

# Endoscopic Portal Pressure Gradient (EUS-PPG) for preoperative risk stratification in chronic liver disease

Dr Charles Carder, Dr Sharan Wadhvani, Dr Colm Forde, Dr Arvind Pallan  
&  
Dr Brinder Mahon  
Queen Elizabeth Hospital, UHB

# Portal Hypertension

PH is the strongest single prognostic factor in liver disease, the development of organ insufficiency and complication in cirrhosis.

Liver resection in patients with clinically significant portal hypertension is associated with:

Significantly  
higher risk of  
complication

>3x risk of  
post-  
hepatectomy  
liver failure

36.4%  
increased  
hazard of  
death.<sup>1</sup>

1. Aliseda D, et al. The Impact of Portal Hypertension Assessment Method on the Outcomes of Hepatocellular Carcinoma Resection. Ann Surg [Internet]. 2023 Dec 21 [cited 2023 Dec 30]; Available from: <https://journals.lww.com/10.1097/SLA.00000000000006185>



# Current Guidelines

In patients with cirrhosis undergoing liver resection or other non-hepatic surgery, recommendations<sup>2,3</sup> include:

- Caution in this patient population
- Multimodal methods of risk stratification
- Multidisciplinary input
- Careful patient counselling

2. Northup PG, Friedman LS, Kamath PS. AGA Clinical Practice Update on Surgical Risk Assessment and Perioperative Management in Cirrhosis: Expert Review. *Clinical Gastroenterology and Hepatology*. 2019 Mar 1;17(4):595–606.

3. Abbas N, et al. Guidance document: risk assessment of patients with cirrhosis prior to elective non-hepatic surgery. *Frontline Gastroenterol* [Internet]. 2023 Sep 1;14(5):359–70. Available from: <https://fg.bmj.com/lookup/doi/10.1136/flgastro-2023-102381>

# Portal Pressure Gradient

Derived from the Hepatic Venous Pressure Gradient (HVPG)

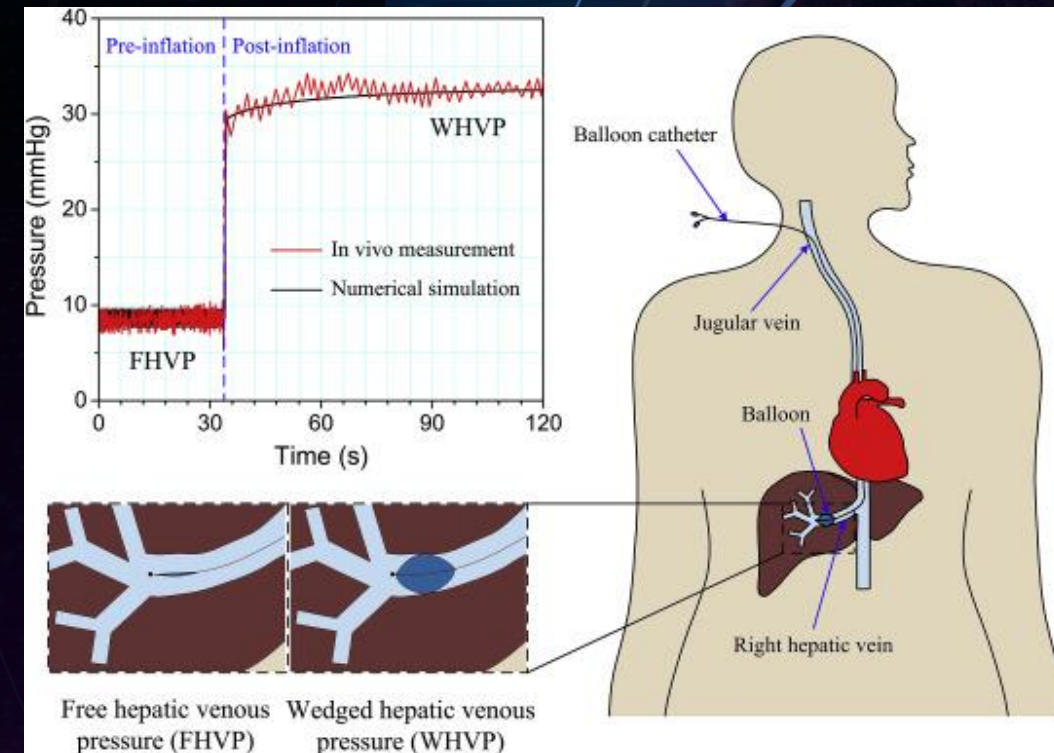
- Normal  $\leq 5$  mmHg
- Portal Hypertension 5-9 mmHg
- Clinically significant portal hypertension  $\geq 10$  mmHg



