

Current Views on Treatment of Vertigo and Dizziness

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Abstract

Based on the current literature treatment of vertigo and dizziness was summarized depending on its origin. Attention was drawn to the most common causes of vertigo and early differential diagnosis between central and peripheral vertigo. There are three main methods of treatment for vertigo: pharmacotherapy, rehabilitation and surgical treatment. Pharmacotherapy in the treatment of vertigo has its place mainly in the acute phase of attacks. Rehabilitation is one of the most important methods of vestibular compensation support, recommended in the vertigo treatment after the resolution of acute symptoms in most cases. Benign paroxysmal positional vertigo usually release after repositional maneuvers such as Epley maneuver. In some diagnoses, such as Ménière's disease or migraine associated vertigo, appropriate diet can be favorable to preventing the attacks. Surgery is used in some cases where there is no improvement after pharmacotherapy and also in tumors, vascular and cervical spine lesions. In some patients with vertigo, treatment success depends on multidisciplinary cooperation: an otolaryngologist, a physiotherapist, an internist, a vascular surgeon, a neurosurgeon or a psychiatrist.

Keywords: Vertigo; Dizziness; Treatment; Diagnostic tests

Introduction

The epidemiological data indicate that among all patients who come to General Practitioners (GPs) those who suffer from vertigo and balance disorders account for 5-7%. These people are also estimated at 10-12% of the otolaryngologists' patients. Vertigo may be present in patients of all ages; However, becomes more prevalent complaint with increasing age of patient. Among people over the age of 65, vertigo is the third in the order of most common causes of visits to the doctor's office.

Effective treatment depends on accurate diagnosis of causes of the complaints, although in the case of vertigo is not an easy task. The first and most important step in diagnostics of the patient with vertigo is a precise medical interview including, next to questions of concomitant diseases and medications, getting information about duration and frequency of symptoms, presence of triggering/alleviating factors, accompanying signs, trying to find out the nature of the reported symptoms, not suggesting the answer. Well-conducted interview with the patient helps to clarify and detail characteristics of such complaints, which often means something different for the patient and the doctor, despite using the same terminology. The doctor should determine if the patient reports vertigo, dizziness, lightheadness or presyncope.

In balance disorders of the vertigo type the subjective sense of motion is dominating, most commonly of the type of the spinning of one's surroundings. This is accompanied by nausea, vomiting, or sudden sweating.

The vertigo-type balance disorders should be differentiated from other types, such as:

- Dizziness, meaning movement-related feeling of instability (e.g. while stepping up on a stool). Dizziness often accompanies vertigo, but can also appear independently. Dizziness and walking disorders appear in the old age (disequilibrium-presbyastatis).
- Lightheadedness is described as stupor, blackout or disorientation.
- Presyncope is the feeling of upcoming swoon or collapsing with darkening sight or ringing in the ears, without losing consciousness.

According to the data published by Tacikowska and Kubieczk-Jagielska, 50% of balance disorders is caused by pathology of the inner ear, 5% is caused by neurological disorders, 5% includes orthostatic dizziness and adverse effects of drugs, about 15% are psychiatric and psychiatric causes, and about 25% of vertigo and dizziness etiology is unknown [1]. It should be remembered that, especially in the elderly, dizziness/vertigo may be of mixed character and several reasons can be imposed.

The most common causes of vertigo are benign paroxysmal positional vertigo, acute vestibular neuritis or labyrinthitis, Ménière's disease, migraine and cervical migraine, as well as anxiety disorders. Less common causes include vertebrobasilar ischemia, benign or malignant ear tumors. Differentiating between peripheral and central vertigo is usually possible just after clinical examination of the patient, whereby further therapeutic decisions can already be made at the initial steps of diagnostics. In most cases of patients with vertigo, advanced clinical diagnostics is not necessary, as they can be successfully treated on the GP level with only periodic otolaryngological control.

Vestibular System Function versus Vertigo

Vertigo-type balance disorders are the result of acute one-sided vestibular dysfunction of the peripheral character (inner ear labyrinth - vestibular receptors, vestibular nerve, and vestibular ganglion) or central character (vestibular nuclei of the brain stem, the other nerve centers and vestibular pathways, vestibular field in the cerebral cortex).

