

EVALUATION OF THE STUDY OF DIAGNOSTIC TESTS IN VESTIBULAR DISORDERS

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Abstract:

The paper evaluates the specificity and diagnostic significance of such widely used diagnostic vestibular tests as finger to nose, finger to finger test, Barr-Fisher test, adiadochokinesis test, balance tests in Romberg pose simple and complicated, straight line walking, flank gait, and Fukuda marching test. The peculiarities of their course in patients with peripheral, central and mixed type of vestibular analyzer lesions are discussed. The optimal tests for determining the level of vestibular analyzer lesion at the initial examination of a patient with vertigo are proposed.

Keywords: vestibulometric tests, vertigo, vestibular dysfunction.

Introduction

According to various authors, dizziness is among the three most frequent complaints presented by patients to a general practitioner at an outpatient appointment [1,3,5]. On average, 5 people out of 1000 annually seek medical help due to dizziness and balance disorders [2,7]. The difficulty in examining patients with vestibular complaints lies in the fact that dizziness, balance and coordination disorders are only symptoms of multiple diseases, different in etiology and pathogenesis [1,4]. Vestibular tests aimed at detecting pathology of the vestibulospinal tract are inferior in their diagnostic significance to oculomotor and positional tests.

Nevertheless, this examination does not require special expensive equipment, does not cause discomfort to the patient and is available for mastering by a doctor of any specialty. At the same time, it makes it possible to suspect vestibular analyzer damage of central or peripheral genesis already at the initial examination, and to refer the patient for additional examination and consultation with an otoneurologist [6,11]. The Russian literature pays considerable attention to a large number of vestibular tests, in contrast to foreign literature, in which only the Romberg test, index and marching tests are found [3,4]. Most of the described tests are not standardized



[7,10]. Conducting all existing test procedures when examining each patient with vestibular complaints leads to significant unjustified time and financial costs [8,9].

The aim of the study was to evaluate diagnostic vestibular tests and to establish the optimal set of them to determine the level of vestibular analyzer lesion during the initial examination of a patient with vertigo.

Material and methods of research

We evaluated vestibular tests: finger to nose, finger to finger test, Barr-Fisher test, adiadochokinesis test, balance tests in simple Romberg pose and complicated, straight line walking with closed eyes, flank walking, and Fukuda marching test. For each of the above tests, we calculated sensitivity (Sp) and specificity (Se) indices.

Based on the obtained Sp and Se values, we determined the predictive value of the tests by calculating the likelihoodratio (LR) for a positive result (LR+).The examined sample consisted of 41 patients suffering from previously verified vestibular disorders of various genesis.

The sample was divided into 3 groups on the basis of localization of vestibular analyzer lesion. In the first group (n=25, men-10, women-15; mean age 49.3±12.5 years) the peripheral type of vestibular analyzer lesion was revealed, caused by such nosological forms as Meniere's disease, vestibular neuronitis, benign positional paroxysmal vertigo (BPPV). In the second group (n=8, men-2, women-6; mean age 66± 6.7 years) there was a verified lesion of the central part of the vestibular analyzer caused by acute cerebral circulation disorder in the vertebral-basilar system (6 cases) and cerebellar neoplasm (2 cases). The third group (n=8, men - 6, women - 2; mean age 64.3±10.2 years) included patients with vestibular ataxia. In addition, a control group of healthy volunteers without pathology of the vestibular analyzer was formed (n = 32, men - 16, women - 16; mean age 23 ± 3.3 years).

The quantitative composition of the groups, as well as the nosologies included in the three groups, is presented in Table 1.

Table 1 Quantitative composition of groups, patients with cochleovestibular disorders

Patients included in the study	Кол-во человек	Доля выборки %
Total patients	41	100
BPPV	5	12,5
Vestibular neuronitis	8	19
Meniere's disease	12	30
Vestibular ataxia	8	19
Disturbance of cerebral circulation	6	15
A cerebellar neoplasm	2	4,5
Control group	32	



The diagnosis of the patients was verified as a result of the following methods of investigation: videonystagmography, bithermal caloric test, tonal threshold audiometry, electrocochleography, neuroimaging methods and ultrasonic diagnostics. In addition, the patients were consulted by a neurologist, ophthalmologist, and therapist, if necessary.

