Hand-Arm Vibration Syndrome

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Symptoms

Vascular

‘White finger’ or blanching attacks

These attacks begin at the fingertips but, with increasing vibration exposure extend to the middle and roots of the digits. Initially this blanching is localized to the tips of one or more digits but eventually it spreads to involve all fingers as far as the metacarpophalangeal joints of all digits. The blanching is usually circumferential however it can be down one side of the finger. In very severe cases, with years of vibration exposure, the thumbs can be involved. The palms are rarely affected.

The attacks are usually precipitated by exposure to cold. They occur more frequently in winter than summer.

During an attack of whiteness the fingers lose sensitivity. The attacks last for about 20 minutes to 1 hour. Following an attack of whiteness as the blood supply returns there is a period of reactive hyperaemia during which the hands appear red and this may be accompanied by painful tingling. Many affected subjects state they prefer to allow their hands to re-warm naturally as trying to warm them up themselves induces very severe pain.

Between attacks the fingers resume normal colour.

The greater the total exposure to vibration the more frequent the attacks become. In very severe cases, with great exposure over long periods ulcers can appear at the fingertips and the finger assumes a permanent blue hue.

Neurological

The symptoms are tingling, numbness and loss of sensation in the fingers which are said to result in difficulty performing fine tasks through loss of manual dexterity, lack of finger co-ordination, loss of grip strength and clumsiness of the hands.

Initially these symptoms are felt towards the end of the working day and week with significant recovery during prolonged periods of rest, such as weekends or holidays. With further exposure to vibration the tingling and numbness increase in severity and become permanent. This then results in difficulties experienced in domestic, leisure and hobby activities.

Development and progression

The neurological symptoms usually develop first. However there is no set rule. Although unusual the neurological symptoms can develop at the same time or following the first attack of whiteness.

BS6842 annexes a table which gives predictions for the onset of the vascular symptoms in terms of levels and years of vibration exposure. For example exposure to an A(8) of 2.8m/s² over a period of 8 years might be expected, in accordance with the table, to produce finger blanching in 10% of persons so exposed. Although a factor to be taken into account when deciding whether the onset of symptoms is consistent with an individuals alleged level and period of exposure the table is not conclusive. Sensitivity to vibration varies from person to person. Some people are more susceptible to the effects of vibration and symptoms can appear after only a short period of exposure. Others are more robust and symptoms may only appear after many years of exposure.
The table in BS6842 only refers to the vascular symptoms of HAVS. There are no similar studies or tables setting out the relationship between vibration dose exposure and the onset of neurological symptoms.

At the 1994 Stockholm Convention it was the consensus opinion of the delegates that if symptoms arose more than one year and certainly two years after exposure to vibration ceased then the cause was not vibration.

Although symptoms may only first appear after many years of exposure following onset with continued exposure they may deteriorate from one stage to the next relatively quickly perhaps only within a couple of years.

Initially the vascular and the neurological symptoms have little effect on the life style of the affected individual but as symptoms progress increasing problems develop. The vascular symptoms frequently interfere with outdoor hobbies and recreations, for example gardening and fishing. As the vascular symptoms increase attacks can significantly interfere with work activity. During an attack of whiteness the fingers lose sensitivity and there may be difficulty with fine tasks such as handling small screws and coins. These intermittent problems are usually far less significant than the permanent neurological symptoms when the hands lose sensitivity, strength and manual dexterity. In the most severe forms this interferes with all activities of daily living for example tying shoelaces, fastening buttons, assembling small components and renders the individual seriously disabled.

During the early stages symptoms are mild and are frequently put down to a variety of other causes, such as increasing age, or as part of the workers’ lot. An individual is unlikely to attend his GP. It is only as the symptoms progress, become permanent and work and lifestyle become affected would you expect an individual to become more concerned and attend his GP/Occupational Health with complaints.

Studies show the vascular symptoms may improve once exposure to vibration stops. Little is known about the prognosis of neurological symptoms. Based on the consensus of opinion in the 1994 Stockholm Convention arguably the neurological symptoms should not continue to get worse two years after exposure ceases.

**Diagnosis**

A medical expert when considering whether an individual has HAVS or not will consider the following:

**History**

1. Employment history: Details of vibration exposure.
2. Clinical history: Description of symptoms, their onset and changes in severity.
3. Medical history: Family history, medication, other medical conditions past trauma or surgery, alcohol consumption and smoking habits.
4. Social history: Hobbies and activities outside employment.

Does the individual have a history of exposure to vibration?

Is the individual’s description of his symptoms and their onset consistent with a diagnosis of HAVS?
From the history given (taken together with the examination and the review of the documentation) is there anything else that could account for the individual’s symptoms? Could the individual’s hobbies for example motorcycling or car maintenance have contributed to or caused his symptoms? Are the individual’s toes also affected or is there a family history of similar symptoms (suggestive of primary constitutional Raynauld’s which some doctors consider is hereditary and affects 4 – 5% of the male adult population, the condition is mostly seen in young women)? Are the fingers of both hands equally affected despite only one hand being used to grip the tool/piece being worked on?

