FibroScan and Parenteral Support – Protocol

Version 2.0 – 10 July 2025

Research Project Protocol

Title:
Effect of Parenteral Nutrition/Fluids on FibroScan Results in Patients with Short Bowel Syndrome

Introduction

Home Parenteral Support (HPS, nutrition and/or fluids) is a life-sustaining treatment for patients with short bowel syndrome and intestinal failure. Both HPS and short bowel syndrome may lead to complications, including hepatic dysfunction. Prolonged use of HPS can result in Intestinal Failure–Associated Liver Disease (IFALD), a heterogeneous condition that may include cholestasis, steatosis, and hepatic fibrosis, thereby increasing the risk of severe liver disease (1). Monitoring liver function in patients with intestinal failure receiving HPS is therefore essential.

FibroScan, also known as transient elastography (TE), is a non-invasive, ultrasound-based method used to assess hepatic stiffness/fibrosis and steatosis (2). This technique has proven effective for excluding fibrosis (TE < 7 kPa) and for predicting clinically significant fibrosis in patients with other liver diseases, such as chronic hepatitis C (3).

While it is well-documented that oral intake of food and fluids can influence TE results (4–6), the impact of HPS has not been clearly elucidated. Previous studies in other patient populations, such as hemodialysis patients, have demonstrated that fluid overload may cause transient elevations in TE values (7). Similarly, a reversible increase in TE values has been observed with elevated intravenous pressure (8). These findings emphasize the need for specific research on how parenteral support (PS) affects TE measurements, particularly in patients receiving long-term intravenous therapy.

The objective of this study is therefore to investigate the applicability and accuracy of FibroScan in assessing liver status among patients with short bowel syndrome and intestinal failure, both before and after administration of PS. This is of particular importance since the timing of FibroScan relative to PS administration and infusion volume is presumed to influence the results, and thereby potentially the interpretation of hepatic status.

By understanding how parenteral support influences FibroScan measurements, we aim to optimize the use of this non-invasive technique for monitoring liver status in patients with intestinal failure, thereby defining the optimal timing of scanning in relation to PS administration. This could potentially enable earlier detection of hepatic complications and thereby improve the long-term prognosis for these patients.

The results of this study will contribute to the establishment of optimal protocols for FibroScan assessment in patients with intestinal failure and short bowel syndrome receiving PS. Ultimately, this will improve the accuracy of hepatic fibrosis monitoring in this patient population, as well as clinical decision-making and patient management in this complex field.

Objectives

To investigate the immediate effect of PS administration on FibroScan results in patients with short bowel syndrome, in order to determine the optimal timing of FibroScan assessments in this patient population.

Methods

Inclusion Criteria
- Adult patients (≥18 years) with short bowel syndrome with capacity to give consent
- Patients receiving regular PS, defined as administration on at least 4 days per week and a minimum of 10 liters of fluid per week
- Patients in a stable clinical condition

Exclusion Criteria
- Patients with known liver cirrhosis
- Patients with active infection, severe dehydration, or significant electrolyte disturbances
- Pregnant patients
- Patients receiving any form of intravenous fluids or medications on the day of the study procedure
- Patients whose parenteral support is tapered with a reduced infusion rate prior to disconnection

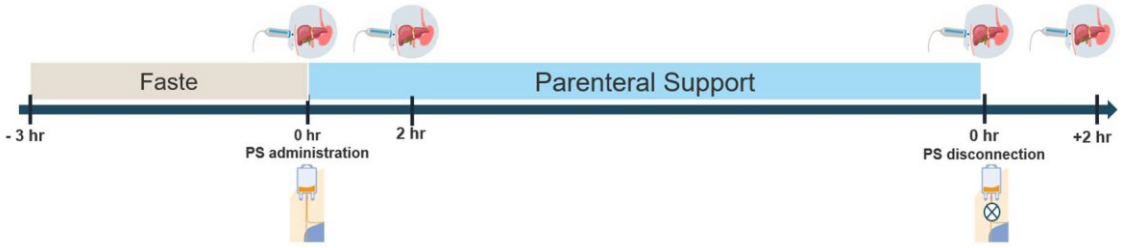
Study Design
Open-label pilot study with a prospective observational design.

Procedures
If the participant has not had blood samples taken within 2 days prior to inclusion, blood tests equivalent to the department's standard admission panel will be collected before inclusion to ensure that no exclusion criteria are met. Samples will be destroyed no later than 7 days after analysis.

Once included, participants must fast and abstain from fluids for 3 hours prior to the examination. Measurements will consist of a FibroScan, blood pressure, body weight, and bioimpedance analysis.

Measurements will be performed:
- Immediately before initiation of PS
- Two hours after initiation of PS
- Immediately after disconnection of PS
- Two hours after completion of PS

Participants will collect urine from 0 to 14 hours. Spot urine sodium will be analyzed at 0 hours and 14 hours. Urine volume will be measured and then discarded. The standard infusion time for PS is set at 12 hours overnight.



Patient Record Information

Following informed consent and study inclusion, data will be obtained from medical records. Consent will allow the investigator and relevant authorities direct access to the patient's medical record. Data will be used to evaluate secondary endpoints. The following information will be collected:

- Age, sex, alcohol consumption (current and past)
- HPS regimen (composition and volume)
- Underlying disease leading to short bowel syndrome
- Comorbidities
- Current medication list
- Most recent standard laboratory results prior to participation

All personal data will be handled in compliance with the Danish Data Protection Act and the General Data Protection Regulation (GDPR).

