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ASSESSMENT OF HEARING LOSS IN PATIENTS ON MAINTENANCE HEMODIALYSIS AND CORRELATION WITH VITAMIN D LEVELS

Nephrology

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ABSTRACT

AIM : To determine the prevalence of hearing loss in patients on maintenance hemodialysis and its correlation with Vitamin D levels

PATIENTS AND METHODS : This study was done at our hospital over a period of two years.Hearing abnormalities were assessed using Pure tone audiometry. Demographic data, dialysis details audiometry graphs were noted.Vitamin D levels were assessed using chemiluminiscence method.

RESULTS: 200 patients were included in the study. Mean age of the patients was 44.3+11.2 years. Sensorineural hearing loss was present in 164 of 200 patients. Majority (75%) had mild Sensorineural hearing loss. All the patients had high frequency sensorineural hearing loss. Vitamin D levels did not show association with hearing loss.

CONCLUSION: SNHL is highly prevalent among patients on hemodialysis. There is no correlation of vitamin D levels with SNHL.

KEYWORDS

INTRODUCTION :

Hearing abnormalities in the form of sensorineural hearing loss was reported to be more common in patients on maintenance hemodialysis compared to general population (1,2). It was reported that hearing loss is of high frequency loss with a notch at 6kHz. Aetiology for hearing loss in this population is reported to be multifactorial. Amongst them , one of the causes described in literature was deficiency of Vitamin D.

We undertook a study to assess the hearing loss and it relation with Vitamin D deficiency in dialysis population.

AIM :To determine the prevalence of hearing loss in patients on maintenance hemodialysis and the correlation with vitamin D.

PATIENTS AND METHODOLOGY :

This observational study was done in our centre, a tertiary care referral centre over a period of 2 years. In our centre, patients are given hemodialysis thrice weekly under government funded cashless scheme. Under this scheme, patients are given dialysis with polysulfone dialyser of 1.3 m2 surface area. Average reuse is 5 per dialyser. Injection Erythropoietin is given twice weekly according to the requirement. Investigations are done periodically as per the government scheme.

Inclusion criteria :

- Patients with hearing loss after the onset of CKD
- Patients of age >18 years and <58 years
- Those who have given consent to participate in the study

Exclusion criteria :

- Patients with hearing loss prior to the onset of CKD
- Patients with familial deafness
- Patients with drug induced hearing loss
- Patients of age >59years

Those who have not given consent to participate in the study.

Demographic data, history of diuretic usage, family history of deafness, drug diary, hearing assessment using pure tone audiometry were evaluated in all the patients. Each patient underwent Rinnes test and Webers test before PTA

All patients are from tropical climate with most of the time spent indoors only.

Vitamin D was assessed using chemiluminiscence

RESULTS :

200 patients satisfied inclusion criteria and were included in the study. Mean age of the group was 44.3+11.2 years. Men were 135 and women were 65 in number.50 Patients had diabetes and 157 had hypertension. Mean systolic Blood Pressure was 142+28mm of Hg and mean diastolic blood pressure was 98±16 mm of Hg.Mean vintage of hemodialysis was 10.46+ 3.48 months. Mean duration of diuretic usage was 9.82 months. 88 patients underwent twice weekly dialysis and 112 patients under went thrice weekly dialysis. Mean inter dialytic weight gain was 3.2+0.8kg. (Table 1).

Table 1.

