CONTRIBUTION OF THE AUDIOLOGICAL AND VESTIBULAR ASSESSMENT TO THE DIFFERENTIAL AND ETIOLOGICAL DIAGNOSIS OF PERIPHERIC VESTIBULAR SYNDROMES

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Abstract

Scope of the study: Vestibular pathology is a complex one, requiring a minute clinical evaluation, as well as numerous paraclinical investigations. The present study analyzes the contribution of the modern methods of vestibular and auditive investigation to the diagnosis of dizziness.

Materials and method: The results of the investigations performed on 84 patients with peripheric vestibular syndrome, on whom a complete audiological and vestibular assessment had been also made, have been retrospectively analyzed.

Results: Anamnestic data and the results of evaluation permitted classification of peripheric vestibular pathology according to topo-lesional and etiological criteria. The most frequently diagnosed diseases were: benign paroxysmal positional vertigo, Ménière syndrome and vestibular neuritis.

Conclusions: Testing of the vestibulo-ocular and vestibulo-spinal reflexes through videonystagmography and, respectively, computerized dynamic posturography, besides tonal vocal audiometry and precocious auditive potentials, is especially important for a positive diagnosis and etiological differentiation of vestibular syndromes.

Keywords: audio-vestibular evaluation, videonystagmography, computerized dynamic posturography.

INTRODUCTION

Nowadays, symptoms such as vertigo, dizziness, disequilibrium or orthostatic instability are among the most common problems with which patients address the ENT consulting rooms. This symptomatology may be determined by either isolated or intricate disfunctions of the multiple systems involved in equilibrium preservation, making difficult a correct diagnosis and the selection of an adequate therapeutical attitude after only a brief medical evaluation. The diagnosis of equilibrium pathology may be established only by a complete analysis of the dizzy patient, involving both systems: the vestibular and the auditive one.

The scope of the study was to assess the importance of acustico-vestibular evaluation on the basis of modern investigations, such as computerized dynamic posturography, videonystagmoscopy and the auditive and vestibular evoked potentials involved in the differential and etiological diagnosis. Also demonstrated is the utility of these investigations which, by objectivation of the medical observations, go beyond the main disadvantages of clinical examination (variability of results, impossible quantification of the functional deficit, subjective nature of the system used for the interpretation of clinical tests).

MATERIALS AND METHOD

The experimental group was formed of 87 patients, investigated and diagnosed with peripheric vestibular syndromes, at the Clinical Recovery Hospital of Iași (ENT Clinics and Department of Audiology and Vestibulogy), over a period of 12 months. The investigation protocol for each case in part included filling in of a questionnaire providing anamnestic data describing the suffering of the patient, as well as other information necessary for a correct diagnosis and evaluation of the influence of pathology upon the quality of life. Another objective was the application of a common algorithm of audiological and vestibular evaluation, with slight variations or restrictions, imposed by the case.
The paraclinical audiological exam included: tonal laminar audiogram, tympanometry with stapedian reflex, vocal audiometry, acoustic oto-emissions, precocious auditory evoked potentials (PEAP). In some cases, in which the suspicion of Ménière syndrome or disease is present, the test to glycerol was recommended, including liminary tonal audiometry performed prior to the administration – per os – of the glycerol solution (1.5 mg/kg body) dissolved in distilled water, as well as at 2 and, respectively 3 hr after glycerol ingestion. Testing of the vestibular function was mainly aimed at evaluating the vestibulo-spinal reflux through computerized dynamic posturography (known as permitting to identify the vestibularly-, visually- or proprioceptively-affected sensorial input) and the vestibulo-ocular reflex through videonystagmoscopically-assisted tests (investigation of the presence of spontaneous nystagmus and of the one provoked by positional tests, the “head thrust” test, the head-shaking test, the fistula test, as well as through caloric stimulation). According to the pathology of each patient, the necessary imagistic investigations (radiological examination of cervical column, Doppler ecography of carotid and vertebral arteries, CT or RMN brain examination) were performed. Some patients necessitated multidisciplinary: neurological, cardiological, rheumatological and endocrinological evaluations. The obtained information was introduced in the data base which provided the statistical support.

RESULTS

The applied tests aimed at a topographical localization of vestibular system’s lesion and at identifying its cause. According to the topolesional criterion, the peripheral vestibular syndromes manifested in the experimental group were dominated, in ratios of up to 64%, by problems with the vestibular receptors; neural pathology represented 31%, while the remaining 5% were caused by diseases of the middle ear, most frequently occurring being atico-anthral choles-teatom, accompanied by peri-lymphatic fistula of the horizontal semicircular canal (fig. 1).

According to the etiological criterion, the most frequent cause of the peripheral vertiginous syndromes in the experimental group was the benign positional paroxistic vertigo (VPPB) (40%), followed by syndrome Ménière (21%) and by infectious or inflammatory affections (vestibular neuronitis), recording a frequency of 14% (fig. 2). Other causes, diagnosed through complex acustico-vestibular investigations, were: cochleovestibular syndromes with vascular causes (9%), vestibular schwannoma (8%), peri-lymphatic fistula of the horizontal semicircular canal (5%) and elderly vestibular syndrome (3%).
the most frequently met pathology was VPPB (63%), followed by syndrome Ménière (32%) (fig. 3).

