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Assessment of Effect of Hyperuricemia on Hearing Function

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Abstract

Background: The aim is to assess the effect of hyperuricemia on hearing function. **Subjects and Methods:** Eighty- six adults in age ranged 18-40 years of either gender with hyperuricemia (Group I) and equal number of age‑ and sex‑matched normal individuals as controls (Group II) were enrolled. All patients were subjected to pure tone audiometric and distortion product OAEs and transient evoked OAEs (DPOAEs and TEOAEs) testing. **Results:** The mean TEOAE S/N ratio at 1 KHz on right side was 8.43 and 8.40 and on left side was 8.24 and 8.35, at 2 KHz on right side was 9.12 and 9.14 and on left side was 9.14 and 9.36, at 3 KHz on right side was 5.54 and 9.02 and on left side was 5.30 and 10.4 and at 4 KHz on right side was 1.81 and 9.4 and on left side was 1.62 and 7.6 respectively. The mean DPOAE S/N ratio at 3 KHz on right side was 13.5 and 13.2 and on left side was 13.8 and 13.9, at 4 KHz on right side was 16.5 and 17.0 and on left side was 15.2 and 15.1, at 5 KHz on right side was 8.93 and 14.3 and on left side was 8.71 and 14.1, at 6 KHz on right side was 5.6 and 9.0 and on left side was 4.3 and 10.2 respectively. The mean TEOAE value in right ear having > 3years and <3 years of duration of hyperuricemia at 1 KHz was 8.51 and 7.52, at 2 KHz was 8.31 and 8.73, at 3 KHz was 7.35 and 3.62 and at 4 KHz was 2.52 and 1.45 respectively. The mean TEOAE value in left ear having > 3years and <3 years of duration of hyperuricemia at 1 KHz was 8.72 and 8.11, at 2 KHz was 8.91 and 9.01, at 3KHz was 7.62 and 3.62 and at 4 KHz was 1.74 and 1.23 respectively. **Conclusion:** It is found that hyperuricemia increases the chances of hearing loss at high frequencies.

Keywords: Cochlea, hearing loss, hyperuricemia.

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Introduction

Various metabolic disorders have been associated with hearing loss due to their direct or indirect effect on the cochlea.[1] Cochlea has complex and terminal blood supply, and subtle changes in vascular supply affect stria vascularis and outer hair cell.[2]

Uric acid (UA), the final breakdown product of dietary or endogenous purine metabolism in humans and principal constituents of DNA, RNA, and cellular energy stores, has been speculated to play a role of anti-oxidation, even though it remains debatable that the relative momentousness of UA as antioxidant in vivo.[3,4] Although a great many epidemiologic and observational investigations have reported a relation between the higher serum UA levels and several diseases including hypertension, progressive renal disease, cardiovascular disease, stroke, diabetes mellitus, insulin resistance and metabolic syndrome, little empirical evidence has been found to establish causal relationship.[5] Recently, hyperuricemia has been implicated in cardiovascular diseases by causing vascular calcification and hypertension, and hence, hyperuricemia can lead to indirect cochlear injury.[6]

However, a systemic review has found weak association between hyperuricemia and cardiovascular diseases. Some researches have speculated that UA might have anti-oxidative effect to cognitive function, multiple sclerosis, Parkinson's disease, and Alzheimer's disease via neuroprotection.[7] We hypothesized that uric acid had the neuroprotective effect to hearing thresholds as other neurological diseases.[8] Considering this, we selected present study to assess effect of hyperuricemia on hearing function.

Subjects and Methods

A sum total of eighty- six adults in age ranged 18-40 years of either gender with hyperuricemia (Group I) and equal number of age‑ and sex‑matched normal individuals as controls (Group II). Patients with history of smoking, alcoholism, noise exposure, ototoxic drugs, renal insufficiency, diabetes mellitus and hypertension were excluded. The ethical approval was obtained from higher authorities. All enrolled patients were well aware of the purpose of the study and they agreed to participate in the study.

After clinical and biochemical examination, all patients were subjected to pure tone audiometric and distortion product OAEs and transient evoked OAEs (DPOAEs and TEOAEs) testing as per the International Standard with Interacoustics AC 40 Clinical Audiometer and GSI audio screener+ respectively, in a fully sound attenuated room. All parameters were recoded and compared between left and right ears. The significance level was assessed below 0.05.

