Exercise limitation in systemic sclerosis: a case-controlled study

INTRODUCTION: Interstitial lung disease and pulmonary hypertension are the leading causes of morbidity and mortality in patients with systemic sclerosis (SSc). Exercise-induced dyspnea is the first manifestation of both complications, which explains why the value of resting tests to predict preclinical heart or lung involvement is limited. Cardiopulmonary exercise testing (CPET) offers a comprehensive approach to identify the cause of exercise limitation. However, the role of CPET in SSc patients without demonstrated cardiac and/or respiratory disease has not been extensively investigated.

AIM: We sought to compare the cardiopulmonary adaptation to exercise of SSc patients without cardiac or pulmonary disease vs healthy volunteers.

METHODS: SSc patients (normal resting echocardiography and pulmonary functional test) and healthy volunteers were prospectively enrolled. They underwent maximal symptom-limited CPET, exercise echocardiography (EXEcho), and 6 minutes walk test. Results were compared after adjustment for age and gender.

RESULTS: Thirty-nine patients (54±12 years) and 43 healthy subjects (46±11 years) were included. Workload was lower in patients than controls (84±42 vs 178±58 W, p<0.001), with similar respiratory exchange ratio (1.27±0.11 vs 1.28±0.10, p=0.570) at peak exercise. Patients had lower oxygen uptake (VO2) at peak exercise (17±8 vs 30±8 ml/min.Kg⁻¹, p<0.001) than controls (Figure 1). They had higher VE/VCO2 ratio (40±7 vs 30±3, p<0.001) and lower end-tidal pCO2 (PetCO2) (35±5 vs 41±3 mmHg, p<0.001) at the ventilatory threshold (VT). Respiratory reserve was preserved, and peripheral oxygen saturation was normal at peak exercise in both groups.

Resting echocardiography revealed larger left atrium in SSc-patients (24±8 vs 20±7 ml/m2, p=0.013) and higher estimated left atrial pressure (LAP) (10±2 vs 8±2 mmHg, p=0.001) vs controls. At ExEcho, total pulmonary resistance (TPR) was higher (3.2±0.6 vs 2.6±0.5 WU, p=0.003) and right ventricular function markers were lower at peak exercise in patients vs controls, despite similar values at rest. Plasma NT-proBNP was within normal range in all patients.

Walk distance was shorter in SSc-patients vs controls (505±80 vs 624±50 m, p<0.001), and correlated with peak VO2, VE/VCO2 slope, and VE/VCO2 at VT.

CONCLUSION: The combination of low peak VO2, high VE/VCO2 slope, low PetCO2, and high respiratory reserve suggests that patients with SSc, without overt cardiac or respiratory disease, present with...
cardiovascular limitation to exercise. This may be related to latent cardiac dysfunction or pulmonary vascular disease.