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Title: Physiologic responses to the incremental shuttle-walk test in adolescents with idiopathic scoliosis

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Body: Exercise limitation has been described in patients with adolescent idiopathic scoliosis (AIS). However, whether the walking performance is impaired in these patients should be elucidated. We aimed to evaluate physiologic responses to the incremental shuttle-walk test (ISWT) in patients with AIS. Twenty-nine patients with AIS and 20 healthy adolescents aged 10-18 years performed two ISWT. During the second test, oxygen uptake (VO_2), CO_2 production (VCO_2), ventilation (VE) and heart rate (HR) were continuously monitored. We assessed the following rates of changes during the ISWT: $\Delta VO_2/\Delta$walking-velocity, $\Delta HR/\Delta VO_2$, $\Delta VE/\Delta VCO_2$, and linearized Δtidal-volume (VT)/ΔlnVE. Forced expiratory volume in 1s (FEV_1) and forced vital capacity (FVC) were also assessed. Patients with AIS showed significant lower values of incremental shuttle-walk distance (ISWD: 498 ± 144 vs. 604 ± 85 m), peak VO_2 [median (interquartile range), 25 (21-27) vs. 28 (24-33) mL/min/kg], peak VE (43 ± 16 vs. 52 ± 14 L/min) as well as lower FEV_1 [2.77 (2.48 to 3.17) vs. 3.33 (3.16 to 3.81) L] and FVC (2.51 ± 0.68 vs. 2.94 ± 0.66 L). Patients also presented significant shalower slope of $\Delta VT/\Delta lnVE$ (0.32 ± 12 vs. 0.45 ± 16), i.e., worse breathing pattern during exercise. In patients, peak VO_2 correlated significantly with ISWD (r = 0.80), FVC (r = 0.78), FEV_1 (r = 0.73) and $\Delta VT/\Delta lnVE$ (r = 0.58). We conclude that patients with AIS present significant walking limitation due to impaired pulmonary function and breathing pattern during exercise. This impairment may partialy explain the reluctance of patients with AIS to perform exercises. Thus, walking-based aerobic exercises should be encouraged in these patients.