Title: Reduction of Hemodialysis Induced Circulatory Stress through Intradialytic Exercise

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Structured Abstract:

Introduction: Cardiovascular disease (CVD) has been well documented as the leading cause of death in the general population worldwide. Physical activity is a modifiable factor in the development and progression of CVD reducing its incidence by 42-44% and reducing mortality and hospital admissions. The presence of chronic kidney disease (CKD), and the recurrence of cumulative circulatory stress caused by hemodialysis (HD) increases the risk of CVD, myocardial stunning, morbidity and mortality. We aim to assess the effect of intradialytic cycling on myocardial stunning in HD. We hypothesized that, through increased cardiac output, intradialytic cycling would provide protection against HD-induced cardiac injury, resulting in fewer regional wall motion abnormalities (RWMA) at peak HD stress.

Methods: 24 adult patients participating in a clinical intradialytic cycling program were recruited of which 19 were evaluated over 2 HD sessions using echocardiography. The control session involved no exercise and the exposure session incorporated the participant's usual intradialytic cycling. Echocardiography was performed, pre-HD, post exercise (or at the same time point for control visit), and at peak HD stress for each visit. Longitudinal strain (LS) values for 12 left ventricular segments were generated using speckle-tracking software [EchoPac, GE], to assess the presence of HD-induced RWMA, indicative of myocardial stunning (>20% reduction in LS in two or more segments).

Results: Mean age was 57.2 and participants were 42% female with median dialysis vintage of 3.8 years. The number of stunned segments at usual exercise time was 4.5 ± 2.6 in control and 3.6 ± 2.7 with exposure, respectively; p=0.168. The number of stunned segments at peak HD stress was 5.8 ± 2.7 in control visit and 4.0 ± 1.8 in exposure visit, respectively; p=0.012. Mean change in number of stunned segments post exercise between control and exposure sessions was -0.95 ± 2.9. Similarly, mean change in number of stunned segments at peak HD was -1.8 ± 2.8.

Discussion: In this observational study, intradialytic exercise significantly reduced HD-induced RWMA. Intradialytic exercise is an easily implementable and safe intervention that has the potential to reduce myocardial stunning in the prevalent HD population. We plan to build on these results assessing RWMA with a non-exercise HD treatment compared to a HD session with exercise. We will obtain echocardiograms pre HD, peak stress and post HD (recovery), we will also assess CT based myocardial perfusion at the same time points for comparison. Additionally, we will be using non-invasive hemodynamic monitoring device that provides patient-specific assessment of cardiovascular stress using a forehead pulse oximeter and proprietary algorithms. In previous work done, we have found outputs to correlate with HD-induced myocardial stunning.