If, for VPPB, positive diagnosis is based on the analysis of the vestibulo-ocular reflex, requiring no additional investigations, in the patients suspected of Ménière syndrome, the internal ear should be evaluated in all ways, even in its dynamics. In the experimental group, with patients suffering from Ménière syndrome, evaluation of the vestibulo-ocular reflex through caloric stimulation under videonystagmoscopic control recorded pathological results in 56% of cases, either as a reduction of vestibular reactivity (39%) or as an abolishment in the reactivity of the corresponding labyrinth (17%). A high ratio (44%) is observed for the conservation of the vestibular function, even in cases in which the disease evolves along a long time period (figs. 4, 5).

![Fig. 4. Results of the caloric sample in Ménière syndrome](image)

<table>
<thead>
<tr>
<th>Caloric sample</th>
<th>Nr. patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal vestibular reactivity</td>
<td>8</td>
<td>44%</td>
</tr>
<tr>
<td>Unilateral vestibular hyporeactivity</td>
<td>7</td>
<td>39%</td>
</tr>
<tr>
<td>Vestibular unilateral areflexia</td>
<td>3</td>
<td>17%</td>
</tr>
</tbody>
</table>

Evaluation of the vestibulo-spinal reflex was made for all patients in the absence of crisis, so that dynamic computerized post-urography evidenced the existence of vestibular deficit in only 44% of cases. This value refers only to the patients showing no complete central vestibular compensation. The test to glycerol, a pathognomonic test for the endolymphatic hydrops, was applied to 10 patients of the group, in 60% of cases hearing loss being improved with at least 15 dB on 3 neighbouring frequencies, the test being thus considered positive. The precocious auditive potentials here mentioned did not identify elements suggesting retrocochlear lesions in any of the patients from this category (fig. 5).

The pathology of the vestibular nerve, representing 31% of the peripheric causes, is dominated by vestibular neuronitis (44%), followed by a concomitant affection of the vestibular and auditive nerve (30%) through inflammatory/infectious processes or vascular mechanisms. Retrocochlear tumoral pathology, diagnosed in 26% of the cases with radicular diseases, represents 8% of the total number of peripheric vestibular affections (fig. 6).

![Fig. 5. Exploration of vestibular function in Ménière disease (n = 18)](image)

**DISCUSSION**

The contribution of the modern audiological and vestibular tests should be discussed as a function of pathology, in some cases – such as, VPPB – their application being not absolutely necessary, unlike the complex cases, when the absence of investigations might neglect pathological entities with evolutive potential, such as Ménière syndrome or vestibular schwannoma.

Out of the 87 patients included in the study, 35 complained of paroxistic positional benign vertigo (VPPB). In 88% of cases, mainly affected was the semicircular posterior canal (CSP), in 9% of the patients – the semicircular horizontal canal (CSO), only 1 patient (3%) having both canals simultaneously involved ipsilaterally. These
results agree with the values provided in the literature: CSP-91%, CSO-6%, CSS-3% [1, 2].

Even VPPB may be diagnosed in the absence of complex audiological and vestibular assessments, its realization evidenced – in the experimental group – association of VPPB of CSP with ipsilateral vestibular neuritis in 4 patients, of VPPB of CSO with the endolymphatic hydrops in 1 patient, as well as association with ear surgery in 1 other case. In 14% of cases, installation of VPPB coincided with a cranial-cerebral trauma, yet, the most frequent one was idiopathic (69%).

The paroxistic positional benign vertigo of semicircular posterior ipsilateral canal appears as a possible and frequent complication of vestibular neuritis, due to the conservation of the inferior branch of the vestibular nerve, which can transmit to the vestibular nuclei impulses caused by the otolithic fragments shifted at this level [3]. Association of VPPB with the endolymphatic hydrops is also frequent, being explained by the histopathological repercussions of endolymphatic hyperpressure upon the utricular and secural macula, a mechanism explaining the coexistence of the Ménière disease with VPPB [4]. The paroxistic positional benign vertigo may be present in the clinical picture of patients months or even years prior to the development of a Ménière syndrome or of other form of endolymphatic hydrops [5].

The experimental group included 18 patients with a clinical symptomatology similar to that of Ménière disease, among which 12 meet the diagnosis criteria, showing the classical audiovesicular symptomatic triad. In two cases (11%), the Ménière disease was diagnosed with bilateral affection, a percent value quite close to the 19% one, communicated by Vrabec et al. [6]. Other 4 patients (22%) were included in the category of subjects with probable Ménière disease (Ménière disease with vestibular consequences), as they complained of vertigo Ménière-like crises not accompanied by coheral symptomatology. Audiological evaluation showed a normal auditive function (one patient complained of unilateral hypoacusia and of a sensation of aural plenitude, yet the tonal threshold obtained on the tonal audiogramme was normal). In two cases (11%), fluctuant hypoacusia and reduced vertiginous crises were produced, yet without meeting the diagnosis criteria of the Ménière-like vertigo, so that they were included in the category of patients with probable Ménière disease (Ménière disease with cochlear affection). Actually, the literature of the field evidences the difficulty to be met in stating the diagnosis of the Ménière disease/syndrome, as most of the patients do not show, in the debut of the disease, the whole symptomatic triad characteristic to it. Such subjects may be considered as having a probable Ménière diagnosis, monitorization of their evolution assuring a complete clinical picture over a variable time interval.