It is different in case of tumors or protracted intoxication of ototoxic medications. Impairment of vestibular system function proceeds

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slowly, can be unilateral, but also bilateral. Such states causing slowly progressing, symmetrical, double-sided damage of the vestibular organ usually do not lead to vertigo-type balance disorders. Examination of patients with vertigo should include performing of the Hallpike's maneuver in order to differentiate between peripheral and central origin of symptoms [2].

Vertigo's Diagnostics

Taking into account different possible causes of vertigo (especially in older patients), making a correct diagnosis can be difficult. Data collected in the anamnesis will be used to perform the proper differential diagnostics (Table 1) [3].

Physical examination should include otoscopy and examination of the presence of nystagmus. We should also perform easy neurological examination known as cerebellar tests –the finger-to-nose test, the rapid alternating-movements tests for dystaxia and dysmetria (dysdiadochokinesia) and static and dynamic tests to assess the efficiency posture and gait (Romberg's test, Unterberger's stepping test). Trying Romberg's test, the patient stands with feet together and outstretched upper limbs. Then the patient is observed to become wobbly and possible direction of incidence is noticed. In Unterberger's test the patient is asked to walk on the spot with his eyes closed. If the patient rotates to one side he may have a vestibular dysfunction on that side, but this test should not be used to diagnose lesions without the support of the other tests.

Another test we should perform is a measurement of blood pressure and pulse in horizontal position, sitting and standing position (diagnostics of orthostatic hypotension).

In order to differentiate between peripheral and central vertigo Hallpike's maneuver should be performed. The examination is carried out by rapid movement of patient's body, when his head is in a "hanging" position that is 10 degrees deviation from vertical. This test induces vertigo or nystagmus in a person suffering from BPPV. Delay in the occurrence of vertigo and nystagmus (by 2-40 seconds), high intensity of the symptoms and rapid recovery after about 60 seconds point to the peripheral localization of the cause of vertigo. No delay in the occurrence of vertigo and nystagmus, mild intensity of the symptoms and their persistence of above 1 minute indicate the central disorders.

The diagnosis of central cause of vertigo is also supported by walking difficulties and the presence of other neurological deficits beyond balance disorders. Hypoacusis or tinnitus suggests peripheral cause of vertigo [4,5]. In such a case extended audiological diagnostics should be performed – pure tone and impedance audiometry,

otoacoustic emission and Brain Stem Evoked Response Audiometry (BERA). These tests allow finding the location of hearing impairment and helping in further differentiation (e.g. of acoustic neuroma).

The suspected presence of the acoustic neuroma must be confirmed by imaging examination-Magnetic Resonance Imaging (MRI). MRI is also the recommended method in diagnostics of nervovascular conflict, multiple sclerosis, changes of vascular origin, meninges and brain inflammation changes and in the evaluation of cervical spine pathology. Supposing middle/inner ear pathology (congenital, inflammatory, neoplastic and traumatic changes) – Computer Tomography (CT) of temporal bones is to consider.

Currently it is becoming easier to access to the otoneurological laboratories equipped for specialized tests such as Electronystagmography (ENG), Videonystagmography (VNG), static and dynamic posturography, Vestibular Myogenic Evoked Potentials (VEMP).

ENG is an objective study based on recording of eye movements (nystagmus) by the use of corneo-retinal potential measurement. It consists of 3 basic steps: oculomotor evaluation, positional testing, and caloric stimulation of the vestibular system. Comparison of the results of the following steps of the study helps to determine whether balance disorders are peripheral (vestibular) or central. For more detailed observation and analysis of these eye movements Video Nystagmography (VNG) is used, to observe nystagmus with a sensitive, active infrared video camera [6].

Posturography is an objective Romberg test. It evaluates the vestibulo-spinal reflex, by registration of the Center of Gravity (COG) of the body movements. The moving COG of the body is a reflection of compensatory, postural movements, performed in the standing posture. Static posturography is carried out by placing the patient in a standing posture on a fixed instrumented platform connected to sensitive detectors, which are able to detect the tiny oscillations of the body. Dynamic posturography differentiates from static posturography generally by using a special apparatus with a movable horizontal platform [6].

