out of these 50 cases were suffering from diabetes mellitus & 25 were volunteers in the age group of 10 to 50 years attended the department of ENT & Medicine at JLN Medical College & Hospital, Ajmer.

Group 1 : 25 volunteers in control group having following criteria.

- Age below 50 years
- No history of hearing impairment caused by other disorder.

- Normal otoscopic examination & eustachiantube examination.
- No family history of diabetes mellitus.
- No history of noise exposure & ototoxic drugs intake.

Group 2 : 50 patients of diabetes mellitus were selected randomly below age of 50 years who fulfilled the following criteria.

Diabetes mellitus biochemically confirmed by fasting blood sugar more than 126 mg/dl, blood sugar more than 140 mg/dl 2 hrs after 100 gram glucose.

- No history of noise exposure & ototoxic drugs intake.
- No history of hearing impairment caused by other disorder.

- Normal otoscopic examination & eustaciantube examination.

Case examination procedure – A complete detailed history, clinical & ENT examination were carried out. Blood sugar was estimated by colorimetric method for true sugar as describe by king & wooten. Fasting & P.P. one & two hours after glucose intake. Other investigation like complete urine examination, blood urea, CBC, Serum cholesterol were also carried out. Audiological examination includes tuning fork tests, pure tone audiometry, tympanometry were done in all cases to describe type & degree of hearing loss.

Calculations : The resulting data were subjected to statistical analysis. Analysis of variance was chosen as method.

Observation:

Table – I : Total cases of SNHL in 2 groups.

Group 1 (N=25)		Group 2 (N=50)	
SNHL	NO SNHL	SNHL	NO SNHL
1	24	15	35
% OF SNHL = 4 %		% OF SNHL = 30%	

In our study only one case (4%) out of 25 in control group had hearing loss, while group two of 50 cases of diabetes mellitus had 15 (30%) cases of sensorineural hearing loss.

Table – II : Distribution of cases in various age groups.

Age range (in years)	Group 1 (N=25)			Group 2 (N=50)		
	SNHL	NO SNHL	TOTAL	SNHL	NO SNHL	TOTAL
11-20	-	5	5	-	3	3
21-30	-	3	3	1	6	7
31-40	-	5	5	2	8	10
41-50	1	11	12	12	18	30
TOTAL	1	24	25	15	35	50

12 cases of SNHL in diabetes mellitus out of total 15 cases were of age group 41 to 50 years, while 2 in age group 31 to 40 years and only one case was in group 21 to 30 years. Thus linear relationship could be established between advancing age and hearing loss from the present study.

Table – III : Distribution of cases according to sex

Group	Sex	SNHL	NO SNHL	Total
1	Male	0	12	12
	Female	1	12	13
2	Male	7	16	23
	Female	8	19	27

According to table 3 in group 2 of diabetes mellitus there are 23 (46%) males and 27 (54%) females .out of total 15 cases of SNHL in DM, 7 (46%) were males and 8 (54%) were females. Thus there is no correlation of SNHL with sex.

Table – IV : Relationship of duration of diabetes mellitus and degree of SNHL

Duration of DM (in years)	Degree of SNHL			NO SNHL	Total
	Mild	Moderate	Severe		
1 – 3	1	-	-	8	9
4 – 6	2	-	-	8	10
7 – 9	4	1	-	13	18
10 – 12	-	2	-	6	8
13 – 15	-	4	-	4	8
> 15	-	-	1	-	1
TOTAL	7	7	1	35	50

Duration of diabetes mellitus is related to degree of SNHL as shown in table 4. Patients who were suffering from DM from less than 9 years of duration had SNHL of mild degree, while who were having DM more than 9 years of DM had moderate degree of SNHL. Only one patient had DM for more than 15 years and he was having severe degree of SNHL.

