



Opinion

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Unmasked Vertigo

Marco Poloni^{1*} and Poloni Nicola²¹Department of Neurology, Mario Negri IRCCS, Milan, Italy²Department of Neurology, University of Insubria, Varese, Italy***Corresponding author:** Marco Poloni, Department of Neurology, Mario Negri IRCCS, Milan, Italy.**Received Date:** November 16, 2018**Published Date:** November 30, 2018

Opinion

Vertigo is a very unpleasant symptom for the patient and a complex clinical problem for the neurologist. First of all: a clear definition is needed, useful for both patients and clinicians and this doesn't seem a problem but, in my professional life I haven't yet found a satisfactory definition: I think that the following is clear and comprehensive: Vertigo is a distorted perception of the position or movement of head in the space. It may be accompanied by nausea, vomiting and by other vegetative symptoms; other signs may be nystagmus and postural deviations with falls. First of all, we must have complete knowledge of the structures which give a contribution to our perception of the position and shift of our head in the surrounding space. These are: 1) The vestibular receptors, 2) The sight, 3) The proprioceptive sensations conveyed by Goll and Burdach tracts in the posterior spinal cord, 4) The cerebellar afferents carrying unconscious information, 5) in a subsidiary way the exteroceptive sensitive system. Vestibular receptor is a very sophisticated structure devoted to monitor both the position of the head and its movement in the space: it fulfils this job through the osseous-membranous labyrinth positioned at skull base in the petrous bone and oriented according to the 3 main plans of the space, sagittal, coronal and horizontal; the apparatus is complex, with osseous and membranous components; the last, surrounded by perilymphe and filled with endolymphatic fluid, contains utriculus and sacculus and semicircular channels with a larger extremity (ampulla); the epithelium is organized with maculas and cristae provided with hairy cells, disposed in such a way to be sensible to the position or shift of the head in every direction; utriculus and sacculus are linear acceleration and position receptors, while the semicircular channels are specifically sensible to rotation.

Labyrinth is able to monitor any movement but, is excited also from convective movements of the fluids due to temperature variation and to the modification of density; this characteristic is useful to assess the brain stem function in coma (caloric test of Barany). In steady conditions vestibular signals are symmetrical, but when one side gets hyperactive it shifts the body and the gaze toward the opposite side and vice versa; note that warm tend

to excite the receptor while cold inhibits it; vertigo appears with nystagmus and nausea; the stimuli are conveyed to four brain stem nuclei and toward spinal cord motor system, the cerebellum, the reticular formation and the oculomotor nuclei; the afferent volley governs nystagmus, (slow beat) with vigil subjects or gaze tonic deviations with coma, to the opposite side with warm water and to the same side with cold one. The sight is much important in the origin of nystagmus as far as the fixation reflex is powerful and able to interfere with the ocular shift by driving the eyes in the primary position (fast beat); besides, vision gets direct control of all movements of the parts of the body. The proprioceptive sensory system gets the nervous system constantly informed on the position of each body segment in the space through receptor in the muscles, tendons and joints; the receptors in the vertebral column, above all at cervical level, are of maximal importance; the sensory exteroceptive sensitive system may give a contribution due to the contact with dress, shoes, ground or sand when we walk on a beach.

The pathways to the cerebellum are very important but unconscious. It is obvious that all these structures involve large segments of our body at different levels with strict relationships with connective tissue, osteo-articular apparatus, blood supply and so on; they can be involved with various pathological alterations. When sight, vestibular receptors, proprioceptive system and cerebellum give a concordant information to the nervous system everything goes on well and the subject feels well balanced, but when the information along the channels is different, something wrong happens, and we feel unhappy and have a sensation of unbalance and dizziness. Let us take some examples: 1) If we are looking to a large object engaging to a wide extent our visual field when it moves, we feel uncertain if what is moving is the object or ourselves, and we feel unstable; we are steady, but the sight give a movement information; 2) When we are carried by a car or by train or plane we are moving, and our vestibular system is stimulated, but our sight and our proprioception give information of absence of movement, above all if we are reading or concentrated on a particular job; we begin to suffer motion sickness and feel nausea and vomiting; 3) If you go to ski in a bad weather day with fog, cloudy

sky and snow, you really don't have any reference and everything around you is white and you lose completely the orientation in the space and falls very badly with nausea and vomiting; in these situations, it is necessary to concentrate on proprioception and seek the aid of exteroceptive stimuli to gain information.