An important role in the diagnosis is played by the test to glycerol, which evidences the presence of endolymphatic hydrops, being also a predictive factor on the efficiency of the diuretic or of the surgical treatment (decompression of the endolymphatic sac). The test was applied to 10 patients, showing a – both subjective and objective – improvement of audition in 60% of the subjects. Some patients related on a reduced intensity of tinnitus and a sensation of aural fullness. The test was considered positive if it determined an improvement of the auditive thresholds with at least 10-15 dB, on three frequencies from the vicinity of the tonal audiogramme and/or of the discrimination threshold with more than 16% to the vocal audiogramme [7]. These results are also supported by the existing literature data, according to which the role of the test to glycerol in the diagnosis of the endolymphatic hydrops is appreciated as having a sensitivity of 47-60% and a specificity of 100%, the conclusion being that, in the case of a positive test, the diagnosis of endolymphatic hydrops is undeniable, while a negative result does not exclude the disease.

In its turn, vertigo is also a syndrome quite difficult to quantify. Videonystagmography and posturography evaluates the vestibular function, however, the structural complexity, the numerous connections, the intervention of the superior nervous centers frequently exceed the detection capacity of the devices employed. Consequently, the results obtained by posturographic exploration of these patients are variable. Out of the 18 patients included in the group, 10 evidenced a normal result of posturography, while 8 of them showed vestibular deficits of various severity.
The conclusion is that a test with a sufficiently high sensitivity, making it specific for the diagnosis of Ménière disease is, for the time being, not available. The diagnosis is established by corroborating the anamnestic data with the results of the audio-vestibular assessment, on excluding, through electrophysiological (PEAP) and/or imagistic (IRM cerebral exam) investigations, another possible etiology of the peripheric vestibular syndrome.

Positional nystagmus was observed in 3 patients (25%), VPPB localization occurring at the level of the posterior semicircular canal. The center of the lesion being frequently at the level of the superior vestibular nerve (which gathers information from the horizontal and superior semicircular canal), the inferior branch of the vestibular nerve remains functional, assuring inervation of the posterior semicircular canal and of the sacula. This explains this pathogenic association, frequently observed in these patients, vestibular neuronitis and begin paroxistic positional vertigo of semicircular posterior canal, whose inervation is conserved [7-9]. All patients showed a modified response, involving diminution or absence of reactivity on caloric stimulation of the vestibule.

The result of dynamic computerized posturography varied mainly according to the interval of time measured from the debut of the disease. Even if all patients evidenced peripheric vestibular deficit on caloric stimulation, the results of posturographic records were normal in 25% of cases, which may be explained by the intervention of the mechanisms of central compensation, seen as more efficient, the younger the patient is (fig. 7a).

In the case of vestibular schwannoma, the slow rhythm of tumour increase causes an insidious installation of unilateral vestibular deficit, permitting the development of central compensation [10]. Therefore, clinically, the patients evidence a discrete vestibular symptomatology, which is a sign of disequilibrium (even more intense in semiobscurity or at sudden modifications of head’s position).

Among vestibular explorations, dynamic computerized posturography, known as assuring a global evaluation of equilibrium, showed polymorphic results in this pathology. Thus, out of the 7 patients of the experimental group showing this pathology, 4 evidenced vestibular deficit recorded posturographically (57%), other 2 patients had vestibular and visual deficit (correlated with a cranial progression of the tumour either towards the vestibular nuclei or towards the visual routes). Only one patient (14%) had no sensorial deficits (which is a normal posturographic result), possibly due to the mechanism of central compensation (fig. 7b).
CONCLUSIONS

Even if, nowadays, the methods for the evaluation of the vestibular function have been significantly improved, due to the fact that the auditive deficit may be now better measured, the audiometric tests still have a major contribution in diagnosing the Ménière disease and also in the unilateral retrocochlear pathology.

Videonystagmoscopy and computerized dynamic posturography permit clinical orientation in the diagnosis and differentiation of the peripheric vestibular syndrome from the central one, through evaluation of the type of spontaneous nystagmus, objectivation of the functional hyporeactivity of one of the labyrinths and registration of vestibular deficit.

Corroboration of the results of the audiological and vestibular investigations with the anamnesis and oto-neurological examination is absolutely necessary. The cost-efficiency ratio of the techniques of audio-vestibular evaluation should be had in view, especially when cheaper and non-invasive methods may provide the necessary information.

References