**Project Title:** Lactate Levels in Cardiac arrest  
**Student Name:** None at this time  
**Faculty Mentor Name:** Christine Van Dillen and Karl Huesgen  
**Research Protocol Review Status:** submitted and revisions are actively being made for re-submission (HuesgenK_OHCA_ROSC_67069230)  
**Background and Significance:** Lack of oxygen during cardiac arrest forces cells to perform anaerobic (without oxygen) rather than aerobic (with oxygen) respiration. Anaerobic respiration produces lactic acid (also known as lactate) which can be measured in blood samples. While lactate is not directly toxic, elevated blood lactate level can be used as a surrogate marker for cumulative hypoxic damage. This is because after prolonged periods without oxygen, such as during cardiac arrest, all cells will eventually sustain terminal damage or initiate apoptotic cellular self-destruction mechanisms. Clinically, this damage manifests as varying degrees of organ failure and ultimately patient death. Thus, even if the heart can be restarted after cardiac arrest (known as Return of Spontaneous Circulation; ROSC), patients often sustain severe or terminal organ and brain damage. Previous in-hospital research has shown that blood lactate level can accurately predict morbidity and mortality after cardiac arrests (3, 5). However, to date there have been no studies of whether prehospital lactate levels after Out-of-Hospital Cardiac Arrest (OHCA) correlate with subsequent clinical course.  
**Hypothesis and Rational:** Our hypothesis is that increasing blood levels of lactate in patients with OHCA will predict clinical outcomes. Specifically, we anticipate that patients with high prehospital blood lactate levels after OHCA/ROSC will have significantly lower rates of survival to hospital admission and survival to hospital discharge. We also anticipate that surviving patients with initial high blood lactate levels will have significantly higher rates of severe neurologic impairment than those with lower levels.  
**Specific Aims:** In our prospective observational study we will measure and record prehospital blood lactate level for all non-traumatic cardiac arrests patients in Alachua County, FL, for whom resuscitative measures are initiated. Patients’ subsequent hospital course will be followed, specifically noting whether each patient survives to reach the Emergency Department (ED), survives to hospital admission from the ED, or survives to hospital discharge. In patients surviving to hospital discharge, the presence or absence of severe neurological impairment will also be recorded. Data will be analyzed to determine whether rising prehospital lactate level correlates significantly with subsequent clinical course.  
**Methods and Materials:** When paramedics are called to the scene of a cardiac arrest, paramedic protocols will include measurement of venous
blood lactate into the standard resuscitation protocols. Of note, Alachua County paramedic basic medical and cardiac arrest protocols already include obtaining intravenous access and measurement of blood glucose. Other protocols include measurement of blood lactate in cases of suspected sepsis. Thus, blood lactate measurement after cardiac arrest does not entail any additional invasive procedures, minimal additional paramedic training, and no need for additional purchase of equipment. Currently we measure levels via a handheld device known as a Lactate Plus. Lactate levels will be documented by the paramedic on scene into preexisting EMS documentation software (EMSPro). Another lactate level will be obtained at the ED and documented in the hospital record (EPIC system). At a later date chart reviews will record prehospital and ED lactate levels as well as outcomes including survival, death, withdrawal of care, and presence or absence of severe neurological impairment in survivors.

**Plan for Data Analysis:** Data analyses will include prehospital lactate levels for all non-traumatic OHCA patients with prehospital initiation of resuscitative measures. Measured lactate average and standard deviation will be calculated for each group. Groups will include (A) OHCA without ROSC, (B) OHCA, ROSC, survival to ED but not hospital admission, (C) OHCA, ROSC, survival to hospital admission but not discharge, (D) OHCA, ROSC, survival to hospital discharge, with severe neurological damage, (E) OHCA, ROSC, survival to hospital discharge, without severe neurologic damage, and (F) OHCA, ROSC, and withdrawal of care. Data will be analyzed to determine whether statistically significant differences exist between groups. A receiver-operator curve will be developed, and threshold lactate levels above which (A) universal non-survival and (B) universal severe neurologic injury will also be calculated.

**Role of Medical Student:** The student will be responsible for chart review and data entry of both the EMS and EPIC records into REDCAP. The student will also participate in writing up the project in journal submission format and present the project as a poster at the completion of the MSRP.

**References:**