A new technique that allows assessing vestibulo-spinal reflex is to study the Vestibular Evoked Myogenic Potentials (VEMP). No response or prolonged latencies in VEMP indicate a failure in the reflex arc course. Incorrect record of VEMP is sometimes seen in Meniere's disease, acoustic neuroma, vestibular neuritis, ototoxic vestibule damage.

Cause of vertigo	Duration of symptoms	Hearing disorders	Central/peripheral vertigo
BPPV	Seconds	no	peripheral
vestibular neuritis	Days	no	peripheral
perilymph fistula, (PLF)	Seconds	yes	peripheral
Ménière's disease	Hours	yes	peripheral
Labyrinth concussion	Days	yes	peripheral
Labyrinthitis	Days	yes	peripheral
Acoustic neuroma	Months	yes	peripheral
Ischemic causes	seconds hours	not usually	peripheral or central, depending on the place of ischemia
Migraine	Hours	no	central
Cerebellum's damage/tumor	Months	no	central
Multiple sclerosis	Months	no	central

Table 1: Vertigo Diagnosis.

Vertigo Treatment

Pharmacotherapy

There is no ideal medicine in treatment of vertigo and dizziness. Pharmacotherapy can be divided into symptomatic and causal or into treatment of incidental and chronic vertigo. Symptomatic therapy should be applied only in cases of acute attack of vertigo accompanied by vegetative symptoms (vertigo shock phase) and the patient usually requires hospitalization. Neuroleptics, anxiolytics and antihistamines of the 1st generation are used, which act on the structures in the medulla, the hypothalamus and the limbic system for reducing neurovegetative symptoms (nausea, vomiting, heart palpitations, sweating, and anxiety). Neuroleptics include chlorpromazine (Fenactil 25-50 mg every 6 h them), promazine (50 mg every 6-8 h iv or im), thiethylperazine (Torecan 6.5 mg every 8 hours iv, im, sc or pr). These medicines are potent anxiolytic because of effect on the dopamine receptors (D2 receptor antagonists) in the limbic system, hypothalamus and cortex. In addition they work antiemetic and sedative. It is important to take into account the occurrence of adverse reactions of neuroleptics possibility, such as convulsions, dyskinesia, cardiac arrhythmias, and hypotension. Therefore, it is important to properly select the route of administration of the medicine and to carefully consider the need of its administration especially in the elderly [7-9].

Benzodiazepines are the most commonly used group of anxiolytics, including diazepam (Relanium, Valium - 15-20 mg in every 12 h), and rarely, in collaboration with the anesthesiologist, midazolam (Dormicum). Side effects, which should be remembered, are quick addiction possibility and memory disorders.

First-generation antihistamines have anticholinergic activity, blocking muscarinic receptors and inhibiting effect on the central nervous system. Among them, in the case of vestibular shock, promethazine (Diphergan 50 mg every 12 h iv or im) is used. In mild vertigo and motion sickness - dimenhydrinate (Aviomarin), hydroxyzine and clemastine can be taken [8,9].

In the symptomatic treatment of acute vertigo prokinetics like Metoclopramide (MTC) may be used, which also exerts Dopamine receptor (D2) blockade in the central nervous system and has a tranquilizing and antiemetic effect, inhibits nausea. Another antiemetic is ondansetron (Atossa), known as a remedy for vomiting during chemotherapy, which blocks serotonin receptors in the central nervous system and has no sedative effects.

Causal pharmacotherapy is used when there is a strong evidence of the vertigo etiology. We might dealing with such a situation in the case of the patient with vertigo diagnosed as otitis media complication or inner ear inflammation, where antibiotics are served.

The potentially causal treatment used in a long-term treatment of vertigo are following groups of medicines: cerebral vasodilators like: calcium antagonists (cinnarizine, flunarizine, nimodipine), derivatives of methylxanthines (pentoxifylline- Trental, Polfilin, Pentohehexal), derivatives of histamine (betahistine- Betaserc, Histigen, Polvertic, Lavistina, Vestibo), alpha-blockers (nicergolina-Sermion), antiplatelet medicines, extract of Ginkgo biloba, and also cytoprotective medicines, steroids and diuretics [8]. Large-scale studies proving the effectiveness of many of the above medicines in patients with vertigo and dizziness is still missing and they should not be routinely prescribed to these patients. Especially polytherapy should be avoided. Causal treatment, especially long-term pharmacotherapy should be individualized according to the patient.

