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Review Article

Clinical Screening of Dizziness in Vertebrobasillary Insufficiency (VBI) and Benign Paroxysmal Positional Vertigo (BPPV)

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ABSTRACT

Dizziness/Vertigo is a symptom having diverse causes. The diagnosis and treatment of patients with dizziness consist of screening examination to rule out pathologies before intervention of physical therapy management. Patients with dizziness have some common musculoskeletal findings. Holistic approach is needed to treat the cervical dysfunction as well as dizziness.

Key words- Dizziness, Vertebraobasillary insufficiency, Benign Paroxymal Positional Vertigo

INTRODUCTION

Dizziness is considered as an abnormal sensation that effects spatial perception and stability. Dizziness is a non specific term, patients complaints it as sensations of lightheadedness, imbalance, illusory feeling of movements or disorientation. [(1)] Historically based on symptoms quality, dizziness is categorized into one of four grades: vertigo (illusion of motion, often spinning), near syncope (feeling of impending faint), disequilibrium (loss of equilibrium when walking), and nonspecific dizziness [(2,3)] with vertigo being the most common (40-50%). [(4)]

Vertigo is described as a sensation of self spinning or of the surroundings results from an imbalance within the vestibular system, [(5)] although in panic disorders it can also be triggered .Pre-syncope is an condition where the symptoms of light-headedness occurs in episodic manner and can results from diffuse temporary cerebral ischemia. According to Sloane, [(3)] disequilibrium or imbalance can be due to abnormal movement of the legs and trunk without the involvement of any sensation inside the head. Dizziness can also be produced due to some psychological disturbances and also be one of the symptom in multiple diseases in older persons for example in cardiovascular dysfunctions, neurosensory, and psychiatric conditions. Dizziness can also occur as a side effect of multiple medications.

Ryan and Cope [(6)] used the term “cervical vertigo” first time and is defined as vertigo associated with neck disorders. Furman and Cass [(7)] described cervicogenic dizziness as a non-specific sensation which originates from abnormal afferent activity from the neck leads to disequilibrium and altered orientation in space. [(4, 8)] Thus the symptoms of imbalance and dizziness can

be associated with neck pain. [9] However, many patients of vertigo having cervical pain and tender muscles are diagnosed with vestibular disorders. Therefore before making the diagnosis, it is necessary to exclude vestibular disorders through detailed history, examination and vestibular function tests. [4] The various causes of cervicogenic dizziness are cervical trauma, cervical degenerative conditions, inflammatory or mechanical problems in the cervical spine [9, 10] being whiplash injury is a common traumatic problem of dizziness. It is estimated that 0.1% of the population will experience whiplash injury every year, with 12-40% having continual problems [11] where dizziness and unsteadiness are mostly experienced (40-70%). [12] Most commonly cervicogenic factors [13] and peripheral vestibular pathology [14,15] exist as the causes of dizziness.

Underlying mechanism for cervicogenic dizziness

To understand the underlying mechanism of cervicogenic dizziness, the proposed hypothesis is neurovascular hypothesis, the vascular hypothesis and the somatosensory input hypothesis. [4]

a) Neurovascular hypothesis *was described by* Jean-Alexander Barré in 1926 and by Yong-Choen Lieou in 1928. This hypothesis suggested that mechanical irritation or compression of the sympathetic plexus surrounding the vertebral arteries are due to degenerative changes or disease in the cervical spine which further results in vasoconstriction of these arteries. This give rise to ischemia and hence dizziness. But there is very minimal effect on the normal auto-regulation of cerebral blood flow. [16]

b) According to the vascular hypothesis, compression of the vertebral artery can cause episodic ischemia of the brain stem or inner ear leading to vertigo. [4] A rare vascular phenomenon named Bow hunter's syndrome can result from mechanical occlusion of vertebra basilar system. [17,18] The cause of this occlusion may be degenerative changes in the cervical spine [19] or an instability at the occipitocervical junction. [20] The compression of vertebral artery can also occur due to the scalenus anterior and the deep cervical fascia or by a hypertrophied ligament of the scalenus anterior and the longus colli muscle through which it passes. [21] According to Heikkila, [4] the main reason for vertebrobasilar insufficiency is arteriosclerotic vascular disease which further can lead to compromised cerebrovascular circulation and thus producing the symptoms like dizziness, vertigo, nystagmus, nausea, and loss of consciousness. [18,19]

c) Somatosensory hypothesis can include the cause of disturbed sensory input from the proprioceptors of the neck leading to a sensory mismatch between cervical, visual and vestibular inputs. [4,8] The proprioception receptors of neck which are densely present in the deep intervertebral muscles in the sub occipital region [22] interact with signals of the vestibular and visual system to stabilize the eyes, the head and posture. [4] Neck pain can lead to the changed firing characteristics of these cervical proprioceptive receptors and causes dizziness.

