Characterization of Vascular Responses to Mechanically Induced Continuous Flow Patterns in Bovine Models

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Recently, Continuous Flow (CF) Left Ventricular Assist Devices (LVAD) have emerged as a long term alternative to heart transplant in heart failure patients. However, CF VAD support diminishes pulsatility, and current technology produces non-physiologic continuous flow rather than physiologic pulsatility. Despite recorded incidence of end-organ complications associated with long-term CF VAD support, vascular responses to CF have not been investigated. Therefore, the purpose of this project was to characterize the effects of reduced pulsatility upon the vasculature and to investigate LVAD flow modulation as a potential mechanism to provide a physiologic pulse, based upon the parameters found in the vasculature. Bovine carotid arteries from acute LVAD, chronic LVAD, and acute HF calves were acquired and stained with a Masson Trichrome stain. To quantify parameters in the vasculature including vessel thickness and collagen to elastin ratio, ImageJ protocols were developed. Elevated collagen content and increased vessel thickness were found in carotid arteries of chronic and HF calves, which may be detrimental to future VAD operation. Additionally, investigation of flow modulation evidenced that these algorithms can produce physiologic pulsatility by varying rotor speed. Flow modulation algorithms may establish CF LVADs as a safe alternative to Heart Transplant.

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