

# VIBRATION DISEASE, ETIOLOGY, TYPES, CLINIC, DIAGNOSTIC METHODS, TREATMENT

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## Abstract

Vibration disease has an occupational character. It develops in workers of manual mechanized labor associated with the use of tools of percussive or rotational nature. Most often vibration disease is found among workers in mining, construction, metallurgy, ship and aircraft construction, transportation industries, as well as in agriculture. The professions that are in the risk group for the development of vibration disease include: drillers, polishers, stone cutters, grinders, asphalt pavers, stump cutters, streetcar drivers and others. Clinical symptoms of vibration disease depend on the frequency of vibration, its nature (general or local) and accompanying factors (noise, forced body position, cooling, etc.).

**Keywords:** General vibration, local vibration, capellaroscopy, polyneuropathy, angiodystonia, poleesthesia, rheovasography, tomography.

## Introduction

Vibration disease (Vibration Syndrome) is an occupational disease that develops after 3-7 years of work in conditions of vibration exceeding the maximum permissible level (MPL). MPL is such a level of harmful factor, which, when exposed not more than 40 hours per week (daily, except weekends), does not lead to diseases. The term "vibration disease" was proposed in 1955 by a Soviet hygienist, Professor Evgenia Andreeva-Galanina. She described in detail various symptoms of the disease and peculiarities of its course. In the disease, first of all, peripheral vessels, nervous and skeletal-muscular system are damaged. There are aching, breaking and pulling pains in the hands, white skin on the fingers, numb and freezing hands. Vibration is mechanical vibrations of machines and mechanisms. Vibrations with a frequency of 3 to 30 Hz are most harmful to people.

## Epidemiology and risk factors

In 2019 in Russia, the disease was detected in 42.7% of patients with occupational pathologies [1,2]. The remaining cases come from musculoskeletal diseases and occupational hearing loss. Vibration disease has become more frequent in recent years, and hearing loss, on the contrary, less frequent. Construction workers, transportation and reinforced concrete workers, as well as workers in the mining, logging and textile industries are mainly affected by vibration [2,4].



### **Etiology**

Sources of localized vibration are mechanized hand tools (with motors), machine and equipment controls, non-mechanized hand tools (without motors), fixtures and machined parts or products held by the worker. Types of industries associated with exposure to general vibration. Sources of general vibration, depending on the category, are transportation vehicles, transportation-technological and technological equipment. Types of industries associated with local vibration. In production conditions there is often a simultaneous impact of local (local) and general vibration, which earlier in our country was considered as combined vibration.

### **Symptoms of vibration sickness from localized vibration**

Vibration sickness from localized vibration is observed mainly in workers who deal with hand tools. It is manifested by pulling, aching pains in the extremities, which occur during rest period and at night. Characteristic is the disappearance of pain in the hands in 10-15 minutes from the beginning of work with vibrating tools. Vibration disease from local vibration is accompanied by paresthesias, which accompany the pain syndrome and can be expressed in the feeling of crawling goosebumps on the skin, tingling or numbness. There is increased chilliness of the hands or feet, attack-like whitening of the fingers, especially in cold weather or in contact with cold water. In cutters, stumpers and workers in similar occupations, whitening of the fingers is observed on the left hand, and in sandpaper workers, polishers, etc., on the fingers of both hands. - on the fingers of both hands.

One of the leading vascular disorders in the clinic of vibration disease. They are manifested by angiodystonic syndrome, peripheral angiospasm, hemodynamic disorders in the form of changes in systolic and minute volume of blood circulation, fall or rise in blood pressure, disturbance of vascular tone and peripheral resistance. Often vibration disease runs with the clinic of neurocirculatory dystonia. In some cases, patients have latent hyperhidrosis. Another leading syndrome that characterizes vibration disease from local vibration is polyneuropathy. In the early stages of the disease, it can manifest itself in the form of increased sensitivity (hyperesthesia), then in the form of its decrease (hypoesthesia). And depending on the degree of vibration disease severity, sensitivity disorders affect only fingers or spread further to hands or feet by the type of "gloves" and "shin guards". They are accompanied by trophic disorders in the form of hyperkeratosis, thickening and deformation of nails, less often - atrophy of small muscles of the hand. In addition to local symptoms, vibration disease from local vibration is accompanied by general malaise, increased irritability, sleep disturbance, dizziness, diffuse headache. Possible cardiac pain, tachycardia, pain in the epigastrium. Functional disorders of central nervous system, with which vibration disease occurs, are manifested mainly by asthenia, neurasthenia and vegeto-vascular dystonia. Cerebral angiospasm may be noted. In case of combined effect of vibration and noise, cochlear neuritis develops, leading to some degree of hearing loss.

