In this study, we investigated the incidence of hearing loss in high and ultra high frequency ranges of the subjects and compared clinical and audiologic features of the patients among three groups with different hearing thresholds.

Results: The incidence of high and ultra-high frequency hearing loss in the subjects was as high as 15% and the proportion of the patients with hearing impairment in ultra-high frequency range was about 74% in normal hearing subjects. This result suggests that hearing loss is not necessary to cause tinnitus and confuses our understanding about tinnitus and cochlear dysfunction.

On the other hand, it is known that some tinnitus patients do not show any hearing loss in the audiogram. This phenomenon suggests that factors other than cochlear dysfunction may play a role in triggering tinnitus in these patients. Considering these factors, we investigated the incidence of hearing loss in high and ultra-high frequency areas have influence on the clinical and audiologic features of the patients.

INTRODUCTION

Subjective tinnitus refers to sound perception that occurs in the absence of an external stimulus. It is a complex phenomenon, has many causes and is related to biological and physiological components. There is a consensus that tinnitus is the result of aberrant neural activity within the auditory pathways. This hypothesis has many causes and is related to biological and physiological components. Therefore, it is crucial to investigate the incidence of hearing loss in high and ultra-high frequency ranges of the subjects.

MATERIAL and METHODS

Among consecutive 200 tinnitus patients, who visited our tinnitus clinic and received extended high-frequency audiology (EHAFA) between July 2009 and February 2010, 85 tinnitus patients who had subnormal hearing with normal hearing sensitivity in voice frequency (250~2 KHz) were included in this study. In EHAFA, air conduction thresholds (AC) was not only measured in frequencies between 125 and 8 KHz but also measured in ultra-high frequency range up to 16 KHz. An additional 25 dB per octave was added to the AC. At the time of the study, all tinnitus patients had normal sensorineural type of tinnitus. Patients who had middle ear disease or cochlear lesions were excluded.

In this study, we investigated the incidence of hearing loss in high and ultra-high frequency ranges of the subjects with normal hearing in ultra-high frequency range. Considering the same discomfort and suffering from tinnitus in normal hearing patients with tinnitus, we evaluated whether hearing loss of these high and ultra-high frequency areas have influence on the clinical and audiologic features of the patients.

RESULTS

Forty-five subjects were classified as HHFHL-TN group, 28 subjects as UHFHL-TN group and 10 subjects as NH-TN group (Fig. 1). The incidence of high frequency or ultrahigh frequency hearing loss in the sensorineural tinnitus patients who did not have any hearing loss in voice frequency was 18% (7/38) and the proportion of the patients with impaired hearing in ultrahigh frequency range (12–16 KHz) but normal hearing in usual frequency was 74% (28/38).

In comparison of clinical and audiologic features among three groups, NH-TN group was significantly younger in age than other groups (Table 1). Significant noise at right side transiently evoked otoacoustic emission (TEOAE), right side distortion product otoacoustic emission (DPOAE) of all frequencies and left side DPOAE of 4.6 KHz were significantly bigger in NH-TN group than other groups (Table 1). Mean loudness of tinnitus in NH-TN group was significantly smaller in NH-TN group (15.8±4.9 dB HL, p<0.001) and mean frequency of their tinnitus was higher in NH-TN group than other groups, but not statistically significant (Table 1).

In conclusion, the incidence of hearing loss in the high frequency range above 2 KHz of tinnitus patients who did not have any hearing loss in voice frequency was highly skewed and the proportion of the patients with impaired hearing in ultrahigh frequency range (12–16 KHz) but normal hearing in usual frequency in pure tone audiometry (125~8 KHz) was about 74%. These results support the deafferentation hypothesis that cochlear damage is a major triggering factor of tinnitus, even if the tinnitus patient has normal hearing thresholds in conventional audiometry, which could be rational in conducting EHAFA in subjectively normal hearing patients with tinnitus. In comparison of clinical and audiologic features among three groups, NH-TN group showed significantly higher age and AC and normal hearing in all frequencies except for 12 KHz and among the other groups, NH-TN group was significantly smaller than the other groups. However, tinnitus scores including THI scores and clinical courses among three groups were not statistically different. Considering same discomfort and suffering from tinnitus in NH-TN group, clinicians should not neglect their tinnitus and treat them appropriately.

CONCLUSION

The incidence of hearing loss in the high frequency range above 2 KHz of the tinnitus patients who did not have any hearing loss in voice frequency was 18%, and the proportion of the patients with hearing loss in ultrahigh frequency range (12–16 KHz) in the tinnitus patients who did not show any hearing impairment in conventional audiometry (125~8 KHz) was about 74%. These results support the deafferentation hypothesis that cochlear damage is a major triggering factor of tinnitus, even if the tinnitus patient has normal hearing thresholds in conventional audiometry, which could be rational in conducting EHAFA in subjectively normal hearing patients with tinnitus. In comparison of clinical and audiologic features among three groups, NH-TN group showed significantly higher age and AC and normal hearing in all frequencies except for 12 KHz and among the other groups, NH-TN group was significantly smaller than the other groups. However, tinnitus scores including THI scores and clinical courses among three groups were not statistically different. Considering same discomfort and suffering from tinnitus in NH-TN group, clinicians should not neglect their tinnitus and treat them appropriately.