

Proceeding Paper

A Delphi Study to Address a Number of Issues Relating to the Practical Management of Hand-Arm Vibration Syndrome and Carpal Tunnel Syndrome in the Workplace [†]

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Abstract: A Delphi study has been undertaken to address eight specific areas relating to the management of hand-arm vibration syndrome and carpal tunnel syndrome, with the aim of providing consensus guidelines.

Keywords: Raynaud's; carpal tunnel; sensory testing; standardised testing; Dupuytren's; health surveillance

1. Introduction

It is over 100 years since the relationship between vibration exposure and symptoms affecting the hands was first recognised. In that time, there have been developments in the approach to staging the severity of these symptoms, which are largely reliant on staging systems, such as the Taylor–Pelmear, and latterly, the modified Stockholm Scale. In the UK, regulations were introduced in 2005, with associated guidance on the assessment of risks, the process of health surveillance, and the management of affected employees. However, a number of issues relating to the management of such employees remain poorly defined.

The Society of Occupational Medicine (SOM) Special Interest Group (SIG) was established in 2017 to facilitate discussion relating to any aspect of vibration-related diseases among members with a particular interest and/or expertise. Since then, a number of publications have been produced, addressing a range of associated topics, but it became increasingly apparent that there was a range of sometimes markedly divergent opinions with regard to several issues. It is believed that this divergence of opinion is not only representative of UK practitioners.

With the aim of providing a consensus opinion on a number of these issues, it was agreed that a Delphi Group should be established [1].

2. Aims

The aim of the Delphi study is to review a number of specific issues that are related to hand arm vibration syndrome (HAVS), about which there is no definitive evidence, but for which a consensus view would be likely to assist those undertaking HAVS surveillance and assessments.

3. Method

In total, 15 members of the SOM SIG agreed to participate, all being occupational physicians with experience of hand-arm vibration syndrome. It was agreed that eight specific topic areas would be subject to the Delphi process, undertaken by email, with one member of the group acting as a moderator for each topic. Following the completion



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of the exercise, the eight topics have been combined to present this summary consensus paper. The broad topics considered are in Table 1, with specific statements subsequently designed by the topic moderator in a format that is consistent with a Delphi exercise, in order to allow for agreement or disagreement and a presentation of supportive evidence from each participant. The moderator formulated the statement(s) for each round, such that the responses are “agree/disagree/undecided”.

Table 1. Subjects streams and initial questions for Delphi study.

| Set | Topic | Issues to Be Addressed |
|-----|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Primary Raynaud’s phenomenon (RP) | What criteria should be used to differentiate primary RP from vascular HAVS? What advice should be offered to those with primary RP wishing to work with exposure to hand transmitted vibration (HTV)? What criteria should lead to a referral for a further investigation of RP? |
| 2 | Frequency of health surveillance | How frequent should increased surveillance be performed for those with stage 2 HAVS and how long should the increased frequency of surveillance continue? |
| 3 | Criteria for vascular staging | With vascular HAVS, should the extent of the blanching always override the frequency of the blanching when staging? If not, how do you balance the frequency and extent when grading? |
| 4 | Use of monofilaments for sensory testing | What cut-off of WEST/SW monofilaments should be used to assess normal sensory perception when assessing whether reduced sensory perception is present in those exposed to hand transmitted vibration? What other factors should be considered when interpreting the results of monofilament testing? |
| 5 | Carpal tunnel Syndrome (CTS) | Should cases of suspected CTS from history and examination be referred for nerve conduction studies before confirming a diagnosis? Should cases of suspected CTS be restricted from using hand vibrating tools until an investigation and treatment is completed? Should cases of a recurrence of CTS be permanently restricted from using vibrating tools? |
| 6 | Peripheral neuropathy and sensorineural HAVS | What advice should be offered to those with peripheral neuropathy/neurological symptoms similar to HAVS that are wishing to work with exposure to HTV? Is there an overlap of HAVS SN symptoms with diabetic neuropathy (DN) symptoms when performing HAV surveillance? What should the frequency of surveillance be? How to mitigate the legal risks for an employer with a missed diagnosis of HAVS masked by DN symptoms? |
| 7 | Dupuytren’s disease | Should cases of Dupuytren’s contracture be restricted from using vibrating tools? If yes, to what severity? |
| 8 | The use of quantitative tests for routine health surveillance | When should cases of HAVS be referred for a tier 5 assessment? Should reduced sensory perception in sensory HAVS be assessed by using more than one QST? If so, at what stage should ST be considered? |

4. Results

There was a good consensus regarding issues relating to differentiation of primary Raynaud’s phenomenon (PRP) from hand arm vibration syndrome (HAVS), and the management of cases of PRP in the workplace. It was agreed through separate statements that PRP generally shows an age of onset below 30 years, usually presents with symmetrical blanching, and that a positive family history and involvement of feet and/or other peripheries is indicative of PRP rather than HAVS. Vascular HAVS generally results from significant vibration exposure, so alternative diagnoses including PRP should be considered in those with short duration lifetime exposure (less than 5 years). Conversely there was a consensus agreement that asymmetrical blanching primarily involving the trigger fingers and leading hand would be more suggestive of HAVS than PRP. Symmetrical blanching affecting all fingers of both hands (with or without other extremities) warrants more in depth enquiry to exclude other conditions (e.g., autoimmune disease, blood or vascular

disorders, medication etc.) when it presents in vibration exposed individuals over the age of 30, with no family history of PRP. HTV exposed individuals with a history of blanching and possible Carpal Tunnel Syndrome should be referred for investigation and treatment of CTS prior to diagnosing RP or vascular HAVS.