# HVPG

## The Gold Standard

- An interventional radiology procedure of percutaneous vein puncture to:
  - Measure free hepatic venous pressure & wedged hepatic venous pressure
  - $WHVP - FHVP = HVPG$
  - Used as an **indirect** measure of portal pressure gradient



# HVPG

## Limitations

- Underestimates pressures in:
  - Pre-sinusoidal & pre-hepatic causes of portal hypertension e.g. **primary biliary cirrhosis & portal vein thrombosis** <sup>5,6</sup>
  - The presence of intra-hepatic venous shunting (present in up to **36% of patients**)<sup>7</sup>
- Correlates poorly with disease severity in NASH cirrhosis <sup>8</sup>

5. Laleman W, et al. Advances in Endohepatology. American Journal of Gastroenterology. 2023 Oct 1;118(10):1756–67.

6. Khanna R, Sarin SK. Non-cirrhotic portal hypertension – Diagnosis and management. J Hepatol [Internet]. 2014 Feb;60(2):421–41.

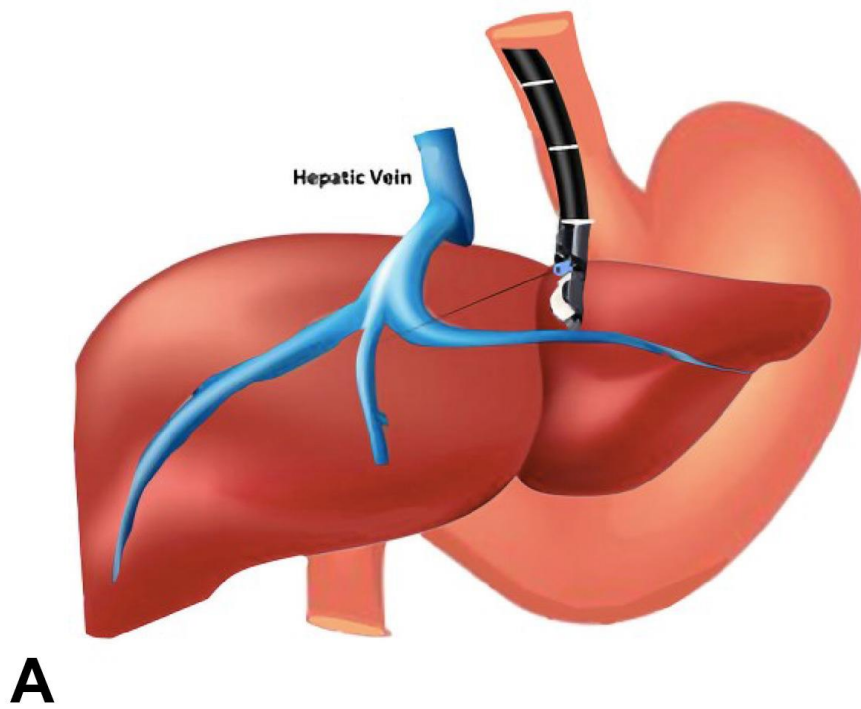
7. Ma J, et al. Impact of Intrahepatic Venovenous Shunt on Hepatic Venous Pressure Gradient Measurement. Journal of Vascular and Interventional Radiology [Internet]. 2020 Dec 1;31(12):2081–8.

8. Ferrusquía-Acosta J, et al. Agreement between wedged hepatic venous pressure and portal pressure in non-alcoholic steatohepatitis-related cirrhosis. J Hepatol. 2021 Apr 1;74(4):811–8.