Endpoints

Primary Endpoint
- Change in TE (FibroScan value) before, during, and after HPS

Secondary Endpoints
- Change in CAP score (FibroScan value) before, during, and after HPS
- Correlation between changes in FibroScan values and the volume/composition of HPS
- Correlation between changes in FibroScan values and changes in body weight, blood pressure, body fluid content (measured by bioimpedance), and urine output
- Patient-specific factors influencing changes in FibroScan values

Participants

Recruitment
Participants will be recruited from patients admitted to the Department of Transplantation and Digestive Diseases, Rigshospitalet, and the associated outpatient clinic, where they receive lifelong follow-up. The principal investigator will identify potential participants during routine clinical practice. Patients who appear eligible based on inclusion and exclusion criteria will initially be asked by their treating physician whether they are willing to be contacted regarding the study.

If the patient consents, the treating/principal investigator will provide the study team with the patient's name and personal identification number. No additional information will be shared at this stage. A member of the study team will then contact the patient to provide further details about the study.

Patients will be offered an informational meeting, either during hospitalization or in the outpatient clinic, where both verbal and written study information will be provided. Patients may have a companion present and are entitled to a minimum of 24 hours for consideration. Written informed consent will be obtained prior to participation.

Sample Size
A total of 20 patients with short bowel syndrome will be included. The sample size was calculated based on an expected change in TE of 1.5 kPa following PS, with an assumed standard deviation of residuals of 2 kPa. With a significance level of 5% and statistical power of 80%, the minimum sample size is 15 participants. To account for potential dropout and ensure adequate statistical power, 20 participants will be recruited. This number is considered feasible within a reasonable timeframe, given the rarity of short bowel syndrome.

Data Analysis

- Repeated Measures ANOVA, paired t-test, or Wilcoxon signed-rank test will be used to compare FibroScan values before and after PS administration.
- Repeated Measures ANCOVA (multiple regression) will be used to identify factors influencing changes in FibroScan values.

Ethical Considerations

The study poses minimal risk to participants, as FibroScan and blood pressure measurement are non-invasive procedures. Mild discomfort may occur due to application of ultrasound gel on the abdomen and pressure from the FibroScan probe. Mild discomfort may also be experienced during blood pressure measurement. Blood sampling may cause minor pain, bruising, or infection, but no significant complications are anticipated.

The study will be conducted in accordance with the Declaration of Helsinki and will be reviewed and approved by the Regional Committee on Health Research Ethics (Region Hovedstaden). Participants will be fully informed verbally and in writing, will be advised that participation is voluntary, and may withdraw at any time. Informed consent (both written and verbal) will be obtained prior to inclusion.

The study will be registered with the Regional Committee on Health Research Ethics. No protocol-related activities will commence until written approval is obtained. The study will follow Good Clinical Practice (GCP) guidelines and comply with applicable data protection regulations.

Financial Considerations

Study participants will not receive financial compensation. The study is investigator-initiated and not sponsored by industry. Neither the investigator nor project staff have financial ties to companies with interests in this study. Funding is provided by the Department of Transplantation and Gastroenterology, Rigshospitalet.

Compensation

The study is covered under Danish law regarding patient complaints and compensation within the healthcare system.

Dissemination of Study Results

Following completion of the study and statistical analysis, results will be submitted for publication in a peer-reviewed medical journal. Both positive, negative, and inconclusive findings will be published. Efforts will also be made to present the results at relevant scientific conferences.

References

1. Pironi L, Sasdelli AS. Intestinal Failure-Associated Liver Disease. Clin Liver Dis. May 2019;23(2):279–91.
2. de Lédinghen V, Vergniol J. Transient elastography (FibroScan). Gastroenterol Clin Biol. Sept 2008;32(6 Suppl 1):58–67.
3. Ugeskriftet.dk [Internet]. 2025 [cited March 28, 2025]. Liver fibrosis can be assessed by non-invasive ultrasound elastography. Available from: https://ugeskriftet.dk/videnskab/leverfibrose-kan-vurderes-ved-ikkeinvasiv-ultralydelastografi
4. Lee J, Lee R, Erpelding T, Siddoway RL, Gao J. The effect of water intake on ultrasound tissue characteristics and hemodynamics of adult livers. Clin Exp Hepatol. 2021;7(2):223–30.
5. Silva M, Costa Moreira P, Peixoto A, Santos AL, Lopes S, Gonçalves R, et al. Effect of Meal Ingestion on Liver Stiffness and Controlled Attenuation Parameter. GE Port J Gastroenterol. Mar 2019;26(2):99–104.
6. Alvarez D, Orozco F, Mella JM, Anders M, Antinucci F, Mastai R. Meal ingestion markedly increases liver stiffness suggesting the need for liver stiffness determination in fasting conditions. Gastroenterol Hepatol. Aug 2015;38(7):431–5.
7. Khunpakdee N, Jayanama K, Kaewdoung P, Promson K, Rattanasiri S, Warodomwichit D, et al. Transient Elastography in End-Stage Renal Disease Patients on Hemodialysis: The Effect of Net Fluid Withdrawal. Blood Purif. Oct 2015;40(3):256–9.
8. Millonig G, Friedrich S, Adolf S, Fonouni H, Golriz M, Mehrabi A, et al. Liver stiffness is directly influenced by central venous pressure. J Hepatol. Feb 2010;52(2):206–10.