

Hand-arm vibration syndrome

Synonyms: HAVS, vibration white finger, VWF

What is hand-arm vibration syndrome?

Prolonged exposure to hand-arm vibration may cause a potentially disabling chronic disorder of the upper limbs, which is called the hand-arm vibration syndrome (HAVS). As well as vascular and neurological injury, HAVS may also involve damage to bones, joints, muscles and tendons in the upper limbs. There may also be damage to the motor nerves innervating the hand muscles. HAVS is therefore a significant health risk for many occupations, especially in temperate climates.^[1]

As a general rule, if caught early and effective action taken to prevent further insult, recovery will occur; however, it may not in advanced cases.

How common is hand-arm vibration syndrome? (Epidemiology)^[2]

HAVS is potentially very serious and disabling. In the UK, the incidence was 113 new cases in 1993/4 and 1009 cases in 2001/2.^[3] The prevalence among exposed workers is estimated to be 50%.^[4]

The development of HAVS depends on several factors, including the intensity and duration of exposure, the type of processes involved and the tools used, as well as genetic and ergonomic factors.^[5]

Symptoms and signs of HAVS may occur even after a short duration of vibration exposure.^[6] ^[7]

Tools most likely to create a risk include chainsaws, grinders, impact drills, scaling hammers, mowers, floor saws, floor polishers, powered hammers (for chipping, demolition, road breaking, etc), sanders and polishers and hand-held saws used for concrete, metal, ground clearance, etc. Jobs involving regular and frequent exposure to vibration are found in a wide range of industries, including:

- Construction and civil work.
- Engineering.
- Forestry.
- Foundries.
- Motor vehicle manufacture and repair.
- Maintenance of parks, gardens, verges, grounds, etc.
- Shipbuilding and ship repair.
- Utilities (eg, gas, water, telecommunications).

Risk factors

The essential risk factor is the use of vibrating tools. Other risk factors are said to be beta-blockers, cigarette smoking and exposure to cold. The evidence with regard to smoking may be inconclusive but smoking is known to have an adverse effect on circulation. Vascular features are more common in a cold and damp climate.

Hand-arm vibration syndrome symptoms (presentation) ^[4] ^[8]

The main features are neurological and vascular.

- **Neurological features** - responsible for the subjective numbness, tingling and pain and the neurological signs of sensory deficits, especially to fine touch discrimination and temperature. There is also reduced manual dexterity and muscle weakness with impaired strength of grip.

- **Vascular features** are blanching of the fingers, especially after exposure to cold and with delayed or poor recovery thereafter. This is a secondary [Raynaud's phenomenon](#) and patients often report white fingers in the morning or after outdoor activity.
- There may be other manifestations from **damage to bone and muscle**. [Dupuytren's contracture](#) can result from cumulative trauma to the palm of the hand. Other effects that have been reported include exostoses and cysts in carpal bones, carpal tunnel syndrome and osteoarthritis.

For diagnosis, the following are required:

- Evidence of long-term exposure to vibration.
- Episodes of digital pallor, with or without confirmed sensorineural effects.
- Exclusion of other causes of Raynaud's phenomenon or sensory changes.
- Diagnosis would be supported by finding of associated musculoskeletal features, calluses on the hand, loss of sensation in the digits affected and muscle weakness. These may not be apparent in the early stages of disease.

Differential diagnosis

- [Raynaud's disease](#).
- [Scleroderma](#).
- [Buerger's disease](#).
- [Hypothenar hammer syndrome](#).^[9]
- [Rheumatoid arthritis](#).
- [Thoracic outlet syndrome](#).^[10]

Investigations^[4]

There is controversy about the interpretation of some tests for the purposes of industrial compensation, so a number of standardised investigations should be used.^[11] Tests available include:

