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Clinical evaluation of vibration-exposed complainants in field surveys

by Peter L Pelmeur, MD, FFOM, CCBOM¹

PELMEUR PL. Clinical evaluation of vibration-exposed complainants in field surveys. *Scand J Work Environ Health* 13 (1987) 284—285. The time constraints on research workers in the field inevitably limit the depth and quality of evaluations, which have two essential components, a questionnaire on the medical and work history and simple clinical tests conducted within a reasonable time frame. The questionnaire should include subject identification and age, personal and family history, past and present occupational history, and past and present hand-arm symptoms. The clinical tests, following a physical examination of the neck and upper limbs, should seek to evaluate the cardiovascular and neurological systems in the hands and arms. Tests to demonstrate the patency of the major vessels, and the response of the digital vessels following immersion in cold water, are feasible and practical, as are neurological tests to determine skin sensitivity to touch and vibration. Grip strength should be evaluated, as well as hearing loss by audiometry. Some errors in diagnosis occur with the use of such screening tests, but subsequent hospital investigations have usually confirmed their overall reliability. It is concluded that with improved instrumentation the evaluation of vibration-exposed workers at initial and follow-up examinations can only improve, as will the validity of the counseling of workers and machine manufacturers to reduce the risk.

Key terms: audiometry, cardiovascular system, clinical tests, grip strength, medical history, neurological tests, physical examination, questionnaire, work history.

The two essential components of field surveys of vibration-exposed workers are the questionnaire to obtain a medical and work history and simple clinical tests which can be conducted within a reasonable time frame.

History questionnaire

The specific questions of the questionnaire naturally vary to some extent between researchers, but essentially the following items must be covered:

1. Subject identification data including age.
2. Personal and family medical history of, eg, cardiovascular and systemic disease, trauma to hands and upper limbs including frostbite, smoking history, alcohol intake, and drug therapy.
3. Past and present occupational history including periods of vibration exposure and type of tools used, both at work and during leisure time.
4. Past and present hand-arm symptoms, especially cardiovascular, neurological and musculoskeletal symptoms, latent interval of the onset of finger blanch-

ing, extent and progression of symptoms, deterioration or improvement, social and work interference, and helpful or aggravating factors.

From an evaluation of these data, a provisional diagnosis may be made of the cause of Raynaud's phenomenon and its grading.

Clinical tests

In the field situation clinical tests have to be simple, easy to apply, and not very time-consuming. They may include the following:

1. Physical examination of the neck, upper limbs, and hands — noting any restriction of movement, muscle wasting or deformities, and scars from lacerations or surgery.
2. Evaluation of the cardiovascular system:
 - (a) blood pressure;
 - (b) Adson's test to determine the presence of any obstruction of the subclavian artery by the scalenus anticus muscle: deep inspiration and rotation of the neck to the affected side, while the intensity of the radial artery is palpated;
 - (c) Allen's test to determine the presence of occlusive lesions at or distal to the wrist: compression of radial and ulnar arteries, followed by repeated fist contrac-

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tion, then release of compression of one artery at a time;

(d) Lewis-Prusik test to determine impaired peripheral circulation: pressure applied to nail bed for 5 s, any delay in return of color being noted;

(e) palpation of fingers and hands to determine skin temperature and verification of such by thermocouple probe;

(f) cold provocation test — there are many variants regarding the room and water temperatures and the time period for immersion in cold water — the optimum appearing to be a room temperature of 20–23°C, body warming to maintain a skin temperature of 33–35°C, and cold-water immersion of each hand separately at 10°C for 10 min with sphygmomanometer occlusion at 30 mm Hg (4.0 kPa) above the systolic blood pressure at the wrist for the first 5 min — skin temperature being recorded at the fingertips prior to immersion and thereafter monitored during the immersion and for up to 30 min afterwards;

(g) digital pulse pressure measurements with provocative cooling — preferable to indirect skin temperature evaluation of digital circulation but not very feasible for use in field surveys, the field survey limitations also generally excluding the use of thermography and Doppler tests of digital circulation.

3. Neurological tests:

(a) the Tinel and Phalen tests to detect carpal tunnel syndrome, a jerk hammer blow being applied in the Tinel test directly to the carpal tunnel region (tingling along the median nerve distribution being noted, if any) and the wrists being flexed in an elevated position for 3 to 5 min in the Phalen test (median nerve tingling being noted, if any);

(b) esthesiometer two-point and wedge tests carried out with instrumentation designed and described by Carlson et al (1), normal response occurring within a separation of 2.4 mm for two-point width discrimination and a height elevation of 0.2 mm for wedge depth sense discrimination;

(c) thermoesthesiometer tests, temperature probes and Minnesota discs having been used in the past to evaluate temperature impairment but the thermoesthesiometer described by Hirosawa (2) appearing to be more appropriate today;

(d) vibration tests, the instrumentation for which has evolved through numerous prototypes, reliable models now being available.

4. Measurement of grip strength or grasping power by the use of hand dynamometers.

5. Audiometry, manual or self-recording measurement being feasible in field surveys — considered necessary in view of the now established occurrence of hearing loss with vibration exposure.

The esthesiometer and vibration tests can be used with advantage in the field situation but recent vibration exposure can influence the response.

Conclusions

The time constraints imposed on research workers in the field, because of the need to minimize work interference, inevitably limit the depth and quality of the evaluation. Some errors in diagnosis will inevitably occur, but subsequent detailed hospital investigation of the cases has usually confirmed the overall reliability of the screening results. Since most of the test results are dependent on subjective responses, the concurrence between the field and hospital examinations is very much to the credit of the patients that have been examined, and the credibility of the field researchers. With improved instrumentation the evaluation of vibration-exposed workers at initial and follow-up examinations can only improve, as will the validity of the counseling of workers and machine manufacturers to reduce the risk.

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