Results and their Discussion

When performing the Barr-Fisher test, arm deviation was observed in 65.2% of patients: in peripheral lesions - in 82% of cases, in central and mixed lesions - in 64% of cases. Among patients with peripheral pathology, only 21.4% had harmonious hand deviation toward oppression, and 25.8% also had hand deviation toward oppression, but it was disharmonious or only one hand (on the affected side) was deviated. Another 7.7% had deviation of both arms in the opposite direction to the oppression. The remaining 15.4% were patients with BPPV who had a disharmonious deviation of the arms in the direction opposite to the affected semicircular canal. In central lesions, the hands always deviated disharmoniously. In vestibular ataxia, an equal proportion of the deviation was harmonious, disharmonious, or there was a divergence of the hands in different directions. Performance of the finger-to-finger test was impaired in 85.7% of patients, in peripheral lesions - in 77% of cases, in central and mixed lesions - in 100% of cases.

Among the peripheral pathology, only 7.7% of patients with vestibular neuronitis had both hands swiping in the direction of oppression, and 38.5% had only one hand (on the side of oppression) swiping in the direction of oppression. In 15.4 % with Meniere's disease, hand swiping was directed in different directions. Another 7.7 % were patients with BPPV, when one hand swiping to the healthy side was detected. In cerebral circulatory disorders, the finger to nose test was disharmonious, regardless of etiology. The finger to nose test showed deviation only in two patients (6.5%) with peripheral lesion of the vestibular analyzer.

In the control group, the finger to finger and finger to nose tests revealed no abnormalities, while the Barr-Fisher test revealed abnormalities in 62.1% of the subjects. Performance of the simple Romberg test was impaired in 28.1% of patients. Among the patients with peripheral level of the lesion - in 30,8 %, and in all of them only a slight swaying was noted, in central and mixed pathology deviations were revealed in 50 % of patients. The complicated Romberg test was disturbed in 90.5 % of patients. In peripheral pathology, deviations occurred in 84.7% of cases, among which 30.8% of patients had torso deviation in the direction of oppression, and another 30.7% had torso deviation in different directions. Another 18.2% of patients with BPPV had deviation in the opposite direction to the affected canal.

In cerebellar neoplasms and cerebral circulatory disorders, deviations in the sensitized Romberg test were detected in 100% of cases. When walking in a straight line with closed eyes, deviation from the center line was observed in 52.4% of cases. In peripheral lesions of the vestibular analyzer, deviations were observed in 38.5% of patients: 15.4 % of them deviated in the direction of oppression, another 15.4 % deviated in both directions, the remaining 7.7 % deviated in the direction opposite to oppression. In central lesions walking in a straight line was disturbed in 75% of cases, in mixed lesions - in 72% of cases. In the control group, deviations



were observed only when performing a complicated Romberg test, and in 17.5% of cases there was a slight staggering. In our study, flank walking was disturbed in 16.7% of patients; the disturbances were mainly detected in patients with central type of vestibular analyzer lesion, and only in one case in a patient with vestibular neuronitis and preserved pronounced ataxia - walking was difficult in both directions and was accompanied by staggering.

Adiadochokinesis was detected in 23.8% of cases: in 50% of patients with central pathology (on both sides or on the affected side); in one patient with mixed pathology and paresis of the ulnar nerve in the anamnesis. Among the peripheral pathology, mild adiadochokinesis disorders were also identified in 6 patients: in three patients, adiadochokinesis was associated with upper extremity trauma or a history of upper extremity joint arthrosis. Another three had a slight left hand lag, regardless of the side of the lesion, which may be due to the predominance of a particular hand, such as in right-handed people. In the control group, no abnormalities were found in these two tests.

When performing the Fukuda test, a side deviation of more than 30° was observed in 19% of patients. Among the peripheral pathology, this test was disturbed in 15.4% of patients. In central, as well as in mixed pathology, in 25 % of patients. In 10 patients (23,8 %) with different levels of lesions it was impossible to perform the Fukuda test due to the patient's fall, which was probably associated with ataxia manifestations. In the control group, torso deviation of more than 30° was also noted in 23.08% of cases.

Thus, according to our data, the Fukuda test does not have sufficient sensitivity for determining the level of vestibular analyzer lesion, nor for diagnosing the side of the lesion.

