BIOMEDICAL SCIENCES PhD PROGRAM

Dr. Mill W. Miller, Director, 114 BS I, 775-2504

DISSERTATION DEFENSE

YIRONG ZHOU

PhD Candidate

"Left Ventricular Dynamics and Pulsatile Hemodynamics during Resuscitation of the Fibrillating Heart Using Direct Mechanical Ventricular Actuation"

Monday, December 10th, 2018

12:30p.m.

NEC Auditorium (Room 101)

Advisor: Mark P. Anstadt, MD
Department of Surgery

Wright State University | Biomedical Sciences PhD Program

Zhou, Yirong, Biomedical Sciences PhD Program
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The application of mechanical forces during resuscitation of the arrested heart can be used to restore life-sustaining circulation. Open-chest manual massage represents the earliest application of this concept (first described by professor Moritz Schiff in 1874). Many cardiac compression devices have been developed for cardiac support since that time. Direct mechanical ventricular actuation (DMVA) is a non-blood-contacting device that has demonstrated efficacy of providing both systolic and diastolic support. The device encompasses the heart and can provide total circulatory support during ventricular fibrillation (VF) or cardiac arrest. DMVA resuscitative support during VF has been shown to be nontraumatic to the myocardium. Notably, resuscitative support using DMVA has the advantage of generating pulsatile flow without blood contact which benefits vital organ perfusion and post-resuscitation neurological outcome. However, ventricular and blood flow dynamics during DMVA support have not been well characterized. Specifically, it remains unclear if DMVA support during VF generates ventricular pump function mimicking the native beating heart, or pulsatile flow characteristics similar to the physiological state. The purpose of this dissertation was to better characterize these fundamentals. Experimental data herein demonstrate that DMVA support during VF arrest can result in LV pump function similar to the native beating heart and near-physiological pulsatile flow dynamics. The physiological pulsatile flow generated by DMVA may explain DMVA's capability for improving resuscitation results. A biventricular mock circulatory system (BMCS) incorporating an anatomical mock ventricle provided supportive *in vitro* data to further confirm these findings.