CANCER PREVENTION & RESEARCH INSTITUTE OF TEXAS

Award ID:
RP180404

Project Title:
Noninvasive detection of anthracycline induced cardiotoxicity using hyperpolarized carbon 13 based magnetic resonance spectroscopic imaging

Award Mechanism:
Individual Investigator Research Awards for Clinical Translation

Principal Investigator:
Zaha, Vlad

Entity:
The University of Texas Southwestern Medical Center

Lay Summary:

More than 20 million cancer survivors will live in The Unites States in 2026 by American Cancer Society estimates. Conventional chemotherapy, such as the anthracycline doxorubicin, results in a more than 15-fold increase in the risk of heart failure in long term cancer survivors. However, the individual sensitivity to anthracycline induced cardiotoxicity cannot be currently predicted. Anthracyclines can damage mitochondria, the subcellular structures that generate energy for heart contraction. This damage results in a deleterious cellular energetic flux imbalance and can activate programmed heart muscle cell death. New technology has been developed that allows to detect these cellular biochemical changes noninvasively in the heart using dynamically hyperpolarized carbon 13 labeled pyruvic acid, a natural metabolite of glucose (Cunningham CH et al, Circ Res, 2016). Our group at UT Southwestern Medical Center has extensive expertise in advanced investigations of heart metabolism and is the first in the United States to apply this novel methodology for heart studies using a clinical research grade infrastructure, as shown by our preliminary data. Anthracyclines are part of several cancer treatment protocols and are used in more than 30% of breast cancer patients. Due to the prevalence of this clinical need and the demonstrated health impact for patients of early identification and treatment of cardiotoxicity, we propose to study changes in the flux of [1-13C]pyruvate in the heart in the course of clinical administration of anthracycline anti-cancer therapy in patients with breast cancer. We will study the correlation of these changes with deposition of fatty acids in the heart and with changes in the global metabolic environment reflected in the blood. We will integrate this analysis with clinical visit data and guideline directed serial measurements of heart function by echocardiography and MRI to establish a personalized profile of early detection of cardiotoxicity.