To assess the diagnostic significance, we calculated sensitivity and specificity indices for all the above tests. In addition, the tests aimed at detecting a purely central lesion (flank walking and adiadochokinesis test) were compared not only with control subjects, but also with patients who had only peripheral pathology (Fig. 1).

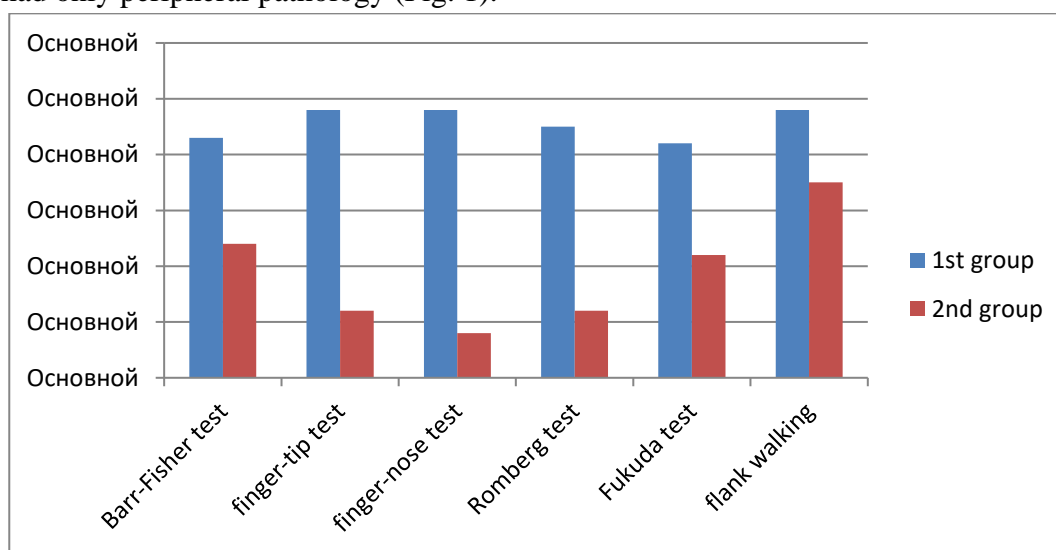


Figure 1. Vestibular test performance in patients with peripheral and central impairment



According to the data of vestibular test parameters, these tests are of great significance in patients with peripheral vestibular disorders. Specificity was calculated in comparison with a group of 25 people with pathology of the vestibular analyzer.

Based on the calculation of the results obtained by us, the likelihood ratios of positive results show that among the statocoordinator tests the finger to finger test has the greatest diagnostic significance (LR+=8,33). Tests aimed at detecting cerebellar lesions: flank walking (LR+=20) and adiadochokinesis test (LR+=6.25) have a sufficiently high value, with flank walking having greater diagnostic significance. The following tests have extremely low LR+: Barr-Fisher test (LR+=1.26), finger to nose test (LR+=2.38) and Fukuda test (LR+=0.77), which casts doubt on their diagnostic significance (Table 2).

Table 2 Positive likelihood ratio (LR) scores, for vestibular tests

Test	(LR)
Barr-Fisher	1,26
Finger to finger	8,33
Finger to nose	2,38
Romberg	8,9
Flank walking	20
Fukuda	0,77

Thus, in patients with a peripheral type of vestibular analyzer lesion, a small adiadochokinesis may be observed in rare cases, even in the absence of upper limb pathology. This is probably due to the predominance of a particular hand in right- and left-handed patients. Nevertheless, the Romberg test has a fairly high sensitivity and specificity, although it is inferior in these indicators to flank walking.

In patients with Meniere's disease statocoordinator tests do not reveal any abnormalities, while statokinetic tests reveal the patient rocking or falling in different directions, which is most likely explained by the mechanisms of vestibular adaptation in this pathology.

The sensitivity of statocoordinator and statokinetic tests is not high. Nevertheless, most of them have high specificity, which makes it possible to avoid false-positive results at the initial examination of a patient with vestibular complaints.

We questioned the necessity of the finger to nose test and the Fukuda test in the initial examination of the patient, as both tests have low sensitivity and are time-consuming.

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