Results

The mean TEOAE S/N ratio at 1 KHz on right side was 8.43 and 8.40 and on left side was 8.24 and 8.35, at 2 KHz on right side was 9.12 and 9.14 and on left side was 9.14 and 9.36, at 3 KHz on right side was 5.54 and 9.02 and on left side was 5.30 and 10.4 and at 4 KHz on right side was 1.81 and 9.4 and on left side was 1.62 and 7.6 respectively. The difference found to be significant P<0.05) [Table 1, Figure 1]

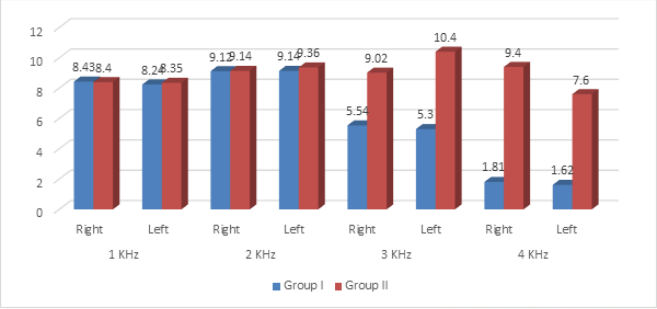

Figure 1: Comparison of TEOAE S/N ratio in both groups

The mean DPOAE S/N ratio at 3 KHz on right side was 13.5 and 13.2 and on left side was 13.8 and 13.9, at 4 KHz on right side was 16.5 and 17.0 and on left side was 15.2 and 15.1, at 5 KHz on right side was 8.93 and 14.3 and on left side was 8.71 and 14.1, at 6 KHz on right side was 5.6 and 9.0 and on left side was 4.3 and 10.2 respectively. The difference found to be significant P<0.05) [Table 2, Figure 2].

The mean TEOAE value in right ear having > 3years and <3 years of duration of hyperuricemia at 1 KHz was 8.51 and 7.52, at 2 KHz was 8.31 and 8.73, at 3 KHz was 7.35 and 3.62 and at 4 KHz was 2.52 and 1.45 respectively. The mean TEOAE value in left ear having > 3years and <3 years of duration of hyperuricemia at 1 KHz was 8.72 and 8.11, at 2 KHz was 8.91 and 9.01, at 3KHz was 7.62 and 3.62 and at 4 KHz was 1.74 and 1.23 respectively. A non- significant difference was observed (P> 0.05) [Table 3].

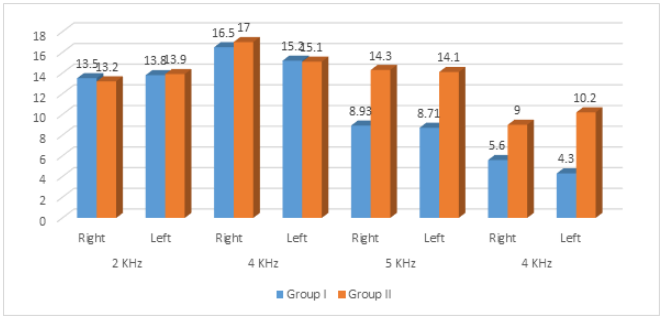

Figure 2: Comparison of DPOAE S/N ratio in both groups

Discussion

Hearing loss is a prevalent medical condition in the elderly population. It reportedly affects half to two thirds of the worldwide population.[9] This sensory dysfunction causes communication difficulties, impaired daily of life activities, and worsened quality of life.[10,11] Observational studies showed significant associations between hearing loss and the incidence of stroke and dementia. Several risk factors have been implicated in this condition, including non-modifiable and modifiable.[12] Another disease that shares the same risk factors and prevalence distribution is hyperuricemia or gout. Therefore, some investigators hypothesized that gout may be a risk factor for hearing loss in the elderly.[13,14] This study assessed effect of hyperuricemia on hearing function.

Our results showed that the mean TEOAE S/N ratio at 1 KHz on right side was 8.43 and 8.40 and on left side was 8.24 and 8.35, at 2 KHz on right side was 9.12 and 9.14 and on left side was 9.14 and 9.36, at 3 KHz on right side was 5.54 and 9.02 and on left side was 5.30 and 10.4 and at 4 KHz on right side was 1.81 and 9.4 and on left side was 1.62 and 7.6 respectively. Saini et al,[15] in 25 hyperuricemic individuals assessed cochlear functions using pure tone audiometry, transient evoked otoacoustic emission (TEOAE), and distortion product otoacoustic emission (DPOAE). They found reduced responses at higher frequencies on DPOAE and TEOAE in the case group. On TEOAE, statistically significant difference was observed in the signal-noise ratio at 4 and 3 KHz. Signal-noise ratio of DPOAE was also found statistically significant at 5 and 6 KHz.