Currently, an important role in the treatment of chronic vertigo has a relatively safe medicine of one of the best-documented efficacy- betahistine. Betahistine blocks presynaptic histamine H3 receptors and stimulates weak postsynaptic H1, but does not exhibit a significant affinity for H2. As a result, it increases the release of histamine in the nerve endings. It exerts relaxant effect on the precapillary sphincters in the inner ear microcirculation, which leads to improved stria vascularis blood flow of labyrinth. It inhibits the activity of vestibular neurons. Betahistine reduces the frequency and intensity of vertigo and tinnitus. It is approved for the treatment of Meniere disease. What more-it does not suppress the compensation process [10]. Some claim that the medicine accelerates the effectiveness of physiotherapy. The optimal therapeutic effects are visible only after a few months, so it is recommended to use for 2-3 months, 24 mg 2 times a day. Another advantage of betahistine is that it does not reduce patient's psychophysical activity. The only contraindication to the use betahistine is a pheochromocytoma. The medicine should be used with caution in patients with asthma, severe hypotension and peptic ulcer.

In case of TIA- antiplatelet therapy is recommended: acetylsalicylic acid (Aspirin, Acard, Polocard 75-150 mg/day), ticlopidine (Ticlo, Aclotin, Ifapidin 500 mg/day in 2 divided doses), or clopidogrel (Plavix, Areplex, Trombex 75 mg/ day). If a history of TIA will develop chronic vertebro-basilar circulatory disorders betahistine should be infused in dose 2x24 mg/day. Other medicines rarely used are cinnarizine and flunarizine. Also cytoprotective treatment is recommended in chronic vertebro-basilar insufficiency: piracetam (Memotropil, Nootropil, Lucetam) - derivative of γ -aminobutyric acid (GABA) in dose 3x800 mg/day for 8 weeks, trimetazidine (Metazydyna, Preductal, Cyto-Protectin), an extract of Ginkgo biloba (Bilobil, Ginkofar). Cytoprotective treatment affects energy metabolism in the cells of the CNS, increases oxygen and glucose utilization, facilitates the synthesis of high energy compounds, increases energy reserve, accelerates the synthesis of neurotransmitters increases metabolism in neurons of the CNS, especially in the states of reduced activity. These processes are responsible for improving the upper floors of CNS function, improve cognitive (learning, memory, attention, consciousness), the improvement of psychophysical activity. However, the cytoprotective medicines should be also prescribed reasonably. Piracetam taken in the evening makes it difficult to sleep. It can cause convulsions, hyperkinesia, weight gain, nervousness too. Trimetazidine can cause or worsen parkinsonian symptoms. Other common side effects of trimetazidine are abdominal pain, diarrhea, indigestion [8,9].

In presbyastasia - dizziness associated with older age, it is encouraged of the patient to walk with a cane, kinesiotherapy, and in some cases therapy of Ginkgo biloba extract and betahistine is recommended [9]. Another group of medicines used in patients with vertigo are steroids, used for example in vestibular neuritis, multiple sclerosis, and sometimes in Meniere's disease [6].

Ménière's Disease

Ménière's disease (endolymphatic hydrops of labyrinth) is characterized by vertigo, tinnitus, low frequency fluctuating hearing loss and feeling of fullness of the ear. In this disease imbalance between absorption and secretion of endolymph and its improper composition leads to increase in volume of endolymph and in consequence to distention of the membranous labyrinth. Treatment should lead to decreasing of the endolymph's pressure. Reduction of the vertigo symptoms can be achieved by implementing low salt diet (less than 1-2 grams of salt per 24 hours) and diuretics (e.g. hydrochlorothiazide 25-

50 mg daily or acetazolamide 500 mg daily). The effect of such treatment for hearing loss and tinnitus is significantly smaller [11,12]. Among all drug therapies used in Meniere's disease and other peripheral vestibular dysfunction, betahistine is the most frequently chosen in Europe. After 40 years of clinical use betahistine has proven effectiveness in Ménière's disease. A major clinical advantage of betahistine compared with many drugs employed in this field is its deprivation of sedative properties that it does not interfere with vestibular compensation. The important role of rehabilitation in treatment of this disease not be also failed to mention [10]. In the suspected immune background of Meniere's disease (bilateral symptoms) corticosteroids can be used (prednizone in oral dose of 1 mg/kg/day for 5-10 days) [8].

