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SJSU Undergraduate Research Grants

Vascular Response to Dynamic Exercise in Adults with Cerebral Palsy

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Abstract

Introduction: Cerebral palsy (CP) is a non-progressive and permanent neurological disorder leading to musculoskeletal dysfunction and immobility. A major clinical problem with CP is early development of cardiovascular diseases with increased rates of mortality. Due to the inevitability of motor dysfunction adults with CP can develop health risk factors, such as obesity and hypertension, at a higher rate compared to the general population. To date, the physiological basis for CP has not been established; how cardiovascular dynamics, such as heart rate (HR), blood pressure (BP), and blood flow (BF), are controlled in individuals with CP has never been identified.

Purpose: To determine differential cardiovascular responses to acute dynamic exercise in adults with CP.

Methods: Total of ten adults with and without CP participated in the study. HR from ECG, beat-to-beat arterial BP from Finapres and brachial BP, and respiration via mechanical pneumobelt were continuously measured before, during and after 3 minutes of handgrip exercise at 35% and 50% of maximal voluntary contraction. In addition, diameter, blood velocity, and flow of the brachial artery were measured using Doppler ultrasound on the contracting arm throughout the experiment.

Results: HR was significantly increased to exercise from rest in both groups with no group differences (Δ9.8±1.2 control vs. Δ10.1±8.4 CP, bpm). Both control and CP groups had increases in BF during exercise compared to at rest (Δ132±22 control vs. Δ75±32 CP, ml/min). Mean BP was significantly increased to exercise from rest in control; however, there were only minor changes in BP to exercise from rest in CP group (Δ7.2±1.6 control, Δ2.2±0.1 CP, mmHg).

Conclusion: While HR and BF increased to exercise from rest in similar fashion, BP did not change to exercise in adults with CP. Our preliminary data speculate that other mechanisms, possibly vascular contribution from non-contracting limbs, may contribute to impaired BP response during exercise in CP.

Findings

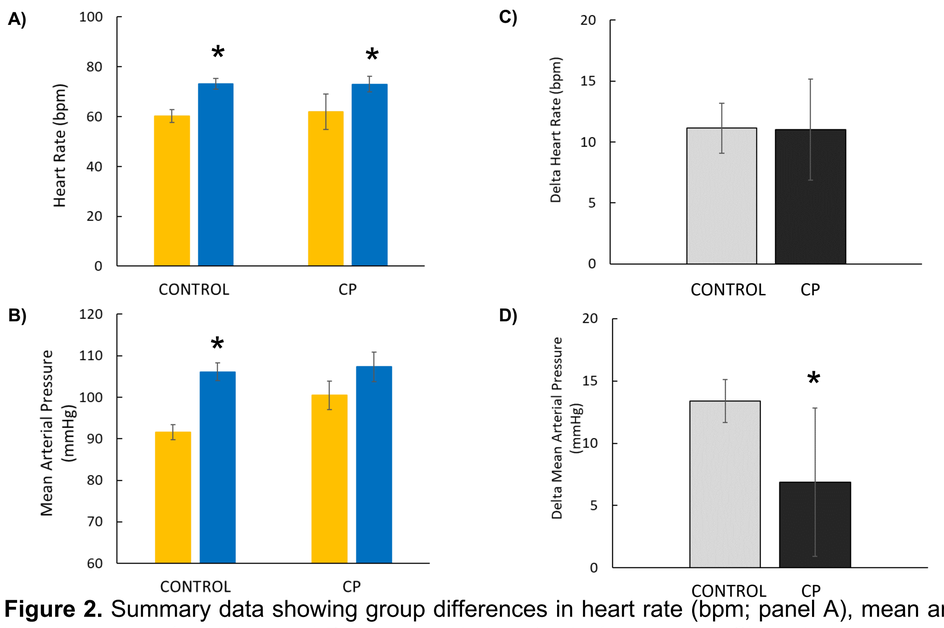

Figure 2. Summary data showing group differences in heart rate (bpm; panel A), mean arterial blood pressure (mmHg; panel B), changes in heart rate (bpm; panel C), and changes in mean arterial blood pressure (mmHg; panel D) in a resting condition **(ORANGE)** and during exercise **(BLUE)** in control and CP. * represent P<0.05 vs. Rest.

