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Maximal Oxygen Consumption Recovery Delay in a Fontan Population

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Maximal Oxygen Consumption Recovery Delay in a Fontan Population

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Describe role of Submitting/Presenting Trainee in this project (limit 150 words): I'm the primary author. I formatted the data for analysis, worked with my mentors to analyze it, and wrote the abstract.

Background, Objectives/Goal, Methods/Design, Results, Conclusions limited to 500 words

Background: Single ventricle patients palliated with the Fontan operation are subject to progressive cardiovascular deterioration during adolescence into young adulthood. This deterioration coincides with declining exercise capacity. Maximal oxygen consumption (VO_{2peak}) less than 50% of predicted is an independent predictor of Fontan morbidity/mortality. In adults, increased post-exercise oxygen uptake recovery delay (VO_{2RD}), a novel index of impaired cardiac reserve capacity and predictor of outcome, was associated with worse heart failure outcomes. VO_{2RD} has not been a routine assessment parameter in pediatrics.

Objectives/Goal: The purpose of this study is to determine the relationship of VO_{2RD} on markers of exercise capacity in the Fontan patient.

Methods/Design: Participants ($n=26$; 9-18years; Male=19, Female=7) with Fontan physiology completed a peak exercise study utilizing a cycle ergometer James protocol. VO_2 was measured continuously during the test and peak effort was defined as achieving an $RER \geq 1.1$. VO_2 Work was defined as the slope of the relationship between VO_2 and work (Watts) during loaded exercise. VO_{2RD} was defined as the time (seconds) VO_2 permanently fell below 90% of VO_{2peak} in immediate recovery. Pearson correlations between VO_{2RD} , VO_{2peak} and VO_2 Work were performed. VO_{2peak} and VO_2 Work were compared between VO_{2RD} fast ($<25sec$; $n=10$) and slow ($>25sec$; $n=16$) groups utilizing Kruskal Wallis test.

Results: VO₂peak was highly variable (~2.5-fold; mean 1.4L/min; range 0.9-2.1 L/min) in the entire cohort with a majority of the participants achieving >50% predicted VO₂peak (n=23). VO₂ work slope was variable in the cohort (~2.5-fold; mean 104.9; range 54-126.6). VO₂RD was variable in the cohort (mean 24 seconds; range 0-55). VO₂ % predicted correlated with age (R²= -0.16, p=0.04). Only mild negative correlation between VO₂peak and VO₂RD (R²=0.16, p=0.04) and no correlation between VO₂ Work and VO₂RD was observed (R²= 0.05 p=0.81). However, those with fast VO₂RD had significantly higher VO₂peak compared to slow VO₂RD (1.5±0.3 vs. 1.2±0.2 L/min; p=0.03).

Conclusions: VO₂RD was significantly associated with exercise capacity (VO₂peak) in the Fontan population and is an additional parameter that should be considered in their exercise evaluation. Only 3 participants in our cohort were below the established VO₂peak threshold (<50%) associated with poor outcomes. Therefore, additional metrics of exercise capacity are needed with exercise testing analysis in Fontans. Future investigations correlating clinical status (quality of life metrics, echocardiographic function) to VO₂RD are needed to ascertain if VO₂RD predicts outcomes in Fontan patients with VO₂peak > 50%.