Migraine Associated Vertigo (MAV)

Epidemiological data show a significant association between vertigo and migraine. Well performed vertigo diagnosis plays a significant role because with appropriate treatment of migraine it resolves faster than after the application of other procedures [13,14]. Primary MAV treatment is carried out as treatment of migraine. There are three main aspects of migraine treatment: avoidance triggering factors, acute symptomatic control, and pharmacological prevention. Recommendations should include the change in eating habits, lifestyle, performing vestibular rehabilitation exercises and using pharmacological treatment. Changes in diet include reduction or elimination of aspartame, chocolate, caffeine and alcohol. Medications like triptans or ergotamine are more effective if used early in an attack. Frequent use of these medications may result in medication overuse headache, in which the headaches become more severe and more frequent. Pharmacotherapy used in prevention of migraine attacks includes: as first line- β -blockers: metoprolol (50-100 mg/day), flunarizine (5-10 mg/day), anticonvulsants: valproic acid (Depakine Chrono 500-800 mg 2 times a day) and topiramate (50-100 mg/day, starts from 12.5 mg), and as second-line-amitriptyline, venlafaxine, naproxen, bisoprolol [15].

In the treatment of vertigo that occurs between attacks of migraine pain and also in prophylaxis, it is advisable to use medicines of antivertiginosa group, e.g. betahistine or flunarizine in usual doses [9,16].

Physiological Vertigo

Motion sickness results from the different information that comes to the receptors of: the vestibule, vision and somatosensory receptors. Motion sickness occurs in some people travelling by different means of transport: by car, ship or plane when contradictory pieces of information are supplied to the central nervous system, sight organ, vegetative centers disrupting the feeling of motion. Symptomatic medications and appropriate training (habituation and adaptation) play the major role in the treatment [17].

Psychogenic Vertigo

Vertigo is often related with anxiety disorders, neuroses or depression. Treating such patients requires attention of a psychologist and a psychiatrist. What should be treated is the fundamental disease, excluding the peripheral genesis of the vertigo each time [18,19].

Exercises of Vestibular Rehabilitation

Physical exercises have been used in vertigo rehabilitation for over 60 years. Resolution of vertigo and balance disorders in case of vestibular organ's damage depends on the equalization of bioelectrical activity between the two vestibules – the compensation process. As a

result of vestibule's damage, there is a unilateral loss of impulse supply in the central nervous system or impulse distortion occurs. Compensation means inhibition of the excessive reactions of the unaffected vestibule and stimulating reactions on the side of the damaged one. Kinesitherapy by repetitive exercises leads to creating a new image of the vestibular situation in the central nervous system as a result of learning, gaining information and remembering. After stabilizing the patient in the acute phase of vertigo by pharmacotherapy, the treatment suppressing the function of vestibules should be reduced to allow faster habituation [20-22].

Benign Paroxysmal Positional Vertigo (BPPV)

This condition is not a symptom of incomplete vestibular compensation, but occurs as the result of the mechanical damage of the otolithic organ in the inner ear. Vertigo usually manifests itself while the patient turns his head, bows the head down or raises it up. Fragments of otoliths gather in the arc of the posterior semicircular canal. In certain head positions, by the force of gravity, deposits of those fragments move rapidly in the endolymph. This leads to hydrodynamic pull on the cupula, its deformation and results in vertigo. Pharmacological treatment in this case is not recommended. However, improvement can be achieved by turning the patient's head in a way allowing the movement of deposits through the non-cupular end of the vestibule.

