Utility of minimally invasive measurement of hepatic venous pressure gradient via the peripheral antecubital vein

We read with great interest the three articles by Bosch,¹ Tripathi,² and Monteiro.³ In those articles, measurement of hepatic venous pressure gradient (HVPG) played a key role in assessing the portal hypertension in patients with advanced liver disease. One obstacle to examining portal hypertension in clinical trials with suitably large cohorts is the substantial barrier to repeated measurement of HVPG. HVPG measurement is performed using a balloon catheter, most frequently inserted from the jugular vein. HVPG measurement is considered to require specific expertise and around a day of hospitalisation, making the procedure relatively expensive and burdensome.^{4 5} Despite many attempts, non-invasive methods have not yet been able to completely replace direct HVPG measurement.^{5 6} Here, we report a study on the methods for HVPG measurement from the peripheral antecubital vein (pHVPG). Although this method has been mentioned in a review of HVPG measurement, no detailed descriptions of this approach have been published.⁴

Forty-one measurements from 37 consecutive patients who underwent pHVPG measurement in our institute between October 2018 and February 2020 were evaluated. This retrospective study was approved by our institutional review board. The system involved introduction of a catheter into the right or left antecubital vein with a 5-Fr sheath. Through the sheath, a 5-Fr cobra-shaped balloon catheter was advanced to the hepatic vein. HVPG measurement was performed as per the standard protocol for the jugular vein.^{6 7} Complications during and after

Table 1 Characteristics of the 41 measurements and liver function before measurements

Demographic characteristics	
All measurements, n	41
Wedge hepatic venous pressure, mm Hg (n=40)*	23.5 (11–37)
Free hepatic venous pressure, mm Hg (n=40)*	8.5 (1–23)
Hepatic venous pressure gradient, mm Hg (n=40)*	14.0 (3–23)
Total bilirubin, mg/dL (n=41)	1.1 (0.1–10.1)
Albumin, g/dL (n=41)	3.3 (1.7–4.6)
Prothrombin time, % (n=38)	78.5 (48–133)
Prothrombin time international normalised ratio (n=38)	1.1 (0.87–1.46)
Platelet count, $\times 10^4/\mu\text{L}$ (n=41)	11.1 (3.3–23.6)
Aspartate aminotransferase, U/L (n=41)	36 (11–175)
Alanine aminotransferase, U/L (n=41)	22 (5–140)
Serum creatinine, mg/dL (n=41)	0.8 (0.4–1.7)
Serum sodium, mmol/L (n=39)	139 (130–143)
Model for end-stage liver disease score (n=37)	7 (6–14)
Child-Pugh score (n=38)	7 (5–10)
Child-Pugh classification (n=38), n (%)	
A	16 (42)
B	19 (50)
C	3 (8)
Non-invasive markers of liver fibrosis	
Lok index (n=41)	0.83 (0.003–0.99)
Albumin–bilirubin score (n=41)	–1.9 (–0.8 to –3.1)
Albumin–bilirubin grade, 1/2/3 (n=41)	(7/25/9)
Procedure time, min (n=40)*	19.1 (8.7–56)
Hospitalised/clinic (n=41)	29/12

Values are given as median (range) or number.

*Hepatic venous pressure gradient measurement was failed to perform in one patient.

pHVP measurement were also evaluated. The resulting HVP was compared with liver function values and fibrosis markers.

Characteristics of the 41 measurements are listed in the [table 1](#). Four patients underwent two measurements of HVP. Twenty-nine measurements were carried out in-hospital and 12 measurements on an outpatient basis. Successful measurement of pHVP was achieved in 40 of the 41 procedures (98%) ([figure 1](#)). A representative example of the procedure is shown in the online supplementary data. We failed to perform pHVP measurement in one patient, who showed occlusion of bilateral subclavian veins. Median procedure time was 19.1 min (range 8.7–56 min). No patients experienced complications

Figure 1 Chest and abdominal X-rays during hepatic venous pressure gradient measurement in procedure 28. The balloon catheter is inserted via the right cephalic vein. The catheter is inserted into the right hepatic vein. The balloon is inflated, and stasis of injected contrast medium is identified.

such as large haematoma or nerve injuries. Four records were excluded because of venous–venous communication, which led to underestimation of HVP. Significant positive correlations were found between pHVP and albumin–bilirubin score ($r=0.34$, $p=0.04$), Child-Pugh score ($r=0.40$, $p=0.02$), model for end-stage liver disease score ($r=0.38$, $p=0.03$) and Lok index ($r=0.38$, $p=0.02$). A significant negative correlation was found between pHVP and platelet count ($r=-0.37$, $p=0.03$).

Although limitation of this study was the relatively small size of the patient cohort, this study showed that pHVP measurement appears safe and feasible, with a high success rate (98%) and short procedure time (median 19.1 min). The HVP values correlated well with liver function values and fibrosis markers, similar to the case of HVP measurement from the jugular vein.⁹ An important benefit of pHVP measurement is that the puncture of antecubital veins is markedly safer than the puncture of a jugular vein. Haemorrhage in the arm as a potential complication is considered controllable without severe outcomes, even in patients with bleeding tendency. This technique does not necessitate a long rest after the procedure or careful observation of the puncture site under admission. Measurement of pHVP could thus be repeatedly applied to outpatients. As reported, HVP measurement is available only in specialised hepatology units.^{4–6} The technique needs to be able to be performed by hepatologists similar to the performance of transjugular liver biopsy to achieve further

expansion of HVP measurement.¹⁰ This technique could offer a useful alternative to conventional HVP measurements.

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