INFLUENCE ON VESTIBULAR FUNCTION BY AUDITORY NEUROPATHY

WANG Jingmiao, JIANG Xinxia, SHAN Chunguang

Abstract

Objective The main purpose of the present study was to describe the vestibular function in patients with auditory neuropathy (AN), and to assess their ability to maintain balance. Methods Vestibular function tests were performed on 32 patients with AN and 36 normal subjects including electronystagmography (ENG) and static posturography (SPG). The results from the two groups were compared. Results Equilibrium function in patients with AN, was abnormal, compared to normal subjects. Conclusion Vestibular function tests, especially static posturography, should be performed on patients with AN.

Keywords: Auditory neuropathy; vestibular function

Auditory neuropathy was named by Starr1 in 1996, now we think auditory neuropathy is a special kind of sensorineural hearing loss which caused by damage of VIII cranial nerve, with the deepening of the studies, we find auditory neuropathy can be presented as a separate disease, in the same time, it can also be associated with other nervous system disease. Recently, more and more research had made on auditory neuropathy, and we have know it’s clinical characteristics, most of the research was on audiology and clinical features. This experiment was made to investigate whether the vestibular function was affected in patients with auditory neuropathy.

Experimental subject and method

Experimental subject

Normal control group: No ear diseases; No vertigo history; Pure tone audiometry examination showed normal hearing; No history of drug application which may has damage on audition; No noise exposure history; No heart disease and no neurological disease; No heredofamilial disease. There were 36 patients in this research, and 20 males, 16 females, their age ranged from 7 to 35 years old, their average age was 19 years old.

Auditory neuropathy group: All patients were selected who had hearing loss history and meet the following conditions: ① Pure tone audiometry showed low frequency sensorineural hearing loss ② Tympanogram showed “A” type, ipsilateral and contralateral reflex has not led ③ Auditory brainstem response was absent or obvious abnormal ④ Otoacoustic emission was normal, contralateral suppression was not exist and distortion product otoacoustic emission was normal or nearly normal ⑤ The results of pure tone audiometry were not consistent with objective auditory threshold, speech audiometry disproportionately worsen than that of pure tone audiometry, and the results of pure tone audiometry were slight or middle hearing loss ⑥ No other disease which may have effect on hearing, for example: media tomography, hypertension, diabetes mellitus and nephrogenous diseases. ⑦ No abnormal results showed in radiological examination. In all 32 cases, there were 14 males and 18 females, their age from 9 yearsto 32 years old, and their average age was 20, the period of deafness was 1 month to 6 years, among these patients, 4 with symptom of tinnitus and 3 with vertigo.

Experimental method

Vestibular function tests were performed on 36 patients with auditory neuropathy by recording electronystagmography (ENG) and static posturography (SPG), in order to improve the sensitivity of SPG, a sponge was placed on the platform, and its thickness was 10 cm, then we can interfere the proprioception of feet and ankle, the data was recorded with eyes opened and closed. then we recorded parameters of saccade test, eye tracking test, optokinetic nystagmus, positional test and caloric test.

Results

In 32 patients with auditory neuropathy there were 6 cases with abnormal results of ENG tests, all showed pe-
Peripheral vestibular lesion, the results of saccade test, eye tracking test, optokinetic nystagmus and positional test were normal. 1 case showed abnormal caloric test, which appeared reduction of unilateral horizontal semicircular canal, 5 cases showed reduction or paralysis of bilateral horizontal semicircular canal.

Static posturography test and it’s related parameters of 32 patients with auditory neuropathy were measured with ST-939 type computerized posturography system. 28 patients recorded centripetal pattern, the locus length, velocity and area of postural sway were significantly increased, there were significantly difference compared with normal subject whether with eyes opened or closed, and the following table is the data of the experiment.

**Discuss**

Patients with auditory neuropathy were predominantly teenagers and they can be accompanied by other symptoms of other peripheral nerve system, and they can be recorded abnormal parameters in static posturography examination. 6 cases were recorded abnormal results of ENG tests, most appeared peripheral vestibular lesion, saccade test, eye tracking test, optokinetic nystagmus and positional test were recorded normal results, caloric test showed reduction or paralysis of horizontal semicircular canal, which suggested that vestibular lesions were involved in patients with auditory neuropathy, vestibular dysfunction may be part of the pathological damage. Wang Jinling and other scholars\(^2,3,4\) also presented vestibular lesions were easily involved in patients with auditory neuropathy. This may dued to the eight cranial nerve, especially the vestibular system, which has complex structure and function, and it is susceptible to the influence of various factors, including the interaction of different system, external factors and the process of diseases.

32 patients with auditory neuropathy, only 3 with vertigo history, most of the patients without symptoms of vestibular impairment, this suggested that vestibular lesion developed slowly, and it can be compensated by various mechanisms. Most cases without vestibular symptoms and it may be easily overlooked. In addition, 6 cases with abnormal results of ENG test, their history of hearing loss were all more than 3 years, their hearing threshold was 50 dBHL or above, and with flat hearing curve. This showed that with the progression of disease of auditory neuropathy, the pore of the range of vestibular lesion, the more serious hearing loss we can recorded. There were other reports of auditory neuropathy complicated by other cranial nerve disease[5,6] , all suggested that auditory neuropathy may be complicated by multiple system dysfunction.

From this test it can be seen that, to 32 patients with auditory neuropathy, the length of locus and velocity of postural sway were significantly increased than that in normal control group, and only 6 cases recorded abnormal results in ENG test, this showed SPG test was more sensitive than ENG test, and the process of SPG test was rapid and simple, the results were objective and reliable. In future clinical work, to patients with auditory neuropathy, we should undertake audiologic testing and vestibular function tests, then we can make a objective assessment of the range of the vestibular lesion. If possible, we should make other cranial nerve examination, so we can make further understanding of the disease.

**References**


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**Table 1** Comparison of parameters in auditory neuropathy and the control group in SPG test with eyes opened

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<th>Groups</th>
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<th>Length of locus (mm)</th>
<th>Velocity (mm/s)</th>
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<td>2193.5±481.25*</td>
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*P<0.05

**Table 2** Comparison of parameters in auditory neuropathy and the control group in SPG test with eyes closed

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