Treatments for Hand-Arm Vibration Disease in Japan

TSUNETAKA MATOBA AND HIROSHI KUWAHARA*

Department of Environmental Medicine, Kurume University School of Medicine, Kurume, 830 and *Yufuin Koseinenkin Hospital, Oita 879-51, Japan

Received for Publication June 12, 1989

Introduction

The treatments for vibration disease which have been widely employed in Japan were firstly adopted by us in 1973 (Matoba et al. 1975b). It has been called the "Yufuin method". Yufuin Koseinenkin Hospital is situated in the Yufuin basin surrounded by hills and a tall mountain, Yufu-dake, and is famous for the resorts with hot springs. In the summer of 1973, the first 6 patients recognized as having hand-arm vibration disease were admitted to the hospital. In those days the treatment for vibration disease had not been established. After analyzing the history, the symptoms and signs, and laboratory examinations, it was concluded that the symptoms and signs consisted of 3 major disorders, peripheral circulatory and nervous disorders, bone-joint system disorders, and central nervous disorders (Matoba et al. 1975a, 1977a). The central nervous disorders included hearing loss, nystagmus, vertigo, and autonomic nervous disorders. About 60 to 70% of the patients had a mixed type with the 3 disorders. These physical symptoms and signs differed with the severity of the disease, the duration of use of vibratory tools, and the work environmental conditions (Matoba et al. 1975c, 1977b).

Treatments

The treatments that we have used for 15 years are as follows:

1. **Physio-balneotherapy**
   - Therapeutic exercise
   - Exercise in a pool (bath)
   - Physiotherapy
   - Thermotherapy: mineral compress, hot pack, infrared, paraffin bath, contrast bath, vibrabath
   - Massage
   - Low-frequency therapy
   - Traction of cervical or lumbar vertebrae

2. **Drug therapy**
   - Vasodilating drugs
   - Calcium blockers: diltiazem, verapamil, nifedipine
   - Alpha-receptor blockers: prazosin, bunazosin
   - Prostaglandin E₁, dl-α-tocopheryl nicotinate, pentoxifylline, kallikrein
   - Anti-inflammatory analgesic drugs
   - Autonomic stabilizers: ergot alkaloids, γ-oryzanol, sulpiride
   - Hypnotics

3. **Nerve blocking therapy**
   - Stellate ganglion block
   - Major occipital nerve block

4. **Surgical therapy**

5. **Education for patients**

   During physio-balneotherapy, therapeutic exercises, and exercises in a pool (water temperature 38 to 40°C) were provided for all the patients. The other therapies...
were selected according to the patient. When these therapies were continued for long durations, the patients and their wives were educated. The education program included information on the pathophysiology of the disease, the importance of the therapies, and the general management of daily life.

The efficacy of the therapies

Before and after treatment, clinical evaluations were made of the subjective symptoms, physical findings, and laboratory examinations. Twenty-two subjective symptoms, such as Raynaud's phenomenon or numbness of the fingers, elbow pain, stiff shoulders, palmar hyperhidrosis, insomnia, and tinnitus, were evaluated on a 1 to 5 subjective scale (Matoba et al. 1977b). Improvement by two or more steps was considered "effective" therapy. The laboratory examinations were as follows. The peripheral function tests included threshold for vibration sensation, threshold for pain, a cold provocation test (one hand immersed up to the wrist in cold water at 10°C for 10 min, after which rewarming rates were measured at 5 and 10 min), grip strength, and a finger tapping test (tapping with one finger for 30s). Electrocardiograms, electroencephalograms (Matoba et al. 1975a, 1977a), autonomic nerve function tests using digital plethysmography with auditory stimuli (Matoba et al. 1975d, 1981b), auditory acuity, and radiographs of cervical and lumbar vertebrae, elbow joints, and hands were examined. Blood chemistry, blood cell counts, and urinary examinations were also included. The findings were evaluated by the physician using the five-step method.

Physiobalneotherapy

Physiobalneotherapy is the key treatment for vibration disease. It affects the whole body and leads to an improvement of the circulatory, nervous, and motor disorders due to an enhancement of blood flow in the injured tissues. When the therapeutic exercise and exercise in a pool are done in a group, the therapy exerts a psychologically favorable influence on the patients (Fig. 1).

Sixty in-patients with vibration disease were divided into two groups matched for age and occupational experience. One group (P) received only physiobalneotherapy and the other group (D) was given a vasodilator, orally, in addition to physiobalneotherapy. The six week double-blind controlled trial showed that the improvement rates for the subjective symptoms and the laboratory examinations were 40 and 33%, respectively, for group P and 83 and 63%, respectively, for group D (Matoba et al. 1977b).

Fig. 1. Therapeutic exercises and exercising in a pool were performed by all the patients.
Drug therapy

Drug therapy may accelerate the effects of physiobalneotherapy (Matoba et al. 1977b, 1985). The improvement rate for the drug therapy ranged between 50 and 80%. For example, dl-α-tocopheryl nicotinate gave an improvement rate of 83% and diltiazem had an improvement rate of 65% (Matoba et al. 1977c, 1985). As the severity of the disease became worse, the value of drug therapy increased (Matoba, 1977c) (Fig. 2).

Nerve block therapy

Stellate ganglion block by procaine was conducted to relieve tinnitus. Empirically, the prevalence of tinnitus in patients with vibration disease was approximately 40%. The improvement rates produced by stellate ganglion block for tinnitus was 63% by self-assessment and 69% by audiometric assessment. The hearing acuity recovered partially and was associated with good or partial relief of tinnitus. Eighteen months of follow-up revealed excellent or good relief of tinnitus in 42% of the patients. The mechanism of stellate ganglion block for the relief of tinnitus appears to be due to the vasodilation from the suppression of sympathetic nerve activity (Matoba et al. 1984).

The comprehensive efficacy

When the severity was classified into four stages, as assessed by the 3 disorders (Matoba et al. 1975c), a poor efficacy was observed for patients in stage III or higher (Fig. 3). It was impossible for them to return to work. Neuroticism (as tested with the Cornell Medical Index) was observed in 33% of the patients, but depression occurred in only a few (Matoba et al. 1975a).

Prognosis

The prognosis following comprehensive therapy in the hospital was "good" for 13%, "good with therapy" for 63%, "fair with therapy" for 15%, and "poor despite therapy" for 9% of the patients during the five to seven years of follow-up (Matoba et al. 1981b). Of the patients with a protracted course of the disease, 26% suffered from hypertension, 9% from hyperglycemia, 11% from abnormal ocular signs in stage II or more in the Keith-Wagener’s classification, and 17% from gastric or duodenal ulcers and other diseases.

Conclusion

Combination therapy including physio-

Fig. 2. The relationship between the severity of the disease and the therapy. As the severity became worse, the importance of drug therapy increased.

Fig. 3. The efficacy of therapy during 3 months of hospitalization. The more severe the disease was, the poorer the recovery rates were.
therapy, balneotherapy, and drug therapy can be effective in the treatment of patients with vibration disease. However, a beneficial effect may not occur in a short period. In general, the clinical course of severe cases of vibration disease is protracted. The patients should be carefully examined for diseases other than vibration disease, and also meet with the physician frequently because a third of the patients have neurotic or near neurotic scores on the Cornell Medical Index.

References