Causes of Dizziness

There are two main causes of vertigo/dizziness, one can be central and the other is peripheral. There are many conditions which are the part of central vertigo .these may include tumors of brain stem or cerebellum, multiple sclerosis, demyelinating disease, arterio venous malfunction. And many conditions Bppv, cervicogenic vertigo, labyrinthitis, meniere's syndrome, semicircular canals trauma or infection, semicircular canal dehiscence syndrome, are in the category of peripheral vertigo. [23] Vertebrobasilar insufficiency closely resembles BPPV in

terms of symptoms caused by cervical spine dysfunction in which the insufficiency is secondary to the osteophytic compression of vertebral artery. The symptoms due to VBI can be result from internal compression occurred in the cases of atherosclerosis and thromoembolism and also from external compression of cervical osteophytes, cervical fracture, dislocation, hypertonic muscle and from abnormal head posture. [(24)]

Clinical manifestation

Benign Paroxysmal Positional Vertigo (BPPV) is a clinical syndrome of peripheral vestibular system represented by recurrent, brief episodes of severe vertigo and rotary nystagmus triggered by specific positions of the head with respect to gravity. [(25)] It is assumed that that BPPV is caused by the movement of free floating small crystals of calcium carbonate called "canaliths" localized in the semicircular canals (commonly the posterior semicircular canal) that create the sensation of vertigo through an asymmetrical activation of vestibular hair cells. [(26)] During changing the position of their head rapidly, intense rotatory vertigo lasting for seconds occurs. It can be associated with episodes of nystagmus, nausea but no hearing loss or tinnitus. [(27)] In recurrent cases, attacks are episodic and often occur in clusters over a period of weeks with remissions of months or years. [(28)] But in VBI, the symptoms might results from degenerative cervical spine changes [(29)] and cervical manipulation [(30)] and the symptoms can be vertigo, unbalance, cloudy eyesight, loss of hearing, tinnitus, headache, nausea and vomiting. [(31-33)] In this condition, there is recurrent symptomatic ischemia in the region supplied by the posterior circulation formed by vertebral arteries. [(34)] The symptomology is divided into non-ischemic (local, somatic cause) and ischemic symptoms(hind brain ischemia). There is only ipsilateral posterior neck pain and occipital headache in case of non ischemic. [(35)] One of the most common symptom of VBI is dizziness [(36)] which occurs as an effect of neck rotation and does not improve with repeated movement as seen in case of BPPV where there are seen reduction of vertigo with repeated neck turning. According to Lee& Kim, [(37)] there are four types of BPPV, Posterior semicircular canal BPPV, Horizontal semicircular canal BPPV, Anterior semicircular canal BPPV & Mixed canal type. The main two causes for BPPV are one in which detached otolith debris could be either attached to the cupula (cupulolithiasis) or second it may be free-floating in the semicircular canals (canalithiasis). Pathological studies have shown that both of these conditions exist.

Diagnostic testing

The vertebral artery test (VAT) is the most common test which determines tolerance to cervical extension and rotation prior to manipulation or to differentiate between dizziness caused by VBI from dizziness caused by other conditions, such as benign paroxysmal positional vertigo (BPPV), an inner ear pathology where Hallpike-Dix test is performed first. In the Hallpike-Dix test and Vertebral artery test, the end position of the patient is similar and also both conditions produce dizziness, therefore differential diagnosis is necessary. So a modified VAT (mVAT) has been used to assist in the differential diagnostic process of dizzy patients and is performed in sitting. [(38)] The VAT movements of coupled rotation and extension of the cervical spine can affect blood flow velocities through the vertebral artery. [(39)] The vertigo in BPPV is provoked by change of head position called as positioning vertigo as compared to the vertigo of VBI where the vertigo is due to maintaining a head posture in a particular position known as positional vertigo. [(40)] The onset of symptoms reported early in VBI lasting upto 40-50 seconds while in bppv the onset is immediate. Moreover the symptoms increases in intensity with the maintenance of head position while in BPPV there is decrease in symptoms within seconds. [(41)] BPPV, which is thought to be due to the

