

DEFINITION

1. Hand-arm vibration syndrome (HAVS) is a complex disorder of the upper limbs found in people whose work involves the use of vibrating tools. The condition is characterised by the presence of vascular, neurological and musculoskeletal disturbances, but any of these three components may predominate.
2. The vascular component of HAVS is discussed generally in the Medical Appendix; *Raynaud's Syndrome*.

CLINICAL MANIFESTATIONS

3. **Vascular effect.** This is the most commonly encountered component, known as "vibration white finger". It consists of episodic, cold-induced vasospasm of the digital vessels; i.e. a secondary Raynaud's syndrome. The blanching is initially confined to the tips of one or more fingers but progresses with time as long as the individual remains exposed to vibration. Eventually the whole length of the finger or fingers is affected in these episodes, which may last several minutes. The thumbs are generally the last digits to be affected. Rewarming is accompanied by the return of colour from white to blue, then red, with tingling and pain. In the most severe cases trophic skin changes, even gangrene, may occur, although this is extremely rare.
4. **Neurological effect.** The most common neurological symptoms are numbness and tingling, at first intermittent, but becoming more persistent with continuing exposure. Reduced tactile discrimination and manipulative dexterity also commonly occur and the individual describes clumsiness and a tendency to fumble with small objects such as buttons and coins.
5. **Musculoskeletal effect.** An array of ill-defined musculoskeletal abnormalities have been associated with exposure to vibrating tools. These include impairment of grip strength, and an increased incidence of osteoarthritis of the wrist and elbow.
6. In order to stage the severity of the condition the Stockholm system of grading (the Stockholm Workshop Scale) is now generally employed. It is based on the subjective history and supported by the results of objective tests. A grade is applied individually to each hand and the vascular and neurological effects are assessed separately.
7. All components may occur in a patient at the same time, and although there is an association between the vascular and neurological effects these two components may present and progress independently. There may be a delay in onset of one or more of the elements of the syndrome and in the recovery phase the vascular disturbance usually resolves before the sensory. Musculoskeletal effects on the other hand being much less well-defined may merge indistinguishably with the normal degenerative processes of ageing.
8. Understanding of the pathophysiology of the condition is still evolving, but it seems likely that there are specific anatomical changes in the small blood vessels of the fingers as well as damage to the nerve fibres and nerve endings.

9. It is usually recommended that people with this syndrome should cease, or materially restrict their use of vibrating tools and if this course is followed early in the evolution of the condition the outlook for recovery is reasonably good. Other measures include the use of anti-vibration gloves and vibration-dampened tools.
10. Continued work with high vibration hand held tools, smoking, other circulatory diseases and low age at the time of diagnosis have an unfavourable influence on the prognosis. The outlook for recovery is greatest in cases of recent onset where early avoidance of vibration has occurred. However even in established cases a perceptible improvement in the vascular problems may occur after some years removed from harmful vibration.

AETIOLOGY

11. Prolonged occupational exposure to hand-held vibrating tools is the primary cause of the syndrome. The most important sources of hand-arm vibration are pneumatic tools (air compressed and electrical) e.g. grinders, sanders, drills, fettling tools, jack hammers, etc. Users of chainsaws, brush saws and grass trimmers are also at risk.
12. Vibration is assessed by the measurement of the acceleration of a device in defined directions. The degree of harm is related to the magnitude of the acceleration and on the velocity and amplitude of the vibration. The short high peak values (impulsiveness) of the vibratory source are also significant.
13. Recommendations regarding exposure to vibration have been set out in the international standard ISO 5349 and in BS 6842 but many authorities consider that they over-simplify dose-response relationships.
14. It is generally accepted that the severity of HAVS is largely related firstly to the length of exposure time, and secondly to the intensity and mechanical characteristics of the vibration itself and the resulting energy absorption by the operator.
15. Other factors which influence the susceptibility of an individual include the ergonomics of the hand-tool, as it has been demonstrated that devices which require a tight grip during operation are more likely to give rise to HAVS. In addition, transmission direction, hand-arm posture and anthropometric factors all play a complex and interrelated part.
16. Exposure to cold increases vulnerability to vibration-induced disease and workers can reduce the risk of HAVS by wearing sufficient clothing, including gloves when working with vibrating tools.
17. The interval between the start of exposure to hand-arm vibration and the onset of symptoms of HAVS varies widely because of the diversity and complexity of causative factors. Estimates vary between 8 months and 17 years in different occupations. It is likely that it will be shorter in cases where the intensity of vibration and cumulative exposure are greatest.
18. The consensus of opinion supports the view that HAVS may become symptomatic for the first time after contact with vibration has ceased. However it is generally accepted that once an interval of one to two years has elapsed since exposure to vibratory tools, symptoms occurring for the first time are not occupational in origin.

CONCLUSION

19. Hand-arm vibration syndrome is a complex disorder of the upper limbs caused by the use of vibrating tools.
20. The commonest symptoms are cold-provoked episodes of spasm of the blood vessels of the fingers (vibration white finger), impaired sensation in the fingers, clumsiness and reduced power of grip.
21. The severity of the disorder is related to the intensity of the vibration and the length of time exposed to it. Symptoms are unlikely to start for the first time more than 1-2 years after cessation of exposure to vibratory tools.

REFERENCES

Pelmear PL. In: (Eds) Baxter P, Adams P, Aw T, Cockroft A, Harrington JM. Hunter's Diseases of Occupations. 9th Ed. Bath. Arnold. 1999. p308-323.

Putz-Anderson V et al. In (Ed) Bernard BP. Musculoskeletal disorders and workplace factors. Cincinnati: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. 1997. 5c1-5c31. National Institute for Occupational Safety and Health. DHHS (NIOSH). Publication no.970141.

Pelmear PL. Hand-arm vibration syndrome. Alberta Occupational Health Newsletter. 1999;16(2).

Chetter C, Kent PJ, Kester RC. The hand arm vibration syndrome: a review. Cardiovascular Surgery. 1998;6(1):1-9.

May 2002