Mean Age		44.3 + 11.2years
Gender	M	135
	F	65
Diabetes	50(25%)	
Hypertension	159(79.5%)	
Mean Blood Pressure	SBP	142 mm Hg
	DBP	91.1 mm Hg
Presumed Native Kidney Disease	CIN	141 (70.5%)
	DN	37(18.5%)
	CGN	22(11.0%)
Mean duration of CKD	12.3 ± 5.67 months	
Duration of HD	10.46 ± 3.48 months	
Frequency of HD	Twice weekly	88(44%)
	Thrice weekly	112(56%)
Mean duration of Diuretic use	9.82 ± 4.2months	
IDWG	3.2 ± 0.8Kgs	
Hemoglobin	8.2 ± 0.9gm/dl	
Sodium	137± 6.1meq/l	
Potassium	5.0± 0.5meq/l	
Chloride	99.2± 3.55meq/l	

In our study, prevalence of sensorineural hearing loss (SNHL) was 82.5% (165/200) , of which majority (75%) had mild senorineural hearing loss (124/165).All the patients had high frequency hearing loss.

There was no statistically significant difference in the baseline characteristics between normal hearing and SNHL group except that all patients of diabetes had sensorineural hearing loss and only one patient had normal hearing ($p<0.05$) (table 2)

Patients were categorized into different groups depending on the severity of hearing loss. Majority (75%) had mild degree of hearing loss, 16.96% (28/165) had moderate degree of SNHL. Two patients had severe SNHL and one patient had very severe SNHL. On comparison of baseline characteristics there was no statistically significant difference between the mild SNHL and moderate SNHL

groups (table 3).Though patients with moderate SNHL were older compared to mild SNHL group, this was not found to be statistically significant (p>0.05).

Table. 2

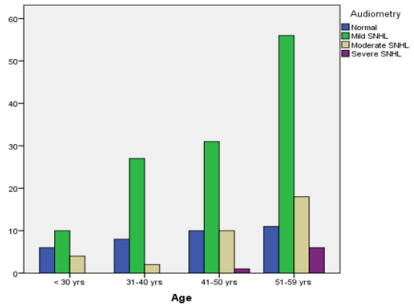
Age		Normal Hearing(35)	SNHL (165)	p Value
		37.5±11.1 y	45.7±11.2 y	0.14
Gender	M	28	107	0.09
	F	7	58	
Diabetes		1(2.8%)	49(29.6%)	0.02
Hypertension		22(65%)	127(76.9%)	0.15
Mean SBP		137.8 mm Hg	143.4 mm Hg	
Mean DBP		88 mm Hg	91mm Hg	
NKD	CIN	33	110	0.13
	DN	1	36	
	CGN	1	19	
H/o Diuretics		9.7±1.7 months	10.2±1.2 months	0.98
Duration of CKD		12.5±1.6 months	11±1.2 months	0.89
Dialysis Vintage		10.3±1.4 months	11±1.4 months	0.59
Frequency of HD	Twice	16	72	0.89
	Thrice	19	93	
Mean IDWG		3.3± 0.8 kgs	3.2± 0.88kgs	0.59
Mean Hb		8.2±0.8 gm/dl	8.2± 0.89gm%	0.31
Mean Sodium		138.7±6.1 meq/l	137.2± 6.08meq/l	0.65
Mean Potassium		5.2±0.46 meq/l	5.0± 0.45meq/l	0.93
Mean Chloride		98.9±3.54 meq/l	99.2±3.54 meq/l	0.07

Table.3

		Mild High Frequency SNHL(124)	Mod High Frequency SNHL(28)	p Value
Age		44.3±11.2 years	48.9±11.3 years	0.055
Gender	M	80	19	0.91
	F	44	9	
Diabetes		34(27%)	10(35%)	0.90
Hypertension		102(83%)	24(88%)	0.32
Duration of CKD		12.2±1.7 months	13.1±1.8 months	0.945
Diuretic Usage		10.1±1.8 months	7.0±1.9 months	0.96
Dialysis Vintage		10.3±1.5 months	10.0±1.5 months	0.51
Frequency of HD	Twice	52	14	0.72
	Thrice	71	14	
Access	RT BCF	18	3	0.67
	RT RCF	22	5	
	LT BCF	33	5	
	LT RCF	50	15	
Mean IDWG		3.2±0.8 kgs	3.2±0.8 kgs	0.21
Mean Hb		8.2± 0.9 gm/dl	8.1±0.9 gm/dl	0.51
Mean Sodium		137±6.1 meq/l	135±6.0 meq/l	0.20
Mean Potassium		5.0± 0.45meq/l	5.2±0.46 meq/l	0.06
Mean Chloride		99.4± 3.5meq/l	99.7± 3.5 meq/l	0.08

