`The hand–arm vibration syndrome’—a prevention challenge or a price to pay?

Hand–arm vibration syndrome

Extensive, long-lasting exposure to manual work involving the use of vibrating power tools has been associated in epidemiological studies with persistent hand function disturbances. The major health hazards reported to date are: a disorder of the peripheral microcirculation, cold-induced Raynaud’s phenomenon or ‘vibration white finger’ (VWF), and neurological disorders in the peripheral nervous system, either in the form of nerve entrapment at various locations or as a peripheral nerve affection (diffusely distributed neuropathy). These health effects, summarized collectively as hand–arm vibration syndrome (HAVS), may cause substantial impairment and disability. The impairment may be experienced as cold intolerance, reduced sensibility, muscle weakness, loss of hand coordination, impaired dexterity, clumsiness and hand cramps. The National Institute for Occupational Safety and Health has recognized that the accumulated scientific knowledge constitutes ‘strong evidence’ for a causal relationship between vibration and these neurosensory and vascular symptoms. Recently, the ‘seriousness of the vascular symptoms’ has been questioned and the suggestion has been made that such symptoms are a ‘common trait’, a view inconceivable to any physician who has witnessed the reduction in quality of life often resulting from the syndrome [1,2].

HAVS is recognized as an occupational disease by the International Labour Office (ILO) and the European Commission [3]. The latest updated version of the ILO list of occupational diseases classifies vibration exposure as an exposure hazard concerning disorders of muscles, tendons, bones, joints, peripheral blood vessels or peripheral nerves (ILO 2002 [3]). According to the former recommendation by the European Commission, ‘angioneurotic disease caused by mechanical vibration is the corresponding disorder comprised in their list of occupational diseases’ [4].

Societies must address the problem of how to provide economic protection for people who suffer reduced capacity to work arising from health problems that might be of occupational origin and which prevent them from being able to generate an income from gainful employment. Several insurance systems have been developed to provide such economic protection, of which workers’ compensation insurance is the most prominent. In cases where workers’ compensation systems fail, the only possible solution is medico-legal compensation through litigation.

In this issue of *Occupational Medicine*, Lawson and McGeoch [5] review the medical assessment process related to the >100 000 claimants among British ex-coal miners for compensation for HAVS [5]. This is by far the largest assessment of general damage in relation to work with vibrating machines ever executed. Their praiseworthy accomplishment provides the possibility of illustrating general questions pertinent to diagnostic procedures. The extent of the difficulties foreseen in creating guidelines for a routine medical assessment is clearly stated within the domain of evidence-based medicine [6]. Some of the difficulties inherent in such a procedure can be understood from the criticism of one of the suggested vascular tests for diagnosis and staging, also presented in this issue of *Occupational Medicine* [7].

Diagnostic dilemmas

There is a danger, in using diagnostic guidelines, that they may be adhered to without the users having sufficient knowledge of the time-frame during which the evidence was collected. When based on past evidence, they may continue to be applied even when newly emerging evidence suggests that they are obsolete. The science of HAVS is still evolving, and there is continuous progress in the accumulation of knowledge. Early twentieth-century findings identified the hazards of white finger, and manifestations of neurosensory origin were included as a separate entity in the staging, proposed at the Stockholm workshop in 1986. Reduced muscle endurance has long been observed, but only recently has evidence of a local effect been summarized and supported [8,9]. Skeletal disorders have been discussed in relation to vibration exposure, but knowledge is still lacking [10]. At present, there remains a question regarding the influence of vibration on sensory integration in the central nervous system, as indicated by functional magnetic resonance imaging [11]. These results may indicate that not only peripheral structures but also central nervous components are involved. The definition of the syndrome will change in the light of progress, as exemplified in the successive reports from the two Stockholm workshops and the recent Southampton workshop on diagnosis [12]. The claimants in the Armstrong versus British Coal cases were injured at a time when vascular symptoms were identified as the major vibration-related health concern. However, the medical assessment process, under the management of Lawson and McGeoch [5], has been performed when the damage
to neurosensory structures is recognized and accepted. When all the cases are concluded there might well be information on yet other possible dangers related to vibration exposure.

