

Hematological and Inflammatory Biomarkers Associated with Pain in Sickle Cell Disease

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Background and Objective:

Pain is the hallmark of sickle cell disease (SCD). Clinically, SCD is characterized by a steady-state phase with chronic pain and a vaso-occlusive crisis (VOC) phase marked by unpredictable, severe pain episodes often requiring hospitalization and opioids. VOCs, caused by the adhesion and obstruction of sickled red blood cells in microvasculature, are among the most debilitating manifestations of the disease. VOCs have four clinically defined phases: prodromal, initial, established, and resolving. We observed abnormal elevation of inflammatory biomarkers in SCD compared to healthy controls at baseline and changes throughout the VOC stages. The goal of this exploratory project of our clinical trial (ClinicalTrials.gov ID: NCT05045820) is to evaluate the inflammatory biomarker-based immunological mechanism associated with pain and acupuncture analgesia in SCD.

Methods:

Peripheral blood samples are collected at baseline and at each VOC phase. Hematological testing (complete blood count with white blood cell differential, hemoglobin electrophoresis, and reticulocyte count) is performed while serum, plasma, and peripheral blood mononuclear cells are simultaneously isolated, aliquoted, and stored for future analyses. Inflammatory markers are assessed with immune assays and cell activation analyses. Patient-reported outcome measures are collected using validated instruments to assess pain, neuropathic symptoms, physical dysfunction, emotional well-being, and quality of life. Samples and data are collected before, during, and after the treatment.

Results:

Our published results have demonstrated significant differences in patient-reported outcome measures and hematological and inflammatory biomarkers in SCD as compared to healthy controls. Additional analytical work is ongoing.

Conclusion and Potential Impact:

Published and preliminary data demonstrate robust clinical outcomes of acupuncture treatment and biomarker-based mechanistic findings related to inflammation in SCD. This project has strong clinical relevance as it investigates biomarker-based mechanisms of pain in SCD and aims to identify therapeutic targets to improve pain management and quality of life.