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CASE REPORT

A case report of absent auditory steady-state responses in an elderly person with moderate sensorineural hearing loss

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Abstract

Background: Auditory steady-state response (ASSR) is a test for the estimation of auditory thresholds. It is used in infants, children, and adults. This case report presented unusual ASSR results in an elderly person.

The Case: Pure tone and speech audiometry**,** tympanometry and acoustic reflexes showed a moderate sensorineural hearing loss in both ears. However, the patient did not respond in the ASSR test to different carrier frequencies with frequency modulations of 40 and 80 Hz.

Conclusion: To date, the results of the different effects of the aging process obtained from ASSR responses have been reported. However, the absence of any response in the ASSR test has never been reported. The patient in this case report may have these results because of a neural deficit.

Keywords: Sensorineural hearing loss; aging; auditory steady-state response

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Introduction

Auditory Steady-state Response (ASSR) is a valid and reliable test for hearing evaluation. It can accurately estimate hearing sensitivity at different frequencies. It has a good estimation of different types of hearing loss [1,2]. ASSR is an objective test and it is mainly used in infants or adults with no valid behavioral responses [3].

Different factors such as neural conditions may affect ASSR responses. In this case report, the results of an elderly person with moderate sensorineural hearing loss (SNHL) are presented. He had absent auditory steady-state responses in different modulation frequencies.

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Case presentation

The patient was an 86 year old male. He had come for hearing aid counseling and only complained about hearing loss. There was no report of any other symptoms including tinnitus, dizziness, vertigo, imbalance, and visual problems. In the first stage of hearing aid counseling, we performed different auditory tests such as pure tone audiometry (PTA), speech recognition threshold (SRT), speech discrimination score (SDS), tympanometry and acoustic reflexes. PTA showed a moderate SNHL (Fig. 1).

SRT was 55 dB HL and SDS was 80% in both ears. Tympanometry was type A in both ears (Fig. 2) and acoustic reflexes were absent for ipsi- and contralateral stimulation on both sides.

After patient counseling, he was convinced to perform ASSR (ICS, CHARTER, Denmark) test. Non-inverting, inverting and ground electrodes were placed at the vertex, C7, and

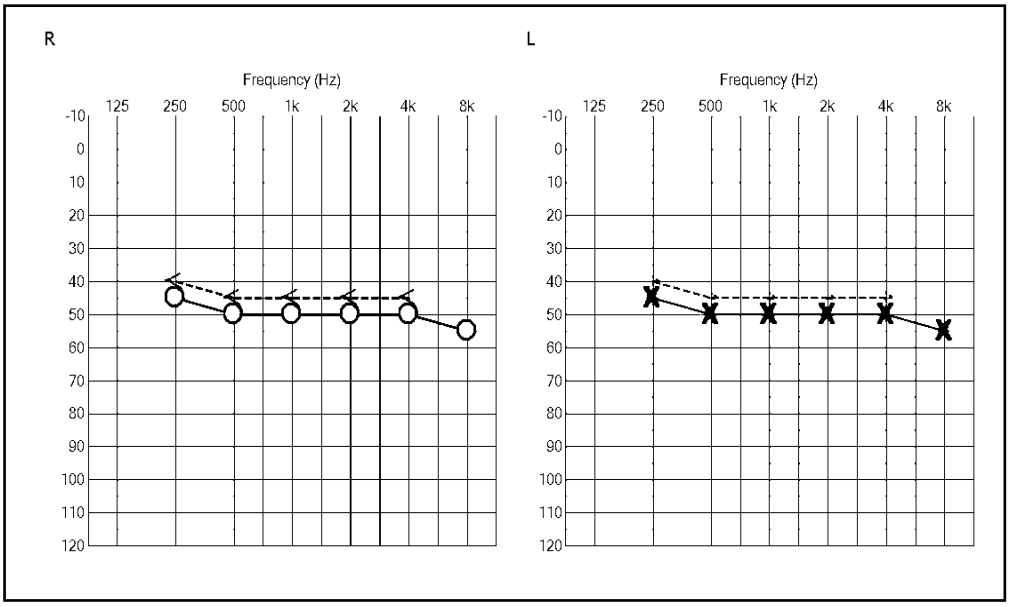

Fig. 1. Results of pure tone audiometry.

forehead, respectively. Electrode impedance was kept under 5kΩ and intra-electrode impedance, under 2 kΩ. Filer setting was 10 to 100 Hz with notch filter at 50 Hz.

ASSR test was performed at both 40 Hz and 80 Hz modulation frequency. The patient was completely awake during the test. The carrier frequencies were 500, 1000, 2000 and 4000 Hz. The test was performed via headphones and stimulus presented binaurally. In intensities over 60 Db HL, each ear was tested by a single frequency. The stimulus was mixed (AM 100% + FM 25%). The test was performed at different intensity levels up to 120 dB HL. The patient

