

DISORDERS DUE TO VIBRATION



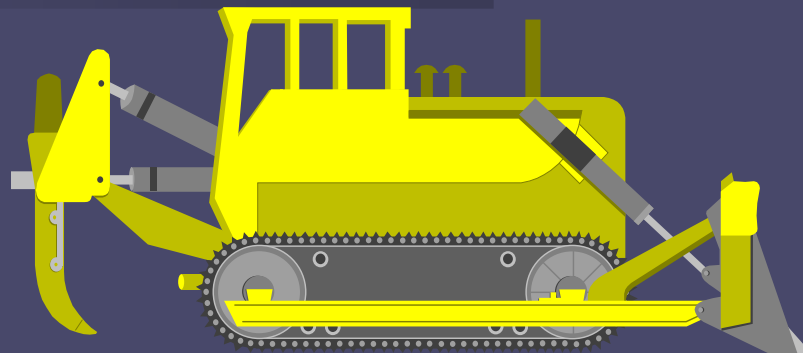
Individuals are exposed:

- to whole-body vibrations and
- local (segmental) vibrations at the tool-body interface in tool users.

Whole-body vibration

occurs in a variety of work settings, including work on ships and oil rigs, piloting helicopters, driving heavy equipment (including trucks, buses, farm equipment), etc.

- Adverse health effects include physical discomfort and motion sickness.
- Additional effects are difficult to quantify because of confounding exposures, but probably include an excess of low back disorders, including disc disease.



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Segmental vibration

- In the field of construction, forestry, foundry work, machining, and mining a large number of vibrating tools and equipment have been found to raise the risk of developing a symptom complex known as *the hand - arm vibration syndrome (HAVS)*.
- The symptoms comprise disorders of
 - (1) the circulation,
 - (2) the peripheral nerves, and
 - (3) the muscles, bones and joints of the hands and arms.

- Vacuoles, cysts, and the decalcification' of carpal bones have also been reported.
- The most prominent symptom of HAVS is periodic ischemic attacks affecting the fingers, known as vibration - induced white finger (VWF), which seems to be brought on by cold.
- The health hazards are related to the characteristics and severity of the vibration, the total vibration exposure time, and duration.



- Vibration magnitude is measured as
 - acceleration ($m.s^{-2}$),
 - vibration frequency (Hz),
 - amplitude (m),
 - direction of application with respect to an anatomic axis,
 - and whether the stimulus is continuous or interrupted.
- Tingling and numbness of the fingers characterize the HAVS in the initial stages.
- Subsequently, blanching of the fingers occurs on exposure to cold.

- **Whitefinger disease** is characterized by spasm of the digital arteries (*Raynaud's phenomenon*).



- Attacks of vasospasm can last for minutes to hours.
- With increasing intensity and duration of exposure the episodes occur more frequently, and the blanching may progress to the base of all fingers.

- Cyanosis secondary to sluggish blood flow is less common, and trophic changes are even more rare.

Raynaud's phenomenon

is a predominant symptom of the syndrome,

- impairment of sensory perception and tactile discrimination,
- a demyelinating peripheral neuropathy of the median and ulnar nerves,
- and reduction in muscle strength may also be present.

- Changes in the musculo-skeletal system of the hand, wrist, and forearm have been difficult to quantify with respect to callus formation, bone changes, muscle fatigue, grip force, and elbow joint damage.
- It has been postulated that bone cysts and vacuoles in the hands and wrists bones, and pseudoarthrosis of the scaphoid are due to vibration.
- All components need to be assessed fully in the evaluation of impairment.

The diagnosis of VWF

- is based on the occupational history of vibration exposures,
- the association of these exposures with episodes of Raynaud's phenomenon, and
- the exclusion of idiopathic Raynaud's disease and
- other causes of Raynaud's phenomenon, including trauma of the fingers and hand, frostbite, occlusive vascular disease, and neurogenic disorders.

The patient should be questioned

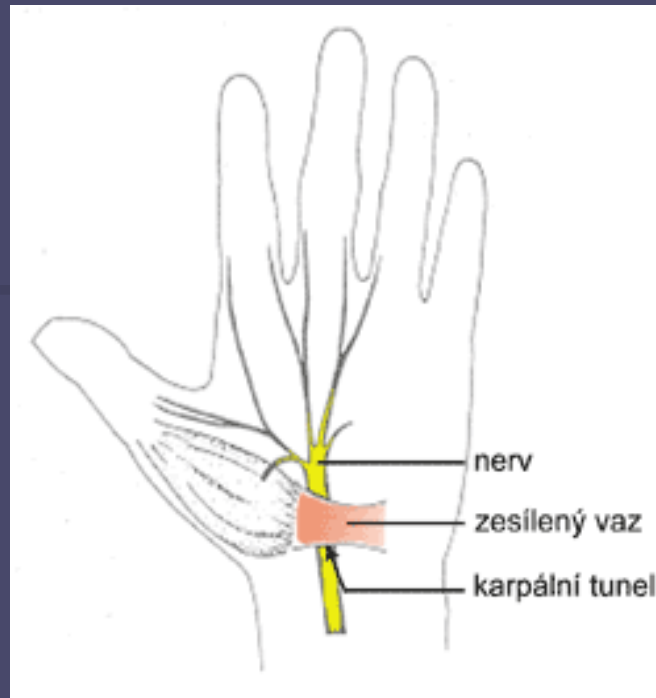
- about family history,
 - drugs taking,
 - and occupation - especially handling ice and the use of vibratory tools.
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- In addition, a history of arthralgia, dysphagia, or xerostomia should be sought as these suggest an underlying collagen disorder.
 - Physical examination should include careful assessment of upper limb pulses by both palpation and auscultation.

- The latter should be done over both the supraclavicular fossas and the deltopectoral triangle.
- These results, together with the measurements of blood pressure in both upper limbs, may show an anatomical distortion of the axillary or subclavian arteries.

There is no one specific diagnostic test,
but tests of peripheral

- vascular function (such as plethysmography),
- cold provocation tests,
- skin thermography,
- neurologic function (sensory and motor nerve conduction velocities - EMG),
- and radiographic investigation may be helpful in defining the extent of pathology.

- If the screening tests for carpal tunnel
 - **Phalen** (wrist flexion) and/or
 - **Tinel** (tunnel percussioin) - are positive, nerve conduction velocity tests will be required for the median and ulnar nerves.



Prevention of HAVS

- requires engineering controls, medical surveillance, special work practices, and personal protective equipment.
- Early diagnosis with ongoing medical surveillance will reduce the sequelae.
- Engineering controls include modification of production lines to eliminate the need to use vibrating hand tools and design of equipment with lower vibration levels.

Work practice controls include:

- proper maintenance of equipment,
- frequent rest periods,
- wearing adequate clothing and gloves to keep the body and hands warm,
- and learning to grasp the tool as lightly as possible while still maintaining control of it.

Treatment

- VWFs` are usually easily reversible
 - if identified early and
 - if the individual is removed from vibration exposure.
- In advanced stages, the disorder is progressive.
- General advice is of paramount importance, stop smoking and avoid cold.
- Electrically heated gloves have been of great benefit to some patients.
- For patients with moderate or severe symptoms drugs may be needed.



Thank you for your attention!