We observed that the mean DPOAE S/N ratio at 3 KHz on right side was 13.5 and 13.2 and on left side was 13.8 and 13.9, at 4 KHz on right side was 16.5 and 17.0 and on left side was 15.2 and 15.1, at 5 KHz on right side was 8.93 and 14.3 and on left side was 8.71 and 14.1, at 6 KHz on right side was 5.6 and 9.0 and on left side was 4.3 and 10.2 respectively. Noha et al,[16] included 20 patients with chronic gout and

Table 1: Comparison of TEOAE S/N ratio in both groups

Frequency	Side	Group I	Group II	P value
1 KHz	Right	8.43	8.40	>0.05
	Left	8.24	8.35	
2 KHz	Right	9.12	9.14	>0.05
	Left	9.14	9.36	
3 KHz	Right	5.54	9.02	<0.05
	Left	5.30	10.4	
4 KHz	Right	1.81	9.4	<0.05
	Left	1.62	7.6	

Table 2: Comparison of DPOAE S/N ratio in both groups

Frequency	Side	Group I	Group II	P value
3 KHz	Right	13.5	13.2	>0.05
	Left	13.8	13.9	
4 KHz	Right	16.5	17.0	>0.05
	Left	15.2	15.1	
5 KHz	Right	8.93	14.3	<0.05
	Left	8.71	14.1	
6 KHz	Right	5.6	9.0	<0.05
	Left	4.3	10.2	

Table 3: Association of TEOAE with duration of hyperuricemia

Frequency	Right ear		P value	Left ear		P value
	<3 years	>3 years		<3 years	>3 years	
1 KHz	8.51	7.52	>0.05	8.72	8.11	>0.05
2 KHz	8.31	8.73	>0.05	8.91	9.01	>0.05
3 KHz	7.35	3.62	<0.05	7.62	3.62	<0.05
4 KHz	2.52	1.45	>0.05	1.74	1.23	>0.05

a similar number of healthy controls. The analysis showed that patients with gout had statistically significant higher pure tone audiometry threshold of the left and right ears. The threshold was higher in both ear at the level of 1000 to 8000 Hz. The percentage of patients with bilateral failed Transient evoked otoacoustic emissions (TEOAEs) was significantly higher in gout group (50% versus 0%). The band response of TEOAE from 1500Hz to 4000Hz was significantly higher in gouty patients as well. There was statistically significant positive correlations between pure tone, speech audiometry, and TEOAE with gout duration and uric acid levels.

Our results showed that the mean TEOAE value in right ear having > 3years and <3 years of duration of hyperuricemia at 1 KHz was 8.51 and 7.52, at 2 KHz was 8.31 and 8.73, at 3 KHz was 7.35 and 3.62 and at 4 KHz was 2.52 and 1.45 respectively. The mean TEOAE value in left ear having > 3years and <3 years of duration of hyperuricemia at 1 KHz was 8.72 and 8.11, at 2 KHz was 8.91 and 9.01, at 3KHz was 7.62 and 3.62 and at 4 KHz was 1.74 and 1.23 respectively. Yang et al,[17] in their study 44084 subjects aged 20-69 years who have serum UA data and received Audiometry Examination Component were enrolled. Hearing thresholds (dB) as a pure tone average at low frequencies (0.5, 1, 2 kHz) and at high frequencies (3, 4, 6, and 8 kHz) were computed. The regression coefficients elucidated as the change of log-transformed mean hearing thresholds upon comparing participants in the highest tertile of serum UA to those in the lowest tertile were –0.067 (P=0.023) in high frequency and –0.058 in low frequency. After adjusting for multiple pertinent covariates, inverse association between tertiles of serum UA and hearing thresholds remained essentially unchanged. The negative trends between serum UA and hearing thresholds were statistically significant in tertile-

based multiple linear regressions.

Conclusion

It is found that hyperuricemia increases the chances of hearing loss at high frequencies. Therefore, all patients with hyperuricemia should be screened for hearing loss.

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