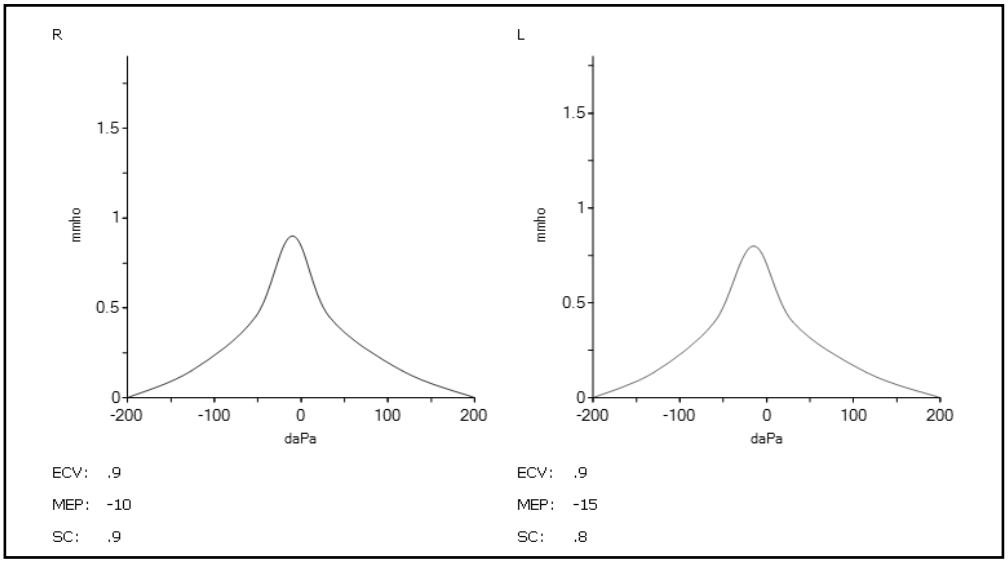

Fig. 2. Results of tympanometry. ECV; ear canal volume, MEP; middle ear pressure, SC; static compliance.

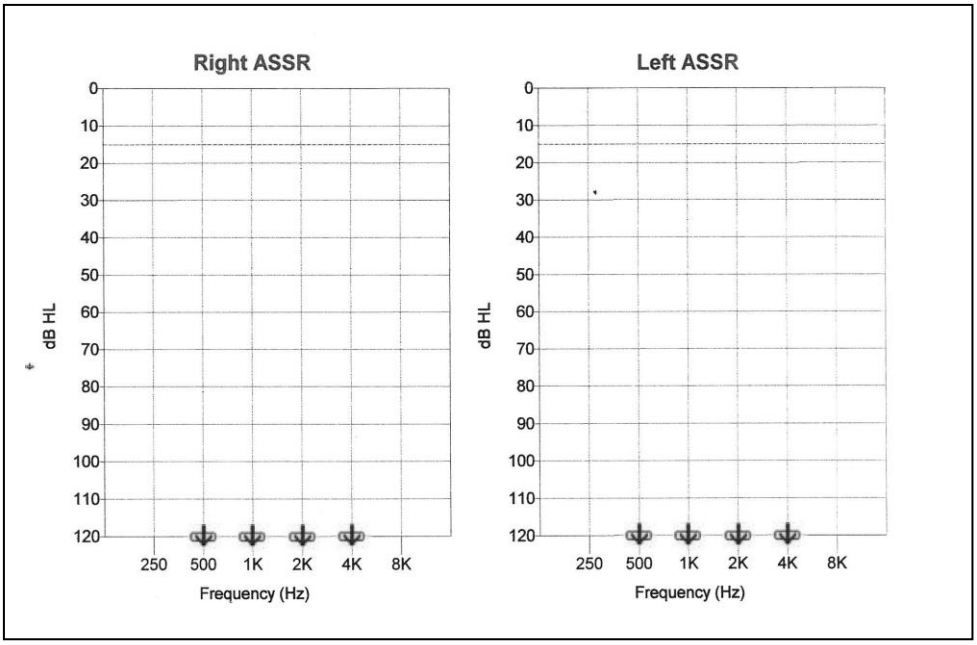

Fig. 3. Auditory steady-state responses of the patient, results of different frequencies are presented in the same graph.

did not respond at different carrier frequencies in all modulation frequencies (Fig. 3). After the ASSR test, the patient did not agree to additional tests for further evaluation such as auditory brainstem response (ABR) or magnetic resonance imaging (MRI).

Discussion

ASSR is a valid and reliable test. It has a good estimation of hearing sensitivity in adults with SNHL [4] and conductive hearing loss [1]. The neural origins of ASSR depend on the modulation frequencies of the stimulus. The normal functions of these structures are essential for obtaining a valid and reliable response. The considerable difference between behavioral thresholds (such as PTA and SRT) and ASSR thresholds may relate to abnormal neural functions of the auditory system. However, the patient did not agree to undergo any neurologic evaluation such as an MRI and he didn't have any other complaints that may have signaled the presence of a neural deficit.

The aging process could not justify the ASSR results in this patient. Aging has some effects on different auditory evoked responses [5,6]. There are some researches about the effects of aging on ASSR responses; however the results are controversial. Some researches show the effects of aging on ASSR responses [7-9], especially with high frequencies [7]. It was suggested that ASSR could be used as an indicator of the aging process in the auditory system [10]. The aging process even showed some effects on ASSR responses in the age-period of 19 to 45 years old [11]. On the other hand, some studies didn't find any aging effects on ASSR responses. In one study there was no difference between two groups; one group with young participants and the other older participants [12]. The aging process also has some effects on behavioral tests for intensity discrimination but ASSR failed to show any difference in the older population [13]. Additionally, to the best of the author's knowledge, no research has reported an absence of ASSR responses in different frequency modulations because of the aging process. Therefore, the results of this patient may not only relate to the aging process.

Conclusion

A considerable difference between behavioral

and ASSR thresholds may relate to abnormal neural function. Further studies in these areas are required.

Conflict of interest

The authors declared no conflicts of interest.

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