Prevalence of mild Sensorineural hearing loss was observed to be progressing as the age increases but was not statistically significant(p>0.05). Moderate Sensorineural hearing loss was observed to be less prevalent in the age group 31-40 years compared to other age groups. Severe sensorineural hearing loss is found to be prevalent more in the age group 51-59 years (Fig 1)

Fig 1 : Graph showing Age and SNHL



200 patients, serum levels of Vitamin D were estimated in 100 patients using chemilumiscence method to determine the degree of correlation between SNHL and vitamin D levels. Based on the severity of Vitamin D stores, patients were divided into Vitamin D deficient, insufficient and sufficient. The baseline characteristics of comparison of all the three groups is as shown in Table 4 .There was no statistically significant difference in baseline characteristics amongst the three groups. In Vitamin D insufficient group there were no patients with severe SNHL. Among the deficient and sufficient groups, severe SNHL was present in four patients and one patient respectively.

Table.4

	Deficient(23)	Insufficient (30)	Sufficient (47)	P Value
Mean Age	40.3±10.3y	47.3±10.5y	42.5±10.4y	0.593
Gender	M=17	M= 17	M= 35	0.44
	F=6	F= 13	F= 12	
Diabetes	3	13	9	0.01
Hypertension	18	25	40	0.72
Duration of CKD	10.5±1.43 months	16.6±6.4 months	11.58± 3.1months	0.27
Diuretic usage	8.1±1.9 months	10.7±3.0 months	9.7±3.2 months	0.47
Dialysis Vintage	8.9±0.9 months	15.3±5.2 months	10.0±3.1 months	0.40
Mean IDWG	2.8±0.96 kgs	3.0±0.95 kgs	2.8±0.93 kgs	0.21
Mean Hb	8.1±0.85gm/dl	8.5±0.8gm/dl	8.4± 0.87gm/dl	0.20
Mean Serum Sodium	139±5.85 meq/l	138±5.8meq/l	137±5.8meq/l	0.51
Mean Serum Potassium	5.1±0.45 meq/l	5.0±0.4 meq/l	4.9±0.46meq/l	0.06
Mean Serum Chloride	99±2.5 meq/l	100.7±2.5 meq/l	100.1±2.6meq/l	0.08

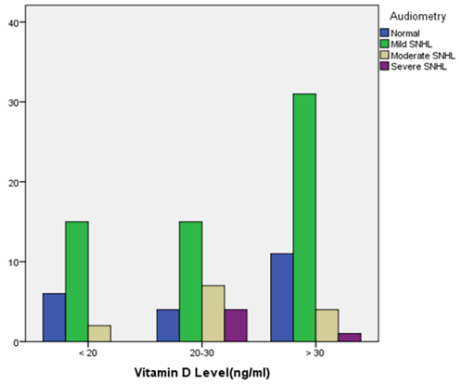
Vitamin D levels with hearing loss

In the present study in the Vitamin D Deficient (n=23) group 6 patients had Normal hearing, 15 patients had mild SNHL, 2 patients had moderate SNHL. In the Vitamin D insufficient (n=30) group 4 had normal hearing, 15 had mild SNHL, 7 had moderate SNHL, 4 had Severe SNHL. In the Vitamin D sufficient (n=47) group 11 had normal hearing, 31 had mild SNHL, 4 had moderate SNHL, 1 had severe SNHL. (Table. 5, Figure.2)

Table.5

Vitamin D level	Normal Hearing	Mild SNHL	Moderate SNHL	Severe SNHL
<20 ng/ml	6	15	2	0
21-29 ng/ml	4	15	7	4
>30 ng/ml	11	31	4	1

Fig 2: Graph showing Vitamin D levels and SNHL



DISCUSSION:

Sensorineural hearing loss is more common in patients on maintenance hemodialysis than in general population. A variable incidence has been reported in literature varying between 45%-77% (1-3).High frequency loss was observed with notch at 6Hz .