Other conditions/medications/toxins which could account for or contribute to an individual’s symptoms are:

**Autoimmune connective tissue disease:**
- Scleroderma
- Mixed connective tissue disease
- Systemic lupus erythematosis
- Rheumatoid arthritis
- Dermatomyositis
- Polyarteritis nodosa
- Sjogren's disease

**Traumatic:**
- Following injury or surgery
- Frost-bite
- Thoracic outlet syndrome
- Cervical spondylosis

**Arterial disease:**
- Thrombo-angiitis obliterans
- Arteriosclerosis
- Thrombo-embolism

**Toxins/drugs:**
- some cancer drugs,
- beta-blockers (used to treat high blood pressure or heart disease)
- anti-migraine medication
- decongestants and, occasionally,
- the contraceptive pill and HRT.

**Neurogenic: (Caused or affected by the nerves)**
- Polio
- Syringomyelia
- Hemiplegia
- Dysglobulinaemia
- Cryoglobulinaemia

**Examination**

**Height and weight**
Studies have shown that there is a twofold increase in the incidence of carpal tunnel syndrome in people who are clinically obese i.e. with a BMI over 25. This may account for an individual’s neurological symptoms.

**Physical examination of the hands, fingers and neck**
The presence of callouses suggest an individual is still undertaking manual work despite his assertions to the contrary. Enlargement of the small joints in the fingers suggests distal
interphalangeal joint arthritis which induces numbness and tingling in the hands. Wasting of
the muscles can be a sign of damage in the motor nerves. There may be evidence of
Dupuytren’s contracture, which causes one or more fingers to bend into the palm of the hand
due to the thickening and shortening of the connective tissue of the palm, although some
literature suggests otherwise there is no evidence that the same is triggered by manual work
or vibration.

Examination of the neck may reveal cervical spondylosis which can cause irritation of the
nerve roots and pain, numbness or tingling in the dermatomes (area of skin supplied by a
spinal nerve). Examination of the neck may also reveal thoracic outlet syndrome
(compression of the nerves and blood vessels between the neck and shoulder) which can
cause pain, arm and hand weakness and numbness in the arm and fingers, the sense of
touch and the ability to feel hot and cold may be lost.

The blood pressure in both arms should be taken. Radial and ulnar pulses should be felt. The
examiner may listen with a stethoscope for a bruit (diminution of the pulse and the presence
of a bruit, the sound that blood makes when it rushes past an obstruction, are signs of
narrowing of the artery, caused by perhaps high cholesterol or high blood pressure, or
possible thoracic outlet syndrome).

Tests for grip strength, light touch (the individual closes their eyes, different filaments of varying
thickness are pressed against the finger with the individual saying whether they can feel it or not),
two point discrimination (the individual closes their eyes, the expert then uses small instruments,
such as the tips of two opened paper clips, to touch two points (fairly close together) on the
hand or finger. Typically, the individual should feel separate touches if the two points are at
least 0.5cm apart). Tinel and Phalen's test for Carpal Tunnel Syndrome should be performed.
Inappropriate signs may be a strong grip when an inability to undertake manual work is alleged,
inconsistent responses to two point discrimination or light touch or a report of tingling in all the
fingers or a throbbing sensation in the hand when Tinel’s or Phalen’s tests are performed.

- **Tinel’s test**
  Performed by tapping the median nerve along its course in the wrist.

  Positive: transient tingling in the thumb, index and middle fingers.

  Negative: no change.

- **Phalen’s test**
  Phalen's test is done by pushing the back of the hands together with the hands hanging down
  for one minute.

  Positive: transient tingling in the thumb, index finger and middle fingers.

  Negative: no change.

**Other tests include:**

- **Allen’s test**
  This tests blood supply to the hands. The hand is elevated and the individual asked to make a
  fist for about 30 seconds. Pressure is applied over the ulnar and the radial arteries so as to
  occlude both of them. Still elevated the hand is then opened. It should appear blanched (pallor
can be observed at the finger nails) Ulnar or radial pressure is released and the colour should
  return in 7 – 10 seconds.
- **Adson’s test**
The pulse is felt as the arm is elevated. If the pulse diminishes in volume or stops the test is positive. A positive test is indicative of thoracic outlet syndrome.

- **Roos test**
The individual raises their arm and closes and opens their hand for 3 minutes. A positive test is indicated by pain, heaviness or profound arm weakness or numbness and tingling of the hand. A positive test is indicative of thoracic outlet syndrome.
No single test is able to confirm or refute the diagnosis of HAVS nor determine its severity.

