Division of Gastroenterology and Hepatology, Digestive Health Center, Northwestern University Feinberg School of Medicine

Evaluation of the Liver's Function and Physiology Using HepQuant-SHUNT to Potentially Differentiate Irreversible from Reversible Hepatic Impairment in Patients with Chronic Passive Hepatic Congestion Secondary to Fontan Circulation

Alexander A. Lemmer[1], Steve M. Helmke[2,3], Shannon Lauriski[2], Gregory T. Everson[2,3], Andrew Defreitas[4], Daniel R. Ganger[1]

[1]Division of Gastroenterology and Hepatology, Northwestern University Feinberg School of Medicine, [2]Gastroenterology and Hepatology, University of Colorado, [3]HepQuant LLC, Denver, CO, [4]Cardiology, Ann & Robert H. Lurie Children's Hospital of Chicago

Disclosures: Everson and Helmke were formerly employed by the University of Colorado and are current employees of HepQuant LLC which is the exclusive licensee of intellectual property (IP) of University of Colorado, Everson, and Helmke. The IP encompasses 10 issued patents and several patents pending. Author Ganger receives a consultant fee from HepQuant LLC.

Background

- **Patients who have undergone Fontan operations develop congestive hepatopathy and associated liver disease.**
- **Standard laboratory tests, imaging studies, liver stiffness assessments, fibrosis biomarkers, and even liver biopsies have demonstrated poor correlation with clinical outcomes.**
- **Novel methods to distinguish reversible hepatic congestion from irreversible hepatic fibrosis are needed to inform clinical decision making.**

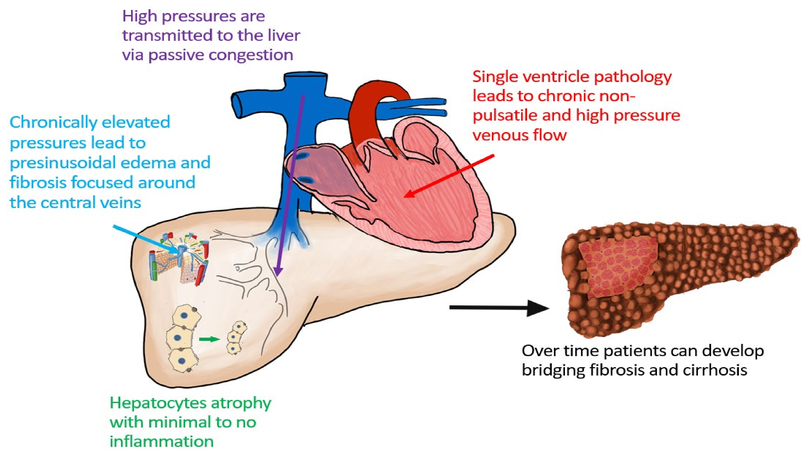
Research Objectives

- **Investigate feasibility and reliability of utilizing the HepQuant-SHUNT test in the Fontan liver disease population.**
- **Improve understanding of Fontan liver disease patho-physiology through quantitative measurements of flow-dependent cholate clearance and portal-systemic shunting.**
- **Produce preliminary data to evaluate if the HepQuant-SHUNT test may have potential in distinguishing reversible hepatic congestion from irreversible hepatic fibrosis.**

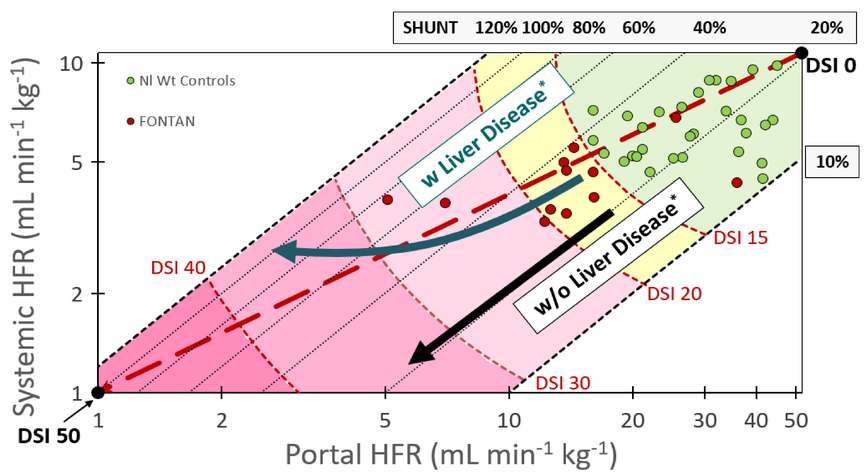
Methods

- **Twelve patients from Northwestern Hepatology clinics participated in this study.**
- **Liver function and physiology were assessed using the HepQuant-SHUNT test which is a dual cholate clearance test for mapping (figure) systemic hepatic filtration rate (HFR) (Y axis), portal HFR (X axis), portal-systemic SHUNT fraction (diagonals), and a disease severity index (DSI) (arcs).**
- **The HepQuant SHUNT results were compared to the clinic's standard assessment validated in the hepatitis C population.**

Fontan Associated Liver Disease Pathophysiology



HepQuant-SHUNT Model and Preliminary Results



Green Dots = Healthy Controls, Red Dots = Post-Fontan Patients, DSI = Disease Severity Index
*HepQuant-SHUNT theoretical model for Fontan patients prior to data collection

Results

- **10/12 Fontan patients fell outside of the normal range defined by DSI >15.**
- **7 patients had DSI 15-20 indicating mild decline in cholate clearance.**
- **3 patients had a DSI >20 indicating more severe impairment of cholate clearance.**
- **2 patients had elevated SHUNTs of 53.6% and 76.1%, possibly representing patients with increased risk for irreversible hepatic fibrosis over merely congestion.**
- **The observed data in this small cohort appeared to follow the hypothetical model; and, patients with DSI>20 had lower platelet counts and greater spleen length.**
- **Other standard labs, ARFI, imaging, and clinical models were not correlated with HepQuant SHUNT results.**

Limitations

- **The sample size of 12 patients is small and these results needs to be investigated in a larger population of patients.**
- **There is no gold standard to compare the hepatic filtration rates or shunt percentages with in this patient population.**
- **Currently no outcome data exists to validate predictive capabilities of the HepQuant-SHUNT measurements.**

Conclusions

- **The HepQuant-SHUNT test may provide an assessment of liver function for use in FONTAN patients that might help discriminate reversible hepatic congestion from irreversible hepatic impairment.**
- **A larger prospective study is needed to validate the utility of the HepQuant-SHUNT test in this setting.**

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