In the present study, 82.5% of the patients had sensorineural hearing loss and 17.5% of the patients had normal hearing. In study by Bazzi et al sensorineural hearing loss was observed in 77%, in the study by

Kusakari et al, 60% of the patients had sensorineural hearing loss and in the study by Charachon sensorineural hearing loss was observed in 75% cases of chronic kidney disease.

In the present study all the patients with sensorineural hearing loss showed hearing impairment in High frequency range, this is in concordance with the study by Gatland et al. who found 41 per cent hearing impairment in low frequencies and 53 per cent in high frequency range.

In the present study 100 patients vitamin D levels were assessed out of which 23 were Vitamin D Deficient, 30 were vitamin D insufficient, 47 patients had sufficient vitamin D levels. In the present study in the Vitamin D Deficient (n=23) group 6 patients had Normal hearing, 15 patients had mild SNHL, 2 patients had moderate SNHL. In the Vitamin D insufficient (n=30) group 4 had normal hearing, 15 had mild SNHL, 7 had moderate SNHL, 4 had Severe SNHL. In the Vitamin D sufficient (n=47) group 11 had normal hearing, 31 had mild SNHL, 4 had moderate SNHL, 1 had severe SNHL. Association of Vitamin D and degree of sensorineural hearing loss is not found to be statistically significant ($p>0.05$). This is in contrast to Brooke et al who found that Vitamin D deficiency is associated with Sensorineural hearing loss. Ozturan reported a notch at 6 Khz in patients of chronic kidney disease.

It is well understood that Kidney and cochlea have similar physiologic mechanisms of active transport of fluid, electrolytes and a probable common antigenicity in addition to certain common genetic factors which are the possible explanations for co existence of oto-renal diseases.

Certain factors like hypertension, the procedure of hemodialysis, electrolyte disturbances, use of ototoxic drugs like diuretics,aluminum toxicity , deposition of amyloid like material in those on long term hemodialysis have been proposed as aetiological factors for high prevalence of hearing abnormalities in patients with kidney disease (4-9). Brookes suggested that vitamin D deficiency could be one of the aetiology of hearing loss in this group (10). In a study done by Ikea etal , Vitamin D deficiency was found to be associated with bilateral SNHL (11).

In our study all the patients had gradual loss of hearing.None had sudden onset of hearing abnormality. All patients with SNHL had bilateral and symmetrical hearing loss as assessed by Webers test and confirmed by PTA.

In our study, prevalence of SNHL was high compared to the prevalence in literature. All the patients had high frequency bilateral SNHL.This is in concordance to the hearing loss at high frequency range reported by Gatland etal,Qin etal, Gurbanov etal and Jamaldeen etal (12).In a study done by Jakic etal in 66 hemodialysis patients, 56 patients had high frequency SNHL and a significant positive correlation was found between mean hearing threshold and age (13).

In contrast to the previous studies, we could not find association with age or vintage of dialysis. In our study, presence of diabetes showed a statistically significant association with SNHL.Patients with diabetes were found to have higher incidence of SNHL probably due to microangiopathy of inner ear (14) compared to non diabetic population. In the meta analysis by Akinpelu etal , it was found that patients with diabetes had higher prevalence of mild SNHL and a greater mean PTA threshold for all frequencies.Not many studies showed an association of SNHL with vitamin D levels.Brooks etal showed a positive association between the levels of vitamin D and SNHL.

CONCLUSION

1. Mild SNHL was the most common hearing abnormality in patients on maintenance hemodialysis, observed in 82.5% of the study population.
2. Vitamin D does not show significant association with hearing loss.

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