We are lucky that vestibular receptor is very sensible but fortunately has the characteristics of being plastic and adaptable too: the correct name of this propriety is habituation; on a ship we can suffer by sea-sickness, but we can adapt with time, but when we return to ground we can suffer again of ground-sickness, at least until the vestibulum doesn't adapt to the new condition. These are just few examples of what we can call physiological vertigo, or pseudo-vertigo, simply due to a variant information through the different afferents responsible to integrate our steadiness in the space in normal situations. There are, also, examples of habituation and training: certain boys have fun revolving on themselves until they fall; the Darvish dancers revolve giddy for 10-20 min or more during their exhibitions; who practices the circular bound flight is used to flight in this way an aero model. Now, if you put attention to the different and very intricate modalities through which the pertinent information reaches our brain you can even find the key to solve the problem of your patient: something went wrong in vestibular apparatus and the pattern of stimuli became discordant between the two sides? It has been responsible a viral infection (labyrinthitis)?, an edema of endolymph (Meniere syndrome)?, a variation of the osmotic pressure of endolymph (Alcohol vertigo)?, a different constitution of perilymph respect to endolymph (hypertonic fluid injections)? or the formation of microcalcification (otoconia) inside the semicircular channels which transforms a receptor of movement in a gravity receptor?, or is simply a sudden variation in temperature which moves the fluid inside the channel due to convective motions? Alternatively, the origin may be toxic, due to drug or a substance. Moreover, the possibility exists that vertigo might be part of a hemispheric crisis or of a seizure. In other conditions vestibular components became the target of an immunologic attack as in Cogan's syndrome or in Susac's syndrome. Or, perhaps, the problem is linked to the vascular supply to the receptor through the labyrinthine artery, the final territory of the vertebrobasilar circulation or may be that the problem is related to the vestibular nerve which may be compressed by a

vascular loop in the cerebellum-pontine angle or may be the site of a tumor growth as happens with schwannomas in Neurofibromatosis (NF2); a disease of brain-stem or cerebellum coming from trauma, tumor, demyelination or stroke has to be ruled out. It is clear that the possibilities related to a pathological condition are really numerous. I want just to recall a couple of strange and unexpected causes of vertigo which I had the chance to observe: one was a colleague who felt dizziness in the morning at the beginning of own work; no information was gained by careful history and objective examination, until he remembered that had changed the lenses of the spectacles! The sight was probably the origin of his problem. Another patient felt dizzy when he exceeded the speed of 100 Km/h on the highway towards Milan; here, I was uncertain if the problem was sight related due to the rapid change of images or if it was psychogenic and fear connected; another particular case was a retired man who had a mastoid fistula rear to the right ear; he felt vertigo when he had a dive or a dip in the sea: here the problem was most probably linked to a vestibular stimulus induced by a sudden drop of temperature near the semicircular channels with consequent convective motion of the endolymphatic fluid; It was like a real life Barany Test! Last case was that of a lady who was always disturbed by sensations of instability and unsteadiness; she was found affected by familial hemochromatosis and that was the origin of derangement of labyrinthine function. Finally, it is right to remember the psychogenic causes of unsteadiness and vertigo, from the panic attacks of phobic-obsessive neuroses to the somatic disturbances of patients affected by different forms of anxiety, depression and unhappiness. Particular and separate discussion deserves the post-traumatic disorders with their medico-forensic implications.

The neurologist involved in the diagnosis of vertigo seems really like an investigator who looks into a disciplined crowd for the killer and follows the clues like a hound.

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None.

Conflict of Interest

No conflict of Interest.