Table – V : Relationship of hearing threshold with severity of disease (fasting blood sugar level)

Frequency Hz.	H.T. in control group (dB)	H.T. of group II patient with fasting blood sugar level 100-150 mg% (dB)	H.T. of group II patient with fasting blood sugar level 151-200 mg% (dB)	H.T. of group II patient with fasting blood sugar level 200 mg% (dB)
500	4.8 ± 5.73	9.37 ± 7.68	15.55 ± 9.70	18.12 ± 12.10
1000	2.1 ± 5.29	5.46 ± 3.72	11.11 ± 9.43	15.46 ± 13.19
1500	2.9 ± 6.29	4.53 ± 6.29	11.94 ± 10.22	15.78 ± 13.75
2000	2.9 ± 7.26	5.78 ± 9.93	13.47 ± 12.18	16.72 ± 12.78
3000	5.2 ± 7.0	4.84 ± 8.8	12.5 ± 12.66	14.37 ± 13.8
4000	3.3 ± 8.5	3.44 ± 9.30	15.27 ± 13.64	18.28 ± 19.26
6000	5.3 ± 10.3	4.37 ± 7.88	14.58 ± 14.87	20.62 ± 22.49

P<0.001 H.T.=hearing threshold

Group two had 16 patients with fasting blood sugar more than 200 mg%. The difference in mean hearing threshold in this group and control group was highly significant ($P < 0.001$) while the mean hearing threshold of 18 patients those who had fasting blood sugar level between 150-200 mg%, when compared with the mean hearing threshold of control group revealed highly significant statistical values ($p < 0.001$) at all the frequencies. The difference in mean hearing threshold of the remaining 16 patients with fasting blood sugar between 100-150 mg% and control was highly significant at lower frequencies i.e. 500 and 1000 Hz. ($P < 0.001$) while it was statistically insignificant at higher frequencies i.e. 1500, 2000, 3000, 4000, 6000 Hz. ($P > 0.05$).

Family History : In group two 11 patients had positive family history of diabetes. But only one case had SNHL rest 10 were having normal hearing. Thus family history of DM had no correlation with SNHL according to our study.

Discussion : Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia & alteration in fat & protein metabolism⁸. Micro angiopathy is the basic disorder of diabetes mellitus & considered to be the most important factor in long term complication of diabetes² & ¹¹. Other causes may be neuronal degeneration¹², degenerated glucose metabolism & hyperactivity of oxygen free radicals¹¹, hypertrophy of intima of blood vessels narrowing in the inner ear and thus hearing impairment.⁹ Several studies reported a higher incidence of hearing loss in diabetes mellitus in comparison to general population^{2,3,4,5,6}. Type of deafness is similar to that due to presbycusis i.e. sensorineural hearing loss but hearing loss is always greater than that can be expected at particular age due to presbycusis.¹⁰ From above observations and results it can

be concluded that sensorineural hearing loss occurs in diabetic patients. This happened even after exclusion of known risk factors like noise exposure, ototoxic drugs & other ear diseases. Duration & severity of diabetes also affects hearing loss.

Present study was conducted on 75 cases subjects, 25 subjects were normal volunteers & served as controls. The remaining 50 were patients of diabetes mellitus. Pure tone audiometry were performed on all subjects.

- Study revealed that 15 (30%) out of 50 patients had sensorineural hearing loss out of them 4 had mild, 10 had moderate & 1 had severe hearing loss.
- Hearing impairment was of sensorineural (cochlear type).
- Advancing age was found to correlate well with increasing hearing loss.
- No correlation could be derived between sex & degree of hearing loss.
- Duration of diabetes mellitus correlated significantly increasing hearing loss.
- Family history of diabetes mellitus was found to have no bearing on the hearing loss in diabetes mellitus.
- Severity of disease was found to be important determining factor in hearing loss. More severe the disease greater was hearing loss.

Conclusion:

Thus it can be concluded that cochlear dysfunction is an important complication of diabetes mellitus. Sensorineural type of hearing loss is the result of micro angiopathic process affecting the vessels of internal ear. Age, duration, severity of diabetes correlate very well with the degree of hearing loss and may be considered important determining factors for hearing loss.

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