There are tests devised for use in the scheme developed by the Department of Trade & Industry to assess miners who allege HAVS. These tests include:

- **Purdue peg board test**
This test evaluates manual dexterity. It requires the individual to use a thumb to fingertip pinch grip to pick up pins and place them in holes in a pegboard as a timed task.

- **Grip strength assessment**
Measured using a hand dynamometer. It requires the individual to squeeze the handle as hard as they are able. The instrument is then handed back to the examiner for a reading to be taken.

- **Thermotactile threshold test**
This test measures the ability of an individual to perceive temperature change being applied to the tips of the fingers. The index and little fingers are used in each hand. The test requires an individual to press a button when he feels a change in the temperature.

- **Vibrotactile threshold test**
The test measures the ability of an individual to perceive vibration when it is applied to the tips of the fingers. The index and little fingers are used. It requires the individual to press a button when he feels a vibration sensation and requires him to keep it pressed until he no longer feels it.

Such tests require expertise and equipment which are usually only available in specialist centres. These tests are not objective and are open to manipulation.

**Review of documentation**

The claimant’s GP notes, hospital and occupational health and personnel records should be considered. The NI Contributions Schedule, any witness and engineering evidence should be reviewed if available.

Is the claimant’s history with regard to the onset and progression of his symptoms consistent with the documentation and the finding on examination? For example does the individual give a different history to occupational health on his assessment by them? Has the individual failed to attend his GP despite alleging his symptoms are having a significant affect of his day to day life? Do the GP notes reveal a medical condition which could be the cause of the individuals symptoms?
Classification

If the diagnosis is made then based on the history, findings on examination and the documentation the medical expert will assess the level of symptoms. The Stockholm Scale is now preferred for classifying the level of HAVS.

Vascular symptoms

<table>
<thead>
<tr>
<th>Stage</th>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>No attacks</td>
</tr>
<tr>
<td>1</td>
<td>Mild</td>
<td>Occasional blanching attacks affecting the tips of one or more fingers.</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>Occasional attacks affecting distal and middle phalanges of one or more fingers.</td>
</tr>
<tr>
<td>3</td>
<td>Severe</td>
<td>Frequent attacks affecting all phalanges of most fingers.</td>
</tr>
<tr>
<td>4</td>
<td>Very Severe</td>
<td>As in 3, with trophic skin changes on tips (rare).</td>
</tr>
</tbody>
</table>

Neurological symptoms

<table>
<thead>
<tr>
<th>Stage</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSN</td>
<td>Vibration exposed, no symptoms.</td>
</tr>
<tr>
<td>1SN</td>
<td>Intermittent or persistent numbness with or without tingling.</td>
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<tr>
<td>2SN</td>
<td>As in 1SN with reduced sensory perception</td>
</tr>
<tr>
<td>3SN</td>
<td>As in 2SN with reduced tactile discrimination and/or manipulative dexterity.</td>
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Carpal tunnel syndrome – The link to vibration

Carpal Tunnel Syndrome (CTS) occurs when the median nerve which runs from the forearm to the hand becomes pressed or squeezed at the wrist. It is one of the most common conditions affecting the nerves in the hand. Estimates as to the prevalence of CTS in the adult male population range from 0.6% to between 8 and 18%. Most cases of CTS develop in people who are between 45 – 64 years of age.

Symptoms usually start gradually with frequent burning tingling or itching numbness in the palm of the hand and fingers, especially the thumb and the index and middle fingers. The symptoms often first appear in one, or both, hands during the night. A person with CTS may wake up feeling the need to ‘shake out’ the hand or wrist. As symptoms worsen individuals might feel tingling during the day. Decreased grip strength may make it difficult to form a fist, grasp small objects or perform manual tasks. In chronic cases the muscles at the base of the thumb may waste away. Some individuals are unable to tell between hot and cold touch.
Increasingly claims are being made for CTS either in tandem or without HAVS. The presence of CTS significantly increases the value of the claim and this is maybe why claims for the condition are on the increase.

The development of CTS in association with vibration exposure is a controversial area. There is a range of opinion regarding the evidence for a causative relationship between vibration and CTS.

The Industrial Injuries Advisory Council reported to Parliament in March 1992 and they concluded ‘From overwhelming clinical evidence ………many cases of carpal tunnel syndrome ……are occupationally caused’ The IIAC concluded that there was a doubling of the risk of CTS among people working with hand held vibrating tools. On the basis of the Council’s recommendations CTS in association with vibration exposure became a prescribed disease in 1992. The IIAC did not publish the evidence on which they based their conclusions. The decision however appears to have been reached on the basis of several epidemiological studies whose statistical base varied between 16 workers (Chamerjee 1982) and 137 workers (Lukas 1982)

The largest study of this subject is that of Professor Burke and others in 2005 in which 26,842 miners seeking compensation were assessed for vascular and neurosensory impairment typical of HAVS and CTS. They found a positive association between HAVS and CTS, in that in 15% of these workers exposed to vibration seeking compensation were suffering from both conditions. However, only 0.4% of these over 26,000 vibration exposed workers were suffering from CTS alone (i.e. not also suffering from HAVS). This is fewer than one would anticipate in a normal aged-matched population not exposed to vibration.