presence of free floating otoliths in the endolymph -stimulating fibers of the posterior semicircular canal, usually does not require imaging studies. A variety of tests have been used for determining the effect of spinal motion on vertebral artery patency. In George's test, bilateral blood pressure, pulse rates are measured and auscultate the subclavian and carotid arteries are auscultated with rotation of head right and left rotation and then in lateral side bending and the last in extension of neck in seated position (Maigne's test) and in the supine position also (DeKleijn's test). Signs of nausea,tinnitus, vertigo, light headaches, slurring of speech, dizziness or nystagmus may indicate vascular compromise or stenosis of the carotid or vertebral arteries. [(42)] A diagnosis of BPPV can be made by correlating historical data and clinical findings. [(43,44)] Patients typically complain of episodes of severe dizziness of sudden onset, precipitated by changes in head position, lasting less than a minute. Attacks may be provoked by lying down or rising out of, bed, rolling over, suddenly turning the head to one side, bending forward and straightening up, or by throwing the head back and to one side as when reaching for something on a shelf. Nausea and vomiting rarely accompany the attacks. [(45)] There is another clinical test called "dizziness test" which distinguishes between the vertebral artery and the semicircular canals of the inner ear. In this test, the patient seated with the shoulders stabilized, now the patient rotate neck actively to left and right to the end range. Next, the head is stabilized in neutral by the examiner and the shoulders are actively rotated as far right and left as possible. If the patient experiences dizziness in both cases, the vertebral arteries may be involved. If dizziness is experience only when the head is rotated, the semicircular canals are probably involved. [(46)] Various techniques like MRA (magnetic resonance angiography), EMF (electromagnetic flow meter) and CDU (color Doppler Ultrasound) are used for the diagnosis of hemo-dynamic status in vertebrobasillary artery system. Currently Color Doppler ultrasonography is the first choice in the examination because it is easy to apply, noninvasive and cheap. [(32)] Doppler sonography is a accepted valid and reliable tool for the evaluate of extracranial vessels and used to assess physiological alteration in blood flow. Mann and Refshauge [(47)] showed decrease in vertebral blood flow with neck rotation and also concluded that manual therapy affects the neck positioning hence the blood flow.

Manual Therapy

Firstly it is essential to distinguish the side effect and adverse effect of manual therapy in vertigo patients associated with VBI and BPPV. Paroxysmal positional vertigo is a self-limiting disorder and therefore considered benign. [(48,49)] Spontaneous recovery can be expected within weeks to months. [(48)] In 20-30% of patients, BPPV persists or recurs for years when untreated. [(49,50)] The position of cervical rotation places tension on the vertebral artery and causes relatively high proportion of injuries. Coulter 1998 recommended that cervical thrust rotation procedure is abandoned to avoid the injuries of vertebral arteries. A study by Haynes (2002) indicated that cervical rotation produced more mechanical stress on the vertebral artery than cervical lateral flexion. The results coincide with the results of various cadaver studies which also demonstrated that head rotation causes narrowing of the contralateral vertebral artery at the C1-C2 level. [(51)] Alternate to the rotatory manipulation, Krauss [(52)] have described translatoric spinal manipulation (TSM) techniques which does not affect the vertebral artery because these manipulations are small amplitude using straight line impulse parallel or perpendicular to the facet joints of vertebral motion segment. Thus the manual therapy along with vestibular rehabilitation has a great effect in improving the patients symptoms. [(7)] Karlberg [(53)] and Reid [(54)] also concluded in the same way that physiotherapy has an effective role in treating the vertigo and

cervicogenic dizziness symptoms. In BPPV, particle repositioning manoeuvre (PRM) based on anatomy of inner ear and pathophysiology of the BPPV has an effect on symptoms and the overall response rates are from 30% to 100%. A study conducted by Steenerson and Cronin [(55)] compared 20 BPPV patients between particle repositioning maneuver intervention with no treatment and found after 3 months that all patients relieved from symptoms after PRM as compared with no treatment group where only 25% of patients got relieved with the symptoms. The symptoms of dizziness arise from upper cervical spine require focused treatment at cervical region. Numerous manual therapy treatment including cervical mobilization, range of motion exercises, strengthening exercises, proprioceptive exercises, soft tissue mobilization and therapeutic agents are effective in improving the cervical mobility and reducing the pain due to joint restriction, muscle tightness, trigger points, increased muscle tone, poor cervical posture and impaired cervical kinesthesia. O'Leary [(56)] highlighted the relationship of pain intensity and superficial muscle activity in mechanical neck pain thus the role manual therapy comes where the manual therapy intervention affects the cervical motor control and also has impact on pain. A study done by Sterling [(57)] showed that mobilization at the level of C5/C6 decrease the activity of superficial neck muscle and facilitates the deep neck flexors which control the cranio-cervical region.

So, vertigo is symptoms and not a disease thus understanding the diagnosis on the basis of presentation of symptoms, effective management can be incorporated. The need is to distinguish between the various causes of dizziness and manage accordingly.

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