There was agreement regarding the management of PRP in the workplace, including that in those with known PRP, exposure to hand-transmitted vibration should be kept as low as practicable below the EAV of 2.5 m/s² or 100 points on the HSE scale, and that these employees should be subject to enhanced surveillance to include annual review of photographic evidence to help monitor progression of symptoms.

HTV exposed individuals who are diagnosed with PRP at health surveillance, should be advised that they can continue with limited exposure (below the Exposure Action Value) with careful monitoring. Those with blanching and a history of health issues known to be associated with RP (e.g., scleroderma, connective tissue disorders, rheumatoid arthritis, hypothyroidism) should be referred.

In respect of HAVS there was 100% agreement that with vascular HAVS the extent of blanching should over-ride frequency of attacks, and that, while photographic evidence should be used to confirm the diagnosis and extent of blanching and vascular staging, the absence of photographic evidence should not be used to discount or overturn a presumptive diagnosis of HAVS where there is a history of sufficient exposure and anamnesis of cold induced distal circumferential finger blanching.

There was consensus (92%) that age and occupational group should be considered when interpreting results of monofilament testing, and universal agreement that, given the paucity of normative data for Semmes Weinstein monofilament perception (SWM) perception in occupational groups, the 0.2 g-f cut off of normality should not automatically be increased for manual workers; however where finger tips are clearly thickened and the distribution of loss of sensory perception is symmetrical, this could be reflected in the interpretation of the SWM results.

There was consensus regarding the statement that those with peripheral neuropathy/neurological symptoms similar to neurological hand-arm vibration syndrome (HAVS) and wishing to work where exposed to hand-transmitted vibration (HTV), should be advised of the possible risks of further neurological loss in hands and fingers due to HTV, and should have a health surveillance assessment initially every 6 months for first two years by a clinician trained in detecting and diagnosing HAVS (if no evidence of progressive neurological deficit in the first two years, annual health surveillance should be considered if working with HTV). There was a range of opinion, failing to reach consensus regarding those with diabetes mellitus, who are at higher risk of CTS, and whether or not they should have quantitative sensory testing at baseline (before exposure to HTV) and then at regular intervals if working with HTV. There was 100% agreement that employees with diabetes mellitus, should not be excluded from exposure to HTV in order to mitigate legal risks for an employer associated with the diagnosis of a late stage of neurological HAVS.

There was a lack of consensus regarding the need for nerve conduction studies before confirming a diagnosis of CTS, whether cases of CTS should be restricted from using hand held vibratory tools until investigation and treatment is complete and whether cases of a recurrence of CTS should be permanently restricted from vibration exposure.

In respect of health surveillance, there was universal agreement that that following a new diagnosis of Stage 2 HAVS, frequency of Tier 4 (physician) assessment should be increased to 6 monthly, until there is no progression in symptoms. Where there has been a 2 year period in which there has been no symptom progression, assessment can revert back to a yearly, Tier 3 (occupational health adviser) or 4 (physician). There was unanimous disagreement with this statement (100% from 12 respondents) that Tier 5 testing (quantitative testing including thermal aesthesiometry and vibrotactile threshold measurement) was required for all cases of HAVS. The first round of the study elicited no overall consensus as to whether reduced sensory perception in HAVS can be staged by using only one quantitative sensory test (monofilaments) or whether quantitative sensory testing (QST) may play a

useful role in refining a sensorineural grading of 2sn into “early” or “late”, although in the second round there was agreement.

In respect of Dupuytren’s disease, there was 100% agreement that employees with DD should not necessarily be restricted from vibration exposure at time of initial diagnosis regardless of severity or functional impairment. There was consensus (82%) that cases of DD should have enhanced health surveillance/periodic observations (e.g., every 6–12 months) to determine the onset of contracture and the need for referral and (91%) that restricting work with vibrating tools should be considered when functional impairment is such that it affects their ability to do work tasks or causing risk to others.

5. Conclusions

This Delphi review has provided a series of statements agreed by members of the UK Society of Occupational Medicine HAVS special interest group. It is anticipated that this will assist colleagues in the management of some of the difficult issues arising from vibration related disease in the workplace.

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Reference

1. Barrett, D.; Heale, R. What are Delphi Studies? *Evid.-Based Nurs.* **2020**, *23*, 68–69. [[CrossRef](#)] [[PubMed](#)]

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