

## VERTIGO IN NEUROLOGICAL PRACTICE

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**SUMMARY** – Vertigo is a common problem in neurological practice, caused by a number of pathomorphological and pathophysiological substrates. The aim of the study was to assess the incidence of particular causes of vertigo in neurological practice. This prospective study included patients treated for vertigo at neurology outpatient clinic. On statistical analysis,  $\chi^2$ -test, t-test, analysis of variance and post hoc LSD test were used. The mean age was  $55.45 \pm 14.8$  years in male patients and  $52.9 \pm 15.1$  years in female patients. The incidence of vertigo was comparable in the two sexes ( $t=0.92$ ,  $p=0.36$ ). The most common cause of vertigo was vertebrobasilar insufficiency and transient ischemic attack of the vertebrobasilar circulation (36.5%), followed by vestibular neuritis (23.5%), stroke (14.8%) and transient ischemic attacks caused by significant carotid artery stenosis (9.6%). Other, more infrequent causes of vertigo in neurology practice were benign paroxysmal positional vertigo, multiple sclerosis, inflammation processes in the middle ear, brain tumors and acoustic neuroma. There was a statistically significant difference in the causes of vertigo according to pathomorphological substrate and patient age ( $f=3.55$ ;  $p=0.017$ ). The patients that had suffered a stroke and those with transient ischemic attacks caused by significant carotid artery stenosis were significantly older. Besides established diagnostic methods, associated symptoms, severity, duration and course of vertigo are of great help in the diagnosis of particular causes of vertigo, which should be taken in consideration on assessing the possible causes of vertigo.

**Key words:** *Cerebrovascular disorders – complications; Vertigo – etiology; Cerebrovascular disorders – diagnosis; Vertigo – physiopathology; Aging – physiology*

### Introduction

Vertigo is an illusion of movement; the patient feels the space and objects to turn around him or himself moving in the space. This can be caused by a disorder in any part of the vestibular system. The vestibular system comprises of the vestibular receptors situated in the internal ear labyrinth, the vestibular nerve, the vestibular nuclei situated in the brainstem, the vestibular ducts and the cortical sensory centers. The vestibular system functions are supplemented by action of the visual, the hearing, the tactile and the proprioceptive systems. The vestibular system controls body balance, orientation in space, head posture and viewing stabilization<sup>1-5</sup>.

Vertigo is caused by poor harmonization of impulses from the vestibular system and other sensory systems that partake in maintaining body balance. This is a multisensory syndrome manifested by illusion of movement of the environment, oculomotor functional disorder (nystagmus), falling when standing or walking, dysmetria and nausea. Not all these symptoms are always present<sup>6-8</sup>.

The diagnosis of vertigo includes otoneurologic examination supplemented by neuroradiologic studies. On clinical examination, ENT specialists also use Dix-Hallpike's maneuver to test for benign paroxysmal positional vertigo (BPPV), and unavoidably audiogram, electro-oculogram (EOG) and brainstem evoked response audiometry (BERA)<sup>9-11</sup>. Neurologic examination consists of the standard neurologic examination and, if required, cerebrospinal fluid (CSF) examination that may indicate further diagnostic work-up<sup>12</sup>. Doppler sonography of extracranial blood vessels and transcranial Doppler (TCD) enable classification of the degree of

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blood vessel stenosis and/or occlusion which significantly affects brain circulation and, consequentially, causes neurologic disorders characterized as vertigo<sup>13,14</sup>. Computed tomography (CT) of the brain, posterior cranial fossa in particular, and high-resolution multislice computed tomography (MSCT) enable visualization of pathomorphological structures also in this highly sensitive area of the posterior fossa where bony structures cause artifacts on imaging<sup>15,16</sup>. Magnetic resonance imaging (MRI) of the brain is also very useful, clearly visualizing spatial relations within particular brainstem structures, especially when demyelination processes are suspected<sup>17,18</sup>. MRI angiography, MSCT angiography and digital subtracting angiography (DSA) provide images of the blood vessel flow and their positional and structural abnormalities, blood vessel malformations and aneurysmal formations<sup>19,22</sup>. The incidence of particular causes of vertigo in neurologic practice is estimated on the basis of clinical findings and diagnostic work-up.