- The **vibrotactile threshold test**, which is used to test the mechanoreceptors. They respond to stretch, edge and texture and the receptors respond at different frequencies. Measurements are taken from the median nerve (index finger) and the ulnar nerve (little finger) in each hand at two frequencies.
- The **thermal aesthesiometry test**, which assesses the thermal receptors' threshold. Readings are again taken from the median nerve and the ulnar nerve.
- The **Purdue Pegboard test**, which is a measure of dexterity and detects loss of fine movement to both hands.
- The grip force measurement test, which measures the grip strength of both hands. This test is not scored but is a useful indication of vibration damage to muscles of the hand and forearm.
- In addition, tests may be used to assess the vascular component. Finger systolic blood pressure measurement follows cooling of the digits and measures interruption of blood flow in response to cold. When interpreting results it should be noted that there is a difference in pressure between the dorsal and palmar surfaces of the hand.^[12]
- The cold provocation test, which provides visual evidence of blanching.

In 1999 a large number of coal miners needed assessment to provide evidence for legal proceedings. Pragmatically, it was considered that a symptomatic history, occupational history and a combination of vibrotactile thresholds, thermal aesthesiometry and cold water provocation testing would be sufficient to diagnose most cases.^[13]

Technetium-99m hand perfusion scintigraphy (as used to diagnose Raynaud's syndrome) can be used to verify the diagnosis.^[14]

Staging

The Stockholm system is no longer used to grade severity and a new two stage process was devised:^[15]

Sensorineural component

- 0N - exposed to vibrations but no symptoms.

- 1N - intermittent numbness +/- tingling.
- 2N - numbness (intermittent or continuous) with loss of feeling of touch, verified by at least one validated measure, such as monofilaments, thermal aesthesiometry or vibrotactile thresholds.
- 3N - numbness (intermittent or continuous) with loss of discrimination by touch +/- manual dexterity low, demonstrated by the Purdue pegboard test.

Vascular component

- Stage 1 - mild, blanching score 1-4.
- Stage 2 - moderate, blanching score 5-12.
- Stage 3 - severe, blanching score >12.

Blanching score is calculated from validated photographs showing the affected digits and scoring as 3 for proximal phalanx, 2 for middle and 1 for distal for each affected digit.

Terminology

The hazard to health from vibration is usually assessed from the average acceleration level of the vibrating surface. A weighting is applied to take into account the variation in damage at different frequencies to give a frequency-weighted acceleration 'A' normally expressed in m/s^2 . If the implement is to be used for up to four hours a day this is called the A4 and, for up to eight hours a day, the A8. ^[2]

Hand-arm vibration syndrome treatment and management^[4]

Non-drug

Eliminate the source of vibration if possible or consider redeployment, keeping the body warm, and stopping smoking. Apply the principles outlined under 'Prevention', below.

Drugs

These have little part to play. Nifedipine or another calcium-channel blocker may be useful to improve the vascular effects of HAVS.

Prognosis and complications^[2] ^[16]

HAVS can have a considerable impact on the quality of life (eg, pain, difficulties with daily activities, anxiety and depression).^[17] ^[18]

Early redeployment can halt or reverse progression of symptoms but, in severe cases, these continue even after removal of the source of vibration.^[19]

A 22 year follow up study found a tendency to irreversibility of finger numbness and finger pain.^[20] Continued vibration exposure was associated with prolonged finger pain.

Carpal tunnel syndrome is associated with the development of HAVS, with increased risk among men under 30 years old. ^[21] ^[22]

Hand-arm vibration syndrome prevention^[23]

If possible, a different technique should be used to avoid the exposure to vibration. Tools must be well maintained. Duration of exposure should be minimised and frequent breaks taken. For those at risk, periodic assessment is advised.

The Control of Vibration at Work Regulations 2005, which came into force in July 2005, placing a legal obligation on employers to assess and identify measures to eliminate or reduce risks from exposure to hand-arm vibration, ensure that control measures to reduce vibration are properly applied and that information, training and health surveillance are provided.

Further reading

- [Hand arm vibration](#); Health and Safety Executive
- [Hand-Arm Vibration Syndrome](#); Department for Work and Pensions, 2004

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