Epley Maneuver

Patient's head is placed in Hallpike's standard position, with a slight tilt backwards and a 45 degrees turn. It causes the movement of otoliths' fragments in the canal and therefore relieves the patient of vertigo. The patient stays in this position for 3 minutes. After this time patient's head is rotated slowly by 90 degrees in the direction of the opposite ear, so it creates 45 degrees angle with the vertical plane. This causes that the deposits move into the non-cupular aperture of the canal. After another 3 minutes the head together with the trunk is rotated further to the unaffected ear, so that the face is directed to the floor at 135 degrees to the vertical plane. The deposits enter the canal's aperture. Patient returns to the sitting position. The deposits enter the vestibule [20]. The patient should remain in the sitting position for the next several hours to prevent another dislocation of the deposits. The presence of the carotid artery stenosis, active ischemic heart disease or limited mobility in the cervical spine are considered as a contraindication for this method [23]. Repositioning maneuvers are an effective method and easy in use. Efficacy of the Epley maneuver, according to the different sources, reaches from 50 to even 100% [24-26].

Surgical Treatment of Vertigo

Surgical treatment of vertigo can be divided into otosurgery, neurosurgery and angiography. Patients can require otosurgery treatment when pathology causing vertigo concerns in the inner or/and middle ear structures, including fistulas, otosclerosis, inflammatory, traumatic and proliferative changes and also in Meniere's disease. Management of tumors of the auditory nerve depends on the measurement of the tumor, the age and general condition of the patient. In elderly patients burdened with comorbidities with high operational risk, usually the method "wait and scan" is used. Stereotactic radiosurgery is chosen in the patients with tumors of more than 3 cm diameter. For smaller tumors microsurgery is considered to be safest method. Following operating accesses can be used: 1st-translabyrinthine - mainly used by otolaryngologists, 2nd-retrosigmoid (under occipital) - carried out mainly by neurosurgeons and used also to cut the vestibular nerve and vascular-nerve conflicts placed around

cerebellopontine angle, 3rd-by the middle cranial fossa in cases of small neuromas. These two last listed methods give the opportunity to save hearing [9].

Neurosurgical treatment is chosen in other lesions such as hematomas, tumors, vascular lesions, pathology of the cervical spine (cervical spondylopathy). Vascular surgery concerns in certain cases of carotid pathology [6]. Persistence of the Meniere's disease symptoms despite the use of the aforementioned pharmacotherapy is an indication for surgical treatment. Those are: transtympanic administration of drugs in the area of the round window (gentamicin, dexamethasone, lignocaine), fixing of the ventilation drain in the tympanic cavity for using pressure equalization system (Meniette Therapy- micropressure therapy), endolymphatic sac surgery (incision, decompression), creating an endolymphatic-perilymphatic fistula (PLF) or treatment causing damage of the vestibular organ surgically (selective vestibular neurectomy, labyrinthectomy) or chemically (aminoglycosides). Selection of an appropriate method depends mainly on the level of hearing loss [6,27].

Summary

Diagnostics and treatment of vertigo remains a challenge for many physicians. In this article reviewing the available literature guidelines about treatment of vertigo were described. It is important to remember about the possibilities of preventing attacks of vertigo in some patients. Rehabilitation should be recommended in most patients in both peripheral and central balance disorders. Important thing is a rational carefully planned pharmacotherapy, avoiding polypharmacy, individually adapted to the patient. An improvement in a patient with balance disorders after treatment does not release the doctor from determining the cause of symptoms. The need of interdisciplinary cooperation in difficult cases of balance disorders is underlined.

