Rheological and immunological findings in dockers with vibration-induced white fingers

Kjell Torén, Mats Berg, Magnus Gudmundsson, and Andrzej Tarkowski

1 Department of Occupational Medicine, Sahlgrenska Hospital, St. Sigfridsgatan 85, S-412 66 Göteborg, Sweden
2 Götaverken Företagshilsovärd AB, Box 8713, S-402 75 Göteborg, Sweden
3 Department of Rheumatology, Sahlgrenska Hospital, S-413 45 Göteborg, Sweden
4 Department of Clinical Immunology, Sahlgrenska Hospital, S-413 45 Göteborg, Sweden

Summary. The aim of the present study was to characterize rheological and immunological features involved in the pathogenesis of vibration-induced white fingers (VWF). Plasma viscosity, at two shear rates (580 s⁻¹ and 1164 s⁻¹), levels of immunoglobulins (IgG, IgM, IgA), circulating immune complexes, rheumatoid factor, antinuclear antibodies, fibronectin, fibrinogen, hemoglobin and erythrocyte sedimentation rate were analysed in 30 male dockers with VWF and in 30 healthy male referents unexposed for hand-arm vibrations. Decreased plasma viscosity was observed among the men with VWF, although formal significance (P < 0.05) was only obtained at shear rate 580 s⁻¹. The decrease was mainly seen among smokers. In the study there were no significant differences between the VWF group and the referents with regard to immunoglobulin levels, autoantibodies and other plasma proteins. From the study it is concluded that workers with VWF may have a decreased plasma viscosity. The biological relevance of this observation is uncertain and deserves further study.

Key words: Vibration syndrome – Raynaud’s phenomenon – Plasma viscosity – Immunoglobulins – Smoking

Introduction

Among workers with long-term exposure to hand-arm vibrations the occurrence of Raynaud’s phenomenon is known as vibration-induced white fingers (VWF). The pathogenetic mechanism of this disease is still uncertain and many theories have been proposed. There are reports on increased whole blood viscosity in subjects with VWF [14, 17] and in patients with Raynaud’s phenomenon due to other causes [5]. Concerning plasma viscosity there are two studies with divergent results on subjects with VWF [14, 17]. Some plasma proteins, especially IgM and fibrinogen, are important determinants of plasma viscosity. There are studies indicating that VWF is associated with slightly increased levels of immunoglobulins [9, 13], but others have not reproduced these findings [3, 4, 8].

During recent years a moderately increased concentration of IgM was observed among the VWF patients referred to our Department of Occupational Medicine. Considering the studies mentioned above, a study was designed to further elucidate the pathogenesis of VWF with respect to analysis of viscosity and immunological parameters. The study was performed on two groups, one with VWF and one consisting of healthy referents not exposed to hand-arm vibrations.

Subjects and methods

Selection of the VWF group. The study was carried out at one of the shipyards in Göteborg, Sweden. In a healthy survey, 77 dockers reported that they suffered from cold-induced white fingers. Sixty-seven of them accepted a clinical investigation where the subjects were classified according to the Stockholm Workshop scale for the classification of cold-induced Raynaud’s phenomenon in the hand-arm vibration syndrome [9]. In that examination, 46 were classified as suffering from cold-induced Raynaud’s phenomenon (≥ stage 1). Further investigation with measurement of digital systolic blood pressure after segmental finger cooling [10] was accepted by 40 men. A positive test (more than 70% decrease in the systolic blood pressure after local finger cooling) was obtained in 34 men and a negative test in six men. All men with a positive test and exposure to hand-arm vibration for more than 5 years were selected to form the VWF group. Thirty men fulfilled these criteria. Their occupations were welders (n = 10), platers (n = 10), plumbers (n = 5), repairmen (n = 3), carpenter (n = 1) and engraver (n = 1).

Selection of the referents. As referents 30 men (foremen and office workers) were selected from the same shipyard. The referents were healthy, i.e. had no signs of interfering disease or Raynaud’s phenomenon, and they were unexposed to hand-arm vibrations. The characteristics of the two groups are shown in Table 1.

Laboratory investigations. From all subjects samples for analysis of blood, plasma and serum were obtained. The samples for plasma were obtained in containers treated with ethylenediamine-tetra-
Plasma viscosity among male dockers with VWF has been investigated in two previous studies [14, 17]. In the first study [14] there were no significant differences in plasma viscosity measured at 10°C and 37°C and shear rate.