### **Symptoms of vibration sickness from general vibration**

Vibration disease from general vibration develops in drivers, as well as in those working on various machinery. As a rule, the onset of the disease falls on the 5th-7th year of such labor activity. Vibration disease from general vibration is characterized by gradual onset with nonspecific vegeto-



vascular disorders of cerebral and peripheral character. Short-term headaches, increased sweating, pain in extremities are observed. In the initial period angiodystonic syndrome and sensory type of polyneuropathy of lower extremities are observed. Already in the early stages of vibration disease there are disturbances in the CNS. They are manifested by increased irritability, sleep disturbance, fatigue and general malaise. Dizziness, eyelid tremor, trembling of fingers of outstretched hands, sometimes - anisoreflexia (difference in tendon reflexes on the right and left sides) may be noted. Vibration disease from general vibration is characterized by predominance of vegetative-vestibular syndrome manifested by nausea, motion sickness and non-systemic dizziness. Vibration disease of moderate degree is often characterized by a combination of polyneuropathy of vegetative-sensory type with polyradicular syndrome. In severe vibration disease polyneuropathy has sensorimotor character and is accompanied by dyscirculatory encephalopathy, less often by diencephalic disorders. In some cases vibration disease is accompanied by dyscirculatory encephalopathy, less often by diencephalic disorders. In some cases vibration disease is accompanied by disorder of secretory and motor function of the stomach, disturbance in the digestive glands. In women vibration disease from general vibration can occur with menstrual disorders in the form of menorrhagia and algomenorrhea, exacerbation of existing inflammatory diseases, colpitis, endometritis, salpingo-oophoritis).

### **Diagnosis of vibration sickness**

Vibration disease is diagnosed by the joint efforts of a neurologist and a therapist. Often additional consultations are required cardiologist, vascular surgeon, gastroenterologist, otolaryngologist. When examining pay attention to the color of the skin of the distal limbs, carefully study vibration and pain sensitivity, analyze the state of the muscular, bone and joint apparatus and cardiovascular system. Thermography, electromyography, electrocardiography, capillaroscopy are used. Conduct a cold test, which consists of immersing the hands in cold water. In case of whitening of the fingers, the test is considered positive, and the delay in the recovery of skin temperature more than 20 min indicates abnormalities in the regulation of vascular tone and a tendency to angiospasm.

When indicated in vibration disease, examination of GI organs is performed: gastric probing, gastroscopy, liver ultrasound, as well as hearing examination: audiometry, threshold audiometry, electrocochleography, acoustic impedanceometry. Due to the variety of clinical manifestations, vibration disease has to be differentiated with many other diseases. For example, with vegetative polyneuropathy, Raynaud's disease, polymyositis, syringomyelia, neuritis, radiculitis. In the presence of diencephalic disorders it is necessary to exclude infectious lesions of the CNS: encephalitis, neurosyphilis, Creutzfeldt-Jakob disease and others.

### **Treatment of vibration sickness**

It is important to start therapy of vibration disease as early as possible. The fundamental point is to eliminate the impact of vibration on the body. In addition, patients with vibration disease should avoid hypothermia and excessive physical exertion. Selection of therapy is carried out on an individual basis depending on the dominant symptoms.



If vibration disease is accompanied by neurosensory disorders, combined treatment with ganglioblockers (diphenyltropin, pachycarpine, hexamethonium), vasodilators (drotaverine, nicotinic acid, vinpocetine) and central cholinolytics (benactizine, chlorpromazine) is used. Pentoxifylline is indicated to improve microcirculation. If the vibration disease runs with vegetative paroxysms, pirroxan is recommended. If asthenoneurotic syndrome in the treatment of vibration disease include sedatives and biogenic stimulants (glutamic acid, aloe). If vibration disease is accompanied by cardiovascular syndrome, papaverine, bendazole and other cardiovascular drugs are recommended.

The complex treatment of vibration disease includes general strengthening therapy: administration of 40% glucose, calcium gluconate, B vitamins (B1, B6, B12). A good effect gives physiotherapeutic treatment: electrophoresis of novocaine and benzohexonium on the collar zone or hands, UHF, reflexology. Massage and hydroprocedures are carried out: hand and foot baths, 4-chamber bath, general baths (hydrogen sulfide, radon, nitrogen, oxygen).

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