Methods

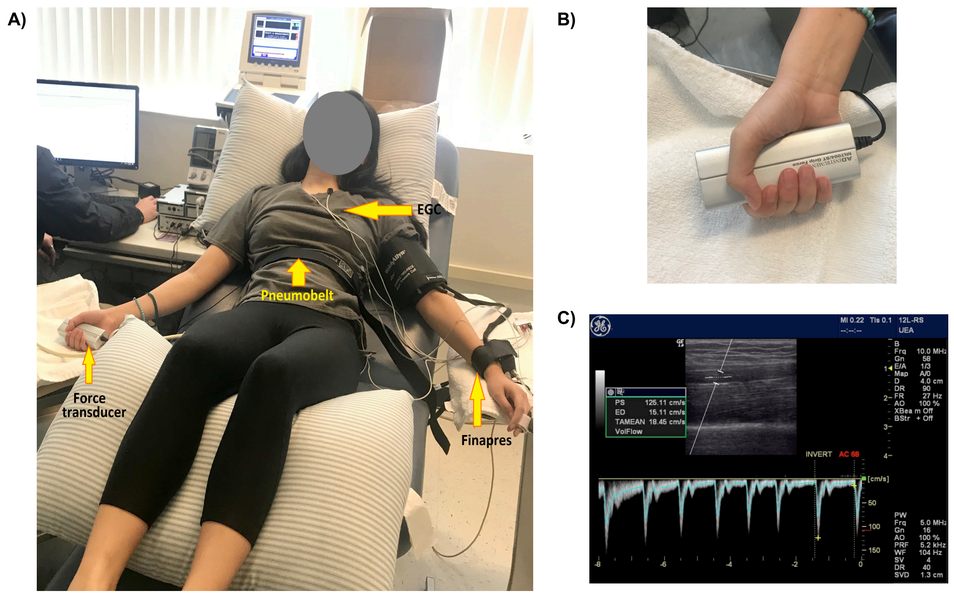

Figure 1. Experimental set-up for overall cardiovascular measurements (panel A), force transducer (panel B) for handgrip exercise, and blood flow velocity recording from Doppler ultrasound (panel C).

Findings

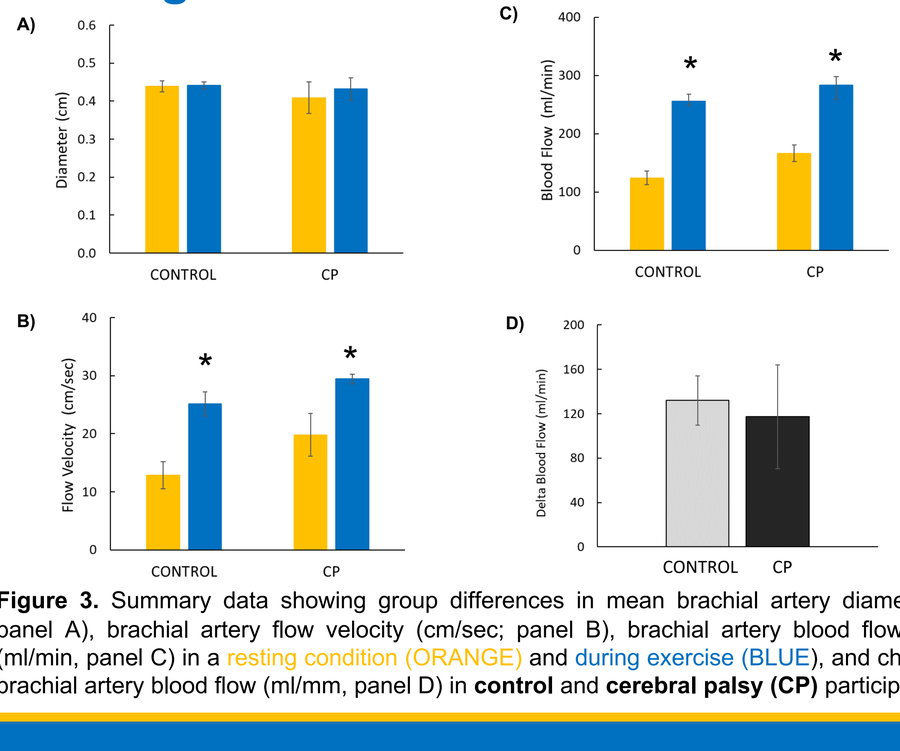

Figure 3. Summary data showing group differences in mean brachial artery diameter (cm; panel A), brachial artery flow velocity (cm/sec; panel B), brachial artery blood flow volume (ml/min, panel C) in a resting condition (ORANGE) and during exercise (BLUE), and changes in brachial artery blood flow (ml/mm, panel D) in **control** and **cerebral palsy (CP)** participants.

Research Questions

1. Will adults with CP have other impaired cardiovascular (such as SV, BF from non-contracting limbs) responses to acute exercise?
2. Will adults with CP have higher total peripheral resistance from non-contracting limbs?
3. Will exercise training alter any changes in cardiovascular system in adults with CP?

Citations

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