

# Occupational Medicine Clinical Update

*Dedicated to the prevention of occupational illness and injuries, and promoting the well-being of all workers*

In unexplained finger numbness and Raynaud's phenomenon, stop and consider this diagnosis before it becomes a permanent disability



## Occupational Health Clinics for Ontario Workers Inc, Samia-Lambton

### White Fingers – Bad Vibes

*A 43-year-old carpenter returns for follow-up, 6 weeks post endoscopic surgery for right carpal tunnel syndrome (CTS). Although his symptoms of night pain have disappeared, he is still complaining of numbness in his fingers and clumsiness with fine motor tasks. He has also noted blanching of the finger tips with exposure to cold.*

In 1911, an Italian physician named Loriga [1] was similarly perplexed by a syndrome of "dead fingers" in miners. What the workers had in common was the use of pneumatic tools.

More extensive investigations into the symptoms associated with vibration were conducted by Hamilton [2] in the U.S. published in 1918. This comprehensive investigation confirmed occupational exposure to vibration as a cause of secondary Raynaud's phenomenon. Since then the scientific literature describing the relationship between vibration from hand-held tools and upper extremity pathology has flourished.

Today, the consequences of long-term exposure to vibrating tools are recognized by occupational safety and health organizations around the world. These consequences include neurological, vascular and musculoskeletal disturbances which have become defined collectively as the Hand-Arm Vibration Syndrome (HAVS).

In the past, HAVS had been known by a number of names: Vibration White Finger (VWF), Traumatic Vasospastic Disease and others. HAVS is characterized by the following features:

- ◆ Vascular - vasospastic (Raynaud's) phenomenon
- ◆ Sensorineural - numbness/tingling of digits, loss of manual dexterity
- ◆ Musculoskeletal - muscle, bone and joint disorders

The internationally accepted grading system [3] for the symptoms of HAVS is shown in Tables 1 and 2.

Typically, the syndrome begins with sensorineural symptoms - episodes of numbness and tingling precipitated by exposure to cold or damp conditions, or the use of vibratory tools. With ongoing exposure, the vascular symptoms become more apparent. Blanching initially affects the distal parts of the digits but will progress proximally if exposure is not reduced or discontinued.

As the condition becomes more advanced, workers will experience persisting sensorineural symptoms accompanied by decreased grip strength and loss of manual dexterity. If exposure is not discontinued at this point or sooner, the disability may become permanent and progressive [4].



Rarely, in very severe cases, the hands become cyanotic with trophic skin changes leading to ulceration and ultimately gangrene. Musculoskeletal changes such as bone cysts and vacuoles, osteoarthroses, and cervical spine degeneration have been described in association with HAVS. However, it appears that these conditions may be more related to confounding variables such as ergonomic factors and issues of force, rather than vibration.

Essentially any hand-held tool that causes vibration

*(Continued on page 2)*

Table 1: Stockholm workshop scale for vascular symptoms in HAVS

Stage	Grade	Description
0		No attacks
1	Mild	Occasional attacks affecting only the tips of one or more fingers
2	Moderate	Occasional attacks affecting distal and middle (rarely also proximal) phalanges = 1 fingers
3	Severe	Frequent attacks affecting all phalanges of most fingers
4	Very severe	As in Stage 3, with trophic skin changes in the fingertips

Table 2: Stockholm workshop scale for sensorineural symptoms in HAVS

Stage	Description
0SN	Exposed to vibration, but no symptoms
1SN	Intermittent numbness, with or without tingling
2SN	Intermittent or persistent numbness, reduced sensory perception
3SN	Intermittent or persistent numbness, reduced tactile discrimination, and/or manipulative dexterity

(including surgical tools) or repetitive impact, can cause HAVS. The exposure period required to produce the symptoms of HAVS ranges from a few months to decades. There is a well-established relationship between exposure to hand-arm vibration (HAV) and the development and severity of HAVS, indicative of a dose-response relationship. Furthermore, with increased intensity and duration of exposure the latency to symptom onset is shortened [5].

### Pathophysiology



Studies suggest that vascular manifestations of HAVS result from disturbance of local and centrally mediated sympathetic reflexes. Biopsies also show severe thickening of the muscularis layer of the arterial wall of the digits, as well as endothelial damage [6].

The peripheral neuropathy of HAVS is associated with a variety of pathological changes [6,7]. These include perineural fibrosis and edema, damaged mechanoreceptors, demyelination and loss of sensory fibers. It also appears likely there is interplay between the vascular and neurological components in propagating the syndrome [6].

