Muscle Damage in Hind Limb Ischemia Murine Model of PAD

Lindsey Carson

College of Engineering

Abstract: Peripheral Artery Disease (PAD), defined as atherosclerotic blockages of the arteries supplying blood to the lower extremities, becomes more common with age and produces a considerable public health burden. PAD produces a progressive accumulation of ischemic injury to the muscles cells, nerves, skin and subcutaneous tissues of the leg. At the level of the skeletal muscle cell, this injury includes altered metabolic processes, damaged organelles, and compromised bioenergetics. High variation in PAD patient clinical presentations complicate the study of skeletal muscle damage. PAD patients have high variation in their clinical presentation, disease severity, and differ greatly in comorbidities. This research studied the muscle pathology in the absence of this high variation of comorbidities by using a hind limb ischemia mouse model of PAD. The objective of this study was to identify novel Raman micro-spectral biomarkers which may characterize biochemical alterations in the diseased muscle and complement existing methods for diagnosis and monitoring of PAD patients. Eight mice had their left femoral artery ligated and a sham procedure on the right limb. The mice were allowed to live for 14-30 days before excision of the gastrocnemius muscle and euthanasia. The harvested muscle was analyzed using Raman micro-spectroscopy. Statistical analysis of the muscle tissue Raman spectra included a paired t-test, principal component analysis and discriminant analysis. Significant differences ($p<0.05$) in spectral peaks were found in the finger print region of the spectra using a paired t-test. Fishers Linear Discriminant analysis on the first principal component was able to correctly classify the ischemic and control muscle tissue with 100% accuracy. The Raman spectral profiles showed a consistent difference between the ischemic and non-ischemic muscle tissue. Raman micro-spectroscopy may provide a novel method of label-free tissue analysis and has the potential to aid in diagnosis and treatment monitoring of PAD patients.

Faculty Sponsor: Kim Cluff