



Hepatic vein resection and reconstruction for liver malignancies: expanding indication and enhancing parenchyma-sparing hepatectomy

Fumihiro Kawano^{1,2}, Yoshihiro Mise^{1,2}, Junji Yamamoto, Atsushi Oba ¹, Yoshihiro Ono¹, Takafumi Sato¹, Yosuke Inoue¹, Hiromichi Ito ¹, Yu Takahashi¹ and Akio Saiura^{1,2,*}

¹Department of Hepatobiliary and Pancreatic Surgery, Cancer Institute Hospital, Japanese Foundation for Cancer Research, Ariake, Tokyo, Japan

²Department of Hepatobiliary–Pancreatic Surgery, Juntendo University School of Medicine, Hongo, Tokyo, Japan

*Correspondence to: Department of Hepatobiliary–Pancreatic Surgery, Juntendo University School of Medicine, 2-1-1 Hongo, Bunkyo-ku, Tokyo 113-8421, Japan (e-mail: a-saiura@juntendo.ac.jp)

Dear Editor

Hepatectomy with hepatic vein (HV) resection and hepatic vein reconstruction (HVR) has been performed previously to expand resectability for patients with otherwise unresectable liver tumours. Owing to recent technical advances in liver surgery, HVR following minor hepatectomy has also been proposed as an alternative to major hepatectomy to spare uninvolved liver parenchyma¹. This letter reports the feasibility of HVR.

Patients who underwent hepatectomy with HVR for liver malignancy from 2002 to 2018 at The Cancer Institute Hospital of Japan

were reviewed retrospectively and postoperative short-term outcomes were analysed. Patients were categorized in two groups according to the indications for HVR: a definitive HVR (D-HVR) group in which liver tumours were unresectable without HVR or staged hepatectomy, and a parenchyma-sparing HVR (P-HVR) group in which HVR was applied to avoid extended major hepatectomy (Fig. 1).

Resectability was evaluated with contrast-enhanced CT with or without supplemental use of MRI or PET². Safety criteria for liver resection were described previously as follows: patients should not have co-morbid conditions that preclude major hepatic resections, and all liver lesions should be amenable to

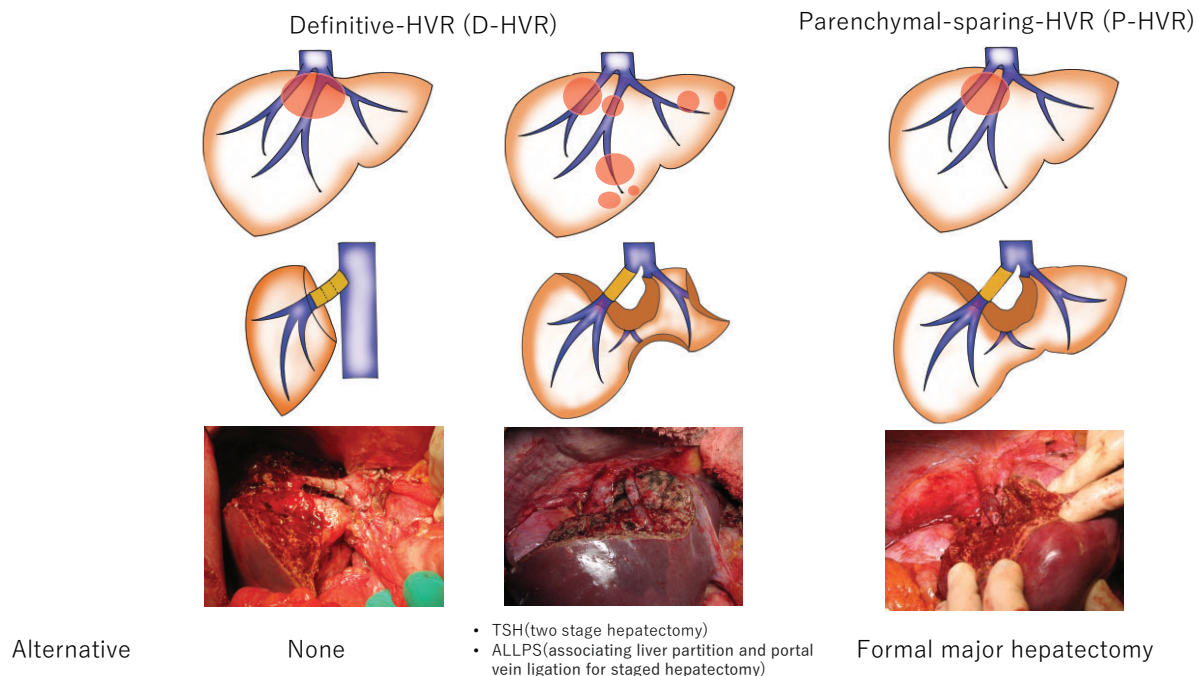


Fig. 1 Hepatic vein reconstruction categorized in two groups according to indication

HVR, hepatic vein reconstruction; TSH; ALLPS.