References

1. Tacikowska G., Kubiczek-Jagielska M. Schemat postepowania terapeutycznego w zawrotach glowy. Instytut Fizjologii i Patologii Sluchu, online: http://ifps.org.pl/doc/material_dydaktyka/tacikowska1.pdf, 2.02.2013
2. Swartz R, Longwell P (2005) Treatment of vertigo. *Am Fam Physician* 71: 1115-1122.
3. Hotson JR, Baloh RW (1998) Acute vestibular syndrome. *N Engl J Med* 339: 680-685.
4. Furman JM, Cass SP (1999) Benign paroxysmal positional vertigo. *N Engl J Med* 341: 1590-1596.
5. Greenberg DA, Aminoff MJ, Simon RP (2002) Disorders of equilibrium. *Clinical neurology*. (5th edn.) McGraw-Hill, New York, USA, pp-95-126.
6. Kubiczek-Jagielska M, Tacikowska G, Diagnosis and treatment of vertigo. Training materials designed for professionals involved in the diagnosis, treatment and rehabilitation of disorders of hearing, voice and speech. Institute of Physiology and Pathology of Hearing in 2002.
7. Prusinski A (2011) Klasyfikacja, obraz kliniczny i leczenie zawrotów glowy. *Polski Przegląd Neurologiczny* 7.
8. Pierchala K (2008) Farmakoterapia zawrotów glowy. *Magazyn Otorinolaryngologiczny*.
9. Narozy W, Prusinski A (2012) Leczenie zawrotów glowy i zaburzen równowagi. (1st edn.) Medical Education, Warszawa, pp: 67-74.
10. Lacour M, van de Heyning PH, Novotny M, Tighilet B (2007) Betahistine in the treatment of Ménière's disease. *Neuropsychiatr Dis Treat* 3: 429-440.
11. van Deelen GW, Huizing EH (1986) Use of a diuretic (Dyazide) in the treatment of Ménière's disease. A double-blind cross-over placebo-controlled study. *ORL J Otorhinolaryngol Relat Spec* 48: 287-292.
12. Santos PM, Hall RA, Snyder JM, Hughes LF, Dobie RA (1993) Diuretic and diet effect on Ménière's disease evaluated by the 1985 Committee on Hearing and Equilibrium guidelines. *Otolaryngol Head Neck Surg* 109: 680-689.
13. Johnson GD (1998) Medical management of migraine-related dizziness and vertigo. *Laryngoscope* 108: 1-28.
14. Rakel RE (1999) *Conn's Current therapy: latest approved methods of treatment for the practicing physician* (51st edn.) Saunders, Philadelphia, USA, pp-923-930.
15. Evers S, Afra J, Frese A, Goadsby PJ, Linde M, et al. (2009) EFNS guideline on the drug treatment of migraine--revised report of an EFNS task force. *Eur J Neurol* 16: 968-981.
16. Prusinski A (2001) Czynnosciove zawroty glowy. *Przew Lek*, pp: 76-80
17. Karlberg ML, Magnusson M (2011) Treatment of acute vestibular neuronitis with glucocorticoids. *Otol Neurotol* 32: 1140-1143.
18. Jacob RG, Furman JM, Durrant JD, Turner SM (1996) Panic, agoraphobia, and vestibular dysfunction. *Am J Psychiatry* 153: 503-512.
19. Staab JP, Ruckenstein MJ, Solomon D, Shepard NT (2002) Serotonin reuptake inhibitors for dizziness with psychiatric symptoms. *Arch Otolaryngol Head Neck Surg* 128: 554-560.
20. Pospiech L (1997) Praktyczne podejscie do rehabilitacji zawrotów glowy i zaburzen równowagi. Biblioteczka Prospera Meniere'a.
21. Yardley L, Beech S, Zander L, Evans T, Weinman J (1998) A randomized controlled trial of exercise therapy for dizziness and vertigo in primary care. *Br J Gen Pract* 48: 1136-1140.
22. Cohen HS, Kimball KT (2003) Increased independence and decreased vertigo after vestibular rehabilitation. *Otolaryngol Head Neck Surg* 128: 60-70.
23. Humphriss RL, Baguley DM, Sparkes V, Peerman SE, Moffat DA (2003) Contraindications to the Dix-Hallpike manoeuvre: a multidisciplinary review. *Int J Audiol* 42: 166-173.
24. Epley JM (1992) The canalith repositioning procedure: for treatment of benign paroxysmal positional vertigo. *Otolaryngol Head Neck Surg* 107: 399-404.
25. Lynn S, Pool A, Rose D, Brey R, Suman V (1995) Randomized trial of the canalith repositioning procedure. *Otolaryngol Head Neck Surg* 113: 712-720.
26. Froehling DA, Bowen JM, Mohr DN, Brey RH, Beatty CW, et al. (2000) The canalith repositioning procedure for the treatment of benign paroxysmal positional vertigo: a randomized controlled trial. *Mayo Clin Proc* 75: 695-700.
27. Blakley BW (2000) Update on intratympanic gentamicin for Meniere's disease. *Laryngoscope* 110: 236-240.