This casts doubt over whether, when CTS develops alone and not associated with other features of HAVS, it is associated with exposure to vibration.

In the most recent review of work related upper limb disorders by the IIAC (July 2006), the evidence for maintaining the prescription of carpal tunnel syndrome in the context of hand held vibrating tool use was reviewed. Despite the Professor Burke study the IIAC found no strong case for revision of the prescription.

A systematic review of the published literature to 1 January 2005 by Palmer and others in 2006 found ‘reasonable evidence that prolonged use of hand held vibratory tools increases the risk of CTS more than two-fold’.

However a recent article in the Journal of Hand Surgery (Lozano-Calderon, Anthony and others. 2008) examined in detail the published evidence on the aetiology of CTS and subjected the data from various studies to rigorous statistical analysis. It concluded that the aetiology of CTS is largely structural, genetic and biological, with environmental and occupational factors playing a minor and more debatable role. It noted ‘There is insufficient evidence to implicate hand use of any type as a important and direct cause of CTS and to do so with confidence may be considered scientifically irresponsible.’

The Burke study and the Lozano- Calderon article are certainly steps in the right direction for defendants in seeking to undermine the view advanced by claimant medics that CTS where it follows vibration exposure is always occupationally induced. However, claims are still likely to succeed whilst there are papers, studies and experts that still support an increased risk of CTS where individuals were exposed to vibration and the IIAC continues to recommend CTS remain a prescribed disease.
Case history

An assessment of James ‘they all call me Jigger’ Pick

42 years of age, right handed, born 1967.

Left school at 16 (1983).
1983 – bakery, four years, no exposure to vibration.
1987 – coalminer six years, exposed to drills and borers
1993 – warehouseman, until the present, no exposure to vibration

MAP 2001 – grading 0V 1SN

Complaints

- Numbness, index and middle fingertips, distal phalanges only, bilateral, onset 1988.
- Hands feel cold with pallor to palms and on flexor surface of fingers, never seen it on the back of the hand, comes on at any time and last for several hours and then just disappears as the hand returns to normal
- Woken at night with numbness and tingling in the fingers from the mid 1990’s. Nocturnal symptoms have settled completely since the carpal tunnel decompression in July 2008.

General health good, no diabetes, rheumatoid arthritis, collagen vascular diseases, on no medications. Significant knee injury 2002. Never been to the doctor with his complaints. His hand problems limit his ability to ride his motorbike and engage in his hobby of metal engraving.

On examination

- 6ft tall, 20 stone (almost morbidly obese).
- Was always very thin and fit until he had to give up football and gym after the knee injury.
- Full finger mobility with 90º of flexion at MP, PIP and DIP joints to all fingers. Thumb function normal.
- Dupuytren nodule in the right palm, present for several years.
- Callosities to the palm, no trophic changes or scars.
- Allen’s test normal, no weakness or wasting of abductor pollicis brevis. Sensibility assessment with Von Frey hairs, Tinel’s sign, Phalen’s test, power of grip.

Issues that the case history throws up

1. Short history of exposure to vibration.
2. Onset of alleged neurosensory Hand-Arm Vibration Syndrome, one year after discontinuing exposure to vibration.
3. Pallor atypical, not circumferential, lasts too long, no phase of engorgement.
6. Good response to carpal tunnel decompression – a guide to causation (vibration or constitutional).

7. Dupuytren's disease and exposure to vibration.

8. Role of hobbies.

**Areas of inconsistency**

1. Very weak grip yet callosities to the palm – “cannot do anything”

2. Sensory impairment prior to exposure to vibration (previous records)

3. Development of sensory impairment 2 years+ after vibration exposure ceases

4. Inconsistency between information/examination at the time of a MAP assessment (including Tinels/Phalens)

5. Pallor or blotchiness?
   - Circumferential
   - Duration of pallor – 40 minutes
   - Phase of painful engorgement

6. CTS – nerve conduction studies define diagnosis – or carpal tunnel decompression
   - Obesity - risk factor
   - Body mass Index:
     - Normal 18.5-24.9
     - Overweight 25-29.9
     - Obese 30-39.9
     - Severely obese 40+

7. Genuine vibration exposure – a harmonic not an activity that jars the hand

8. Security video:
   - Dexterity
   - Very weak grip

9. Duration and vibration dose

10. Progressive deterioration in the absence of additional vibration exposure.

Relevant references


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