## Patients and Methods

This prospective study included 115 patients seeking neurologist's help for vertigo. The patients were followed up throughout diagnostic procedure to definitive diagnosis. The diagnosis was established in line with good clinical practice, based upon the criteria adequate for particular otoneurologic entities that cause vertigo<sup>23</sup>. All patients underwent ENT and neurologic clinical examinations as well as additional diagnostic work-up according to individual assessment, i.e. laboratory tests, Dix-Hallpike's maneuver, EOG color Doppler of extracranial blood vessels, TCD, CSF testing, CT and MSCT of the brain and/or posterior cranial fossa, MRI of the brain, and MRI angiography, MSCT angiography and DSA only in cases of significant carotid artery stenosis.

On statistical analysis,  $\chi^2$ -test, t-test, analysis of variance and post hoc LSD test were used<sup>24</sup>.

## Results

This prospective study included 115 patients examined neurologically for vertigo at a neurologic outpatient clinic. There were 53 (46%) men and 62 (54%) women, with no statistically significant age difference ( $t=0.92$ ;  $p=0.36$ ). Following comprehensive clinical work-up, the causes of vertigo were classified into nine subgroups (Table 1). The most common cause of vertigo was vestibular neuritis, followed by vertebrobasilar insufficiency

with transient ischemic attack (TIA) of vertebrobasilar circulation and significant carotid artery stenosis with TIA. There was no statistically significant sex difference for either vestibular neuritis ( $\chi^2=3.4$ ;  $p=0.33$ ) or vertebrobasilar insufficiency with vertebrobasilar TIA ( $\chi^2=2.07$ ;  $p=0.15$ ).

Analysis of variance yielded a statistically significant age difference in the causes of vertigo ( $f=3.55$ ;  $p=0.017$ ). The mean age of patients with vestibular neuritis was  $52.7 \pm 14$  years, and of those with vertebrobasilar insufficiency with vertebrobasilar TIA  $59.9 \pm 12.9$  years. Post hoc LSD test produced a statistically significant difference between these patients and those with carotid artery stenosis with TIA. The patients with carotid artery stenosis with TIA were significantly older ( $66 \pm 8.4$  years) than other patients.

Other causes of vertigo are acoustic neuroma, BPPV and multiple sclerosis, however, their incidence was significantly lower and could not be statistically analyzed.

## Discussion

Vertigo occurs more often in the sixth decade of life, probably because of the higher rate of atherosclerotic changes as the most common cause, thus making the basis of stroke and TIA. At this age, degenerative changes of the cranial spine have become more pronounced, thus providing a substrate for vertebrobasilar insufficiency<sup>25-27</sup>.

Table 1. Pathomorphological characteristics of vertigo in neurological practice

Vertigo	n	%
Vestibular neuritis	27	23.5
Vertebrobasilar insufficiency with VB TIA*	42	36.5
Stroke	17	14.8
Multiple sclerosis	4	3.5
Otitis media	2	1.7
Brain tumor	3	2.6
Carotid artery stenosis with TIA**	11	9.6
Acoustic neuroma	5	4.3
BPPV***	4	3.5
Total	115	100

\* vertebrobasilar insufficiency and transient ischemic attack of the vertebrobasilar circulation;

\*\* carotid artery stenosis and carotid artery transient ischemic attack;

\*\*\* benign paroxysmal positional vertigo

Significant carotid artery stenosis is a stenosis of  $\geq 70\%$  of the blood vessel lumen, which requires surgery. All patients with significant stenosis also show signs of vertigo, mild hemiparesis or hemihypesthesia. Along with vertigo symptomatology, patients with vertebrobasilar TIA also exhibited some signs of posterior cranial fossa involvement, and occasionally symptoms of medulla oblongata lesions. In stroke patients, vertigo was associated with dysarthria, and in one case with Wallenberg syndrome (lateral medullary syndrome). However, according to literature data, only a small proportion of patients with stroke and TIA suffer from vertigo, while there is a wide array of stroke symptoms<sup>28</sup>.

Besides having an intense illusion of movement of the environment, patients with vestibular neuritis also developed severe nausea, vomiting and nystagmus, while the speech was preserved. Vertigo attacks were accompanied by intensive symptomatology and lasted for several days.

Vertigo was associated with otalgia, and in one case also with elevated body temperature, suggesting otitis media, as confirmed by subsequent diagnosis. In contrast to literature data<sup>29</sup>, in the present study there was no case of bilateral vestibular neuritis, neuritis relapse during the one-year period of follow up, or Bell's palsy. There was only one case of hearing impairment in a patient with otitis media, which is consistent with literature reports<sup>30</sup>.