The time window of interest is a further problem. VWF and vibration-related neurosensory disorders may get better, although their prognosis is uncertain. A number of people do recover. For how many years must a person be free from attacks of VWF before the condition can be considered to be in complete remission? The time from exposure termination to possible recovery may differ, and it may also vary between neurological and vascular symptoms.

The possible discrepancy between reported hand problems, impaired function and disability raises the question of whether medical problems can be reduced to something that can be measured using ‘objective’ tests only. In the medical assessment of HAVS, the patient’s history and examination constitute the key to diagnosis [13], even within the framework of new laboratory tests. From a detailed history, a skilled physician can derive clues that indicate the location as well as the pathology of the lesion. Therefore, the physical examination and the laboratory tests should be tailored to correspond to the hypothesis deduced from the history. The decision to administer a given test or manoeuvre is made on the assumption that the results will significantly change the pre-test probability for the diagnosis.

The purpose of each diagnostic test must be considered when evaluating its applicability. Especially in attempting early diagnosis of pre-symptomatic disease, single screening, multiple screening or ‘case-finding’ among workers, any test used must have a high proven validity. The optimal tailored medical assessment needs initially to rule out non-vibration injury cases and ultimately to securely rule in cases of vibration injury. There are various tests which perform these functions but they are not necessarily the same tests. The interpretation of both positive and negative results must come within the concept of the aim to rule the diagnosis in or out.

One way or another, the results will end up classifying some results as ‘normal’ and others as ‘abnormal’. Traditionally, medicine defines normality as a concept based on statistical properties (e.g. mean ± 2 SD). However, the value of diagnostic criteria based on this definition of normality is limited, as diagnosis is also driven by the need to identify individuals likely to benefit from treatment. Advances in therapy make new demands on diagnosis. A thorough knowledge of treatment and management is therefore a requirement for successful diagnosis. Several attempts to highlight the importance of treatment are under way. There will shortly be a report from the workshop in Nancy on treatment and management [14]. The staging of degree of damage according to the Stockholm workshop scale may need revision in the light of new therapeutics and management.

HAVS is a preventable disorder

The most immediate way to improve the health of hand-intensive manual workers using vibrating tools is to launch concentrated efforts to prevent the origin of the syndrome. HAVS is an exposure-related disorder, and as such can be successfully prevented. Several measures have already been taken and more should be encouraged. The European Parliament and Council aim to prevent HAVS by enforcing minimum health and safety requirements regarding hand–arm vibration exposure through the introduction of exposure limit values and action values [15]. The lowest exposure levels for various machines can easily be found from web-based information sources. The exposure levels for various hand-held tools and the levels for whole-body vibration are published on the website of the Swedish National Institute of Working Life [16]. A complete CD tool on vibration management provided by the Health & Safety Executives is also reviewed in this issue of Occupational Medicine (Book Review, p. 344).

A project to develop guidelines for hand-transmitted vibration health surveillance has recently been initiated within the frame of a European Vibration Research Network (EU-programme: BIOMED 4, BMH4-3251-CT98-3251, G-12-SSMI). The guidelines will include sections on current knowledge of hand–arm vibration injuries, prevention measures and health surveillance (pre-employment and periodic medical examinations, screening tests and special diagnostic investigation, medical removal), and a list of relevant references.

A durable, successful policy for both primary and secondary prevention has to be founded on the ability to manage careful clinical assessment with a thorough knowledge of exposure characteristics, diagnostics, prognosis and the necessary knowledge of treatment/management. These are prerequisites for the ability to encourage prevention and manage work-related disorders in a field where knowledge is continuously developing. We may in the future include plasticity changes of the central nervous system, the possible interaction of vibration and stress parameters (load on the autonomic system), stress manifestations, and effects that have hitherto been regarded as local that may turn out to be a general effect of vibration. The contribution from the medical assessment of the British ex-coal workers will provide us with important insights into, for example, prognosis, the effect of tobacco use, the interplay with other diseases and new symptom manifestations. If we do not prevent those injuries that we know about, and have no strategies for dealing with new injury manifestations, the only remaining option is to meet disability claims!
References
1. Hadler N. ‘Primary Raynaud’s’ is not a disease or even a disorder; it’s a trait. *J Rheumatol* 1998;25:2291–2294 [editorial].