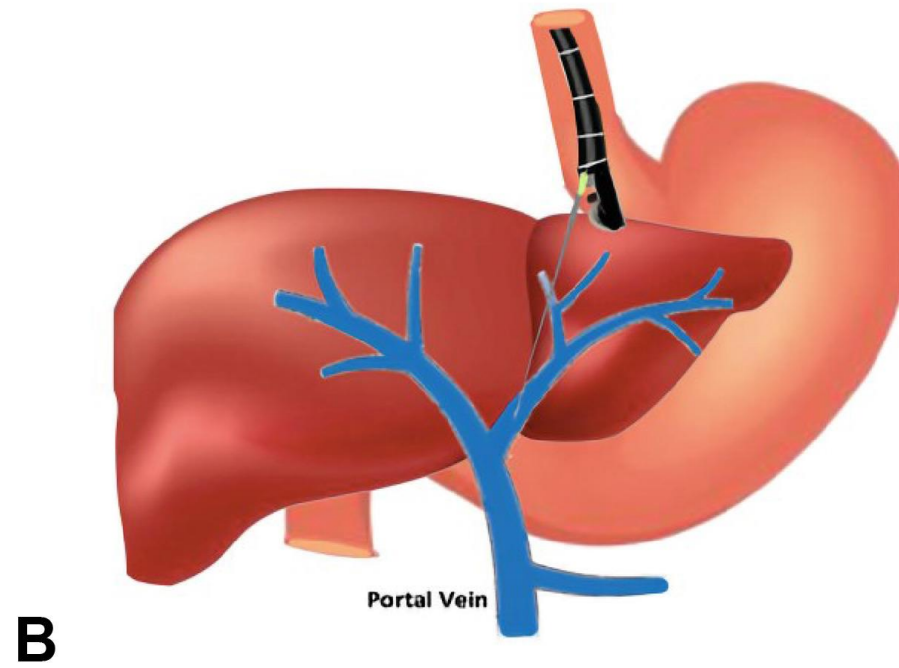


# EUS-PPG

EUS-guided Hepatic Vein Pressure Measurement



EUS-guided Portal Vein Pressure Measurement



# Early EUS-PPG Validation

## “Excellent correlation”

- ...with the standard trans-jugular (HVPG) method in animal models<sup>10</sup>
- ...with histological hepatic fibrosis, clinical, laboratory, endoscopic and imaging variables of advanced liver disease<sup>11</sup>

10. Huang JY, Samarasena JB, Tsujino T, Chang KJ. EUS-guided portal pressure gradient measurement with a novel 25-gauge needle device versus standard transjugular approach: a comparison animal study. *Gastrointest Endosc* 2016 Aug ;84(2):358–62.

11. Choi AY, Chang KJ, Samarasena JB, Lee JG, Li X, Guo W, et al. Endoscopic Ultrasound-Guided Porto-systemic Pressure Gradient Measurement Correlates with Histological Hepatic Fibrosis. *Dig Dis Sci*. 2022 Dec 1;67(12):5685–92.



# Study Aims

---

## To Demonstrate:

- The utility of EUS-PPG in a new, complex surgical patient cohort
- A viable alternative to HVPG in pre-operative risk stratification
- The safety profile and suitability as an outpatient investigation

# Methods

---

- All EUS-PPG procedures performed in a single quaternary referral centre since May 2021 were included
- Patient selection by MDT discussion
- Selection criteria included liver lesion for planned resection or non-hepatic surgery, with suspicion of chronic liver disease or features of portal hypertension.
- Procedure performed by experienced endosonographer or senior clinical fellow
- Retrospective analysis



# Results

---

- 56 total patients
- 64 years +/- 13 (mean, SD), 79% male
- MELD 3 Score
  - 9.2 +/- 3.5, 6-26 (mean, SD, range)
- Childs Pugh Score
  - 5.6 +/- 0.9, 5-8

# Results

---

- “Hepatocellular carcinoma for liver resection” was the commonest indication 47/56 (84%)
- Technical success in 100% cases
  - Defined as calculation of PPG
- No major complications or endoscopy related readmissions
  - 1 small haematoma and 1 “trace free fluid” noted at time of EUS



# Results

- PPGs
  - 5.5 mmHg +/- 5.6, 0-25 (mean, SD, range)
  - Normal = 36/56 (64%)
  - Portal Hypertension (>5) = 11/56 (20%)
  - Clinically Significant PH (>10) = 9/56 (16%)
- 9 patients with CSPH identified as “high risk”
  - counselled & offered alternative non-surgical treatments
- 11 patients with PH able to safely proceed to surgery

# Learning Points

---

- EUS-PPG has clinical utility in multimodal risk stratification of patients
- Pending further clinical validation this has the potential to replace HVPG as a more direct and accurate measurement of portal pressures
- With careful MDT patient selection this can be the final guiding factor for surgical vs. non surgical treatments in patients with borderline or suspected liver disease
- EUS-PPG is a safe procedure suitable for outpatient endoscopy