Multiple sclerosis is a demyelinating disease characterized with scattered neurologic deficits of the central nervous system. Vertigo is rarely ascribed to multiple sclerosis as the first syndrome<sup>31</sup>. If clinical status suggests it as the possible cause of vertigo, CSF examination, evoked potentials and MRI of the brain should be performed. Along with the moving illusion, all patients also had some other typical signs: positive Lhermitte's sign in one patient, absence of abdominal reflexes in two patients, and previous numbness of a part of the body lasting for several days in one female patient. All these are typical signs indicative of multiple sclerosis, thus requiring additional diagnostic work-up<sup>32</sup>. Patients with acoustic neuroma had gradually appearing mild vertigo and hearing problems, and impaired corneal reflex in one case. Tumors of the posterior cranial fossa caused mild and gradually appearing vertigo, and mild nausea, which is consistent with literature data<sup>33,34</sup>. BPPV is characterized by typical clinical picture, and is additionally verified by Dix-Hallpike's maneuver and EOG<sup>9-11</sup>.

## Conclusion

The most common causes of vertigo are TIA and vestibular neuritis. Other causes are less frequently observed. The clinical picture of vertigo predominated by particular disease signs and characteristics indicates the possible causes of vertigo. The duration, severity and course of vertigo differ depending on the causes. The most common pathomorphological substrates of vertigo are vertebrobasilar insufficiency with TIA, vestibular neuritis and stroke, while multiple sclerosis, TIA with carotid artery stenosis, BPPV and otitis media are by far less frequently recorded. The rate of vertigo due to significant carotid artery stenosis is higher in older age. Therefore, clinical characteristics of vertigo (duration, severity and course) are correlated with age, may indicate the possible causes of vertigo and help identify the pathomorphological substrate.

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## Sažetak

## VRTOGLAVICA U NEUROLOŠKOJ PRAKSI

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Vrtoglavica je učestali problem u neurološkoj praksi uzrokovan nizom patomorfoloških i patofizioloških supstrata. Cilj istraživanja bio je utvrditi učestalost pojedinih uzroka vrtoglavice u neurološkoj praksi. Provedeno je prospektivno istraživanje uzroka vrtoglavice u bolesnika obrađivanih u neurološkoj ambulanti. U statističkoj obradi rabili smo  $\chi^2$ -test, t-test, analizu varijance i post hoc LSD test. Srednja životna dob oboljelih muškaraca bila je  $55,45 \pm 14,8$  godina, a žena  $52,9 \pm 15,1$  godinu. Utvrdili smo da podjednako obolijevaju muškarci i žene ( $t=0,92$ ;  $p=0,36$ ). Najčešći uzrok vrtoglavice bila je vertebrobazilarna insuficijencija i tranzitorna ishemijska ataka vertebrobazilarnog sliva (36,5%), a slijedili su prema učestalosti vestibularni neuritis (23,5%) i moždani udar (14,8%) te tranzitorna ishemijska ataka uzrokovana značajnim stenozama karotidnih arterija (9,6%). Ostali znatno rjeđi uzroci vrtoglavice u neurološkoj praksi bili su benigna paroksizmalna pozicijska vrtoglavica, multipla skleroza, upalni procesi srednjeg uha, tumori mozga i akustični neurinomi. Utvrđena je statistički značajna razlika uzroka vrtoglavice s obzirom na patomorfološki supstrat prema dobi bolesnika ( $f=3,55$ ;  $p=0,017$ ). Oboljeli od moždanog udara i oni s tranzitornom ishemijskom atakom uzrokovanom značajnom stenozom karotidnih arterija bili su značajno starije životne dobi. Posebna pomoć u dijagnostici pojedinih uzroka vrtoglavice uz dijagnostičke metode su pridruženi simptomi te težina, trajanje i tijek vrtoglavice, o čemu treba voditi računa pri procjeni mogućih uzroka vrtoglavice.

*Ključne riječi: Cerebrovaskularne bolesti – komplikacije; Vrtoglavice – etiologija; Cerebrovaskularne bolesti – dijagnostika; Vrtoglavica – fiziopatologija; Starenje – fiziologija*



*ANIJA MATIČEVIĆ – Hommage à Henri Matisse (Emine?), 2007. ulje na platnu, 30x40 cm*