Longitudinal Characterization of Hemodynamic Changes with Multimodal Optical Techniques in Patients with Sickle Cell Disease Treated with Mitapivat

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Background

- There is an unmet need for robust, point-of-care technologies that can assess tissue hemodynamics influenced by treatments for sickle cell disease (SCD).
- Mitapivat, an oral pyruvate kinase activator, has been shown to improve red blood cell metabolism and anemia in patients with SCD [1,2].
- Optical technologies are an attractive, non-invasive candidate for assessing tissue hemodynamics at the bedside.

Methods

- Participants (n = 15) were enrolled in a longitudinal study of mitapivat, at the NIH in collaboration with NHLBI (Clinicaltrials.gov, NCT04610866). Nine with baseline data were evaluated.
- Time-domain near infrared spectroscopy (TD-NIRS) measures attenuation and delay of an incident light pulse to recover quantitative hemoglobin concentration and tissue oxygen saturation (StO2), the ratio of oxyhemoglobin (O2Hb) to total hemoglobin (THb) [3].

Results

**Acute Hemodynamic Changes**

- Over entire year, mean brain StO2 increased (+4.3%) which mirrors mean increase in blood Hb (+1.3 g/dL).
- Reduced CBV (-1.4 mL/100g) and OEF (-4.5%) were also observed.

**Long Term Hemodynamic Changes**

- Muscle hemodynamics also show slight change from baseline, but not as high in magnitude.
- Decreased hemolysis and release of cell-free hemoglobin can reduce nitric oxide scavenging and improve endothelial function, leading to a potential improvement in hyperemic response.

**Conclusions**

- Optical technologies could provide complementary microvascular information for monitoring SCD treatments.
- Observed hemodynamic changes mirror trends observed in hematology markers and could provide additional clinical information.

**References**


**Acknowledgments**

Special thanks to Elise Benning and Kathryn Jassensky for their assistance in data collection and analysis. This work was supported by the Division of Intramural Research of the National Heart, Lung, and Blood Institute and National Institute of Biomedical Imaging and Bioengineering. The clinical arm of this study is part of a Cooperative Research and Development Agreement (CRADA) between NHLBI (SLT) and AGIOS Pharmaceuticals Inc., Cambridge, MA United States.

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