Received: July 05, 2021. Accepted: October 24, 2021

© The Author(s) 2022. Published by Oxford University Press on behalf of BJS Society Ltd.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted reuse, distribution, and reproduction in any medium, provided the original work is properly cited.

resection with clear margins, leaving at least 30 per cent of remnant liver without potentially ischaemic or congested areas in patients with normal liver function. Liver function was assessed by indocyanine green retention rate at 15 minutes (normal, less than 10 per cent). Venous congestion following sacrifice of the involved hepatic vein was evaluated using three-dimensional image-processing software prior to surgery³.

During the study period, 2907 hepatectomies were performed and 41 patients (1.4 per cent) underwent 43 HVRs. D-HVR and P-HVR were performed in 23 patients (56 per cent) and in 18 patients (44 per cent) respectively. Patient demographics and surgical outcomes are summarized in [Table S1](#). A total of 28 patients underwent segmental HV resection. In six patients (21 per cent) the HV was reconstructed with end-to-end direct anastomosis and in 23 patients (79 per cent) by interposing autograft. Customized saphenous vein graft was the most frequently used interposition graft (20 patients)⁴. External iliac vein graft and left portal vein extracted from the resected specimen were used in two and one patient, respectively. Wedge resection alone was performed in 13 patients. One patient had wedge resection in addition to segmental HV resection. All wedge resections were repaired using an autologous patch. The opened umbilical vein was most frequently used (11 procedures). In addition, left hepatic vein (1 patient), left portal vein (1 patient) and ovarian vein (1 patient) were used for patch repair after wedge HV resection. In the D-HVR group, all three HVs were resected in 12 patients.

Major complications, defined by Clavien–Dindo classification grade 3 or above, occurred in four patients of the D-HVR group (17 per cent)⁵. No patient had major complications in the P-HVR group. The 90-day mortality rate was zero in both groups. The resected weight of the liver was significantly greater in the D-HVR group compared with the P-HVR group ($P < 0.001$). One- and 3-year graft-patency rates were 96 and 77 per cent in the segmental resection group, and 91 and 91 per cent in the wedge resection group respectively.

This study reports a large series of HVR characterized by the exclusive use of autologous grafts avoiding artificial or cryopreserved grafts that can be not easily available in clinical practice.

In addition, the limited use of advanced procedures such as total hepatic vascular exclusion and extracorporeal temporal bypass might have contributed to favourable short-term outcomes with no deaths, even though all major hepatic veins were resected in 12 patients (27 per cent). Given these promising results, such an approach might not only expand the indications for surgery for unresectable liver malignancies, but also broaden the indications for parenchyma-sparing resections avoiding a two-step or major hepatectomy.

Disclosure. The authors declare no conflicts of interest.

Supplementary material

[Supplementary material](#) is available at *BJS Open* online.

References

- Mise Y, Aloia TA, Brudvik KW, Schwarz L, Vauthey JN, Conrad C. Parenchymal-sparing hepatectomy in colorectal liver metastasis improves salvageability and survival. *Ann Surg* 2016;**263**:146–152.
- Elfrink AKE, Pool M, Werf LR, Marra E, Burgmans MC, Meijerink MR *et al.*; the Dutch Hepato-Biliary Audit Group. Preoperative imaging for colorectal liver metastases: a nationwide population-based study. *BJS Open* 2020;**4**:605–621.
- Mise Y, Hasegawa K, Satou S, Aoki T, Beck Y, Sugawara Y *et al.* Venous reconstruction based on virtual liver resection to avoid congestion in the liver remnant. *Br J Surg* 2011;**98**:1742–1751.
- Sakamoto Y, Yamamoto J, Saiura A, Koga R, Kokudo N, Kosuge T *et al.* Reconstruction of hepatic or portal veins by use of newly customized great saphenous vein grafts. *Langenbecks Arch Surg* 2004;**389**:110–113.
- Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg* 2004;**240**:205–213.