### Prevalence

Prevalence depends on the degree of vibration exposure in the occupational group. A large 1983 study by the National Institute for Occupational Safety and Health (NIOSH) found prevalence of HAVS ranging from 6% to 100% depending on the group of workers studied [8]. Foundry and shipyard workers were at particularly high risk. In a study of Northern Ontario miners conducted by OHCOW Sudbury [9], the prevalence of HAVS was 50% amongst 162 workers who completed a questionnaire and attended a medical examination (from a total population of 617 miners sent questionnaires).

### Diagnosis

It is important to rule out other secondary causes for the vascular component of HAVS (see Table 3), as well as primary Raynaud's [14]. This can be accomplished through history, physical exam and lab testing. Routine lab tests worth considering include: CBC, ESR, electrolytes, creatinine, glucose, uric acid, serum protein electrophoresis, rheumatoid factor, antinuclear antibodies, cryoglobulin and urinalysis.

Although there are a wide variety of diagnostic modalities that have been employed in the assessment of HAVS there is no gold standard test. The diagnosis is still based on a history of numbness and blanching when exposed to cold/damp environments, with a work history of vibration exposure [10].

Specialized testing/evaluation is also available, through St. Michael's Hospital in Toronto, Occupational Health Services (tel: 416-867-7470, fax: 416-867-3673) to help confirm the diagnosis, and for establishing a baseline for surveillance.

### Associated Conditions

As in the example at the beginning of this article, HAVS can coexist with CTS and there is evidence vibration may cause CTS [5]. Vibration has also been shown to accelerate hearing loss, independent of associated noise exposure, from mechanisms that are not yet understood. It may be related to sympathetic reflexes, as autonomic responses to vibration have been shown to affect cardiac function as well as peripheral vascular tone [4]. There is also evidence of a relationship between HAVS and Raynaud's phenomenon of the lower extremities [11], and also a likely causal relationship between vibration exposure and Dupuytren's Contracture [12].

**Table 3: Secondary causes of Raynaud's phenomenon**

Collagen vascular diseases	scleroderma, systemic lupus erythematosus, rheumatoid arthritis, dermatomyositis, polymyositis
Arterial occlusive diseases	atherosclerosis, thromboangitis obliterans, acute arterial occlusion, thoracic outlet syndrome
Pulmonary hypertension	
Neurologic disorders	intervertebral disk disease, syringomyelia, spinal cord tumours, stroke, poliomyelitis, carpal tunnel
Blood dyscrasias	cold agglutinins, cryoglobulinemia, myeloproliferative disorders, macroglobulinemias
Trauma	vibration, hammer hand syndrome, electric shock, cold, typing, piano playing
Drugs	Ergots, B-blockers, antineoplastics, others

### Treatment

Not surprisingly, modification of activities or removal from vibration exposure is necessary, depending on the severity of the symptoms in HAVS. Efforts towards maintaining higher core body temperature should be pursued. Mitts (in some cases heated) rather than gloves, are recommended [4]. **Cessation of smoking is a key intervention.**

Finally, there is evidence (largely anecdotal) that calcium channel blockers and other agents with vasodilatory properties may be of benefit. Sympathectomy has been used in severe cases, but may offer only temporary relief [6].

If the exposure is discontinued it is possible for the vascular symptoms to recover significantly. The sensorineural component may also recover but typically takes much longer. The degree of recovery in both cases is dependent on the stage and age of the patient.

### Prevention

Since Hamilton's studies of 1918, measures have been initiated to reduce exposure to vibration on a number of different levels [13]. These include alteration of tools (engineering and maintenance), gripping tools lightly, special gloves, modification of work practices (rest breaks, alternating job tasks) and environmental controls (warm, dry).

### Conclusion

Despite these measures HAVS still remains surprisingly prevalent. One of the key reasons is lack of awareness. Physicians can have an important impact on this. When workers with exposure to hand-held tools present with complaints of finger numbness, particularly in the setting of Raynaud's phenomenon, we should all get 'bad vibes'.

#### *References*

1. Loriga, G. 1911. *Pneumatic Tools: Occupation and Health*. In: *Encyclopedia of Hygiene, Pathology and Social Welfare 1934*; (2) Geneva: International Labour Office.
2. Hamilton, A. 1918. *A study of spastic anemia in the hands of stone cutters*. *Bulletin 236: US Bureau of Labour Statistics*. (19), 53-56.
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*Additional references available on request, but not provided here due to space constraints.*

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