TECHNICAL REPORT

Double liver hanging manoeuvre for central hepatectomy

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Abstract
We describe a modification of Belghiti’s liver hanging manoeuvre (LHM) using two small tubes placed in the cut planes, the first between the left lateral and medial sections, and the second along the right hepatic vein, to achieve complete anatomic central hepatectomy for a large tumour compressing surrounding vessels. Using this technique, a large central hepatocellular carcinoma compressing hilar vessels and the right hepatic vein was easily and safely resected in a 57-year-old man.

Keywords
hepatocellular carcinoma, central hepatectomy, double liver hanging manoeuvre

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Introduction
Central liver resection can be performed by an anterior approach for large hepatocellular carcinomas (HCC) which may compress the intra- or extrahepatic vessels.1 However, adequately ensuring the transection plane can be difficult as a result of compression by a large liver tumour. Application of the liver hanging manoeuvre (LHM) was described by Belghiti et al.2,3 We propose a ‘double hanging LHM’ by hanging two transection planes for right para-median sectionectomy for HCC.4

Case report
A 57-year-old man with chronic hepatitis C was found to have a large HCC measuring 9 cm in diameter and occupying segments 4, 5 and 8 on computed tomography (CT) (Fig. 1). The tumour compressed the trunk of the right hepatic vein (RHV) and Glisson’s pedicles at the hepatic hilum. Hepatic function was evaluated as Child–Pugh class A and indocyanine green retention rate at 15 min (ICGR15) was 7.2%. Liver functional reserve was well preserved and the permitted liver volume for resection calculated according to the results of ICGR152 was 68%. The estimated liver volume to be resected according to CT was 54%. The estimated volumes to be resected for right and left trisectionectomy were 72% and 79%, respectively. Based on these findings, resection of segments 4, 5 and 8 was planned using the double LHM.

Technical aspects of the procedure
The patient underwent a thoraco-laparotomy (upper median plus right-sided transverse incision to the ninth intercostal space) in the supine position. We exposed the bifurcations of the RHV, middle hepatic vein (MHV) and left hepatic vein (LHV) and the anterior surface of the vena cava. Mobilization of the left and right lateral sectors of liver was not performed. The double LHM basically followed the method described by Belghiti et al.2 Hepatic transection was performed using the crush clamping method and an ultrasonic dissector during intermittent occlusion of hepatic inflow (15-min occlusion, 5-min de-clamping). Tubes were maintained under tension during transection and the direction of transection was always targeted towards the hanging tube. The space between the RHV and MHV was dissected for 3 cm along the loose connective tissue between the anterior surface of the vena cava and the paracaval caudate lobe, using a long right-angled clamp for the renal artery. Subsequently, the area between the vena cava and the infrahepatic caudate process was dissected and a few short hepatic veins were divided to allow the insertion of forceps. Loose tissue was dissected for 3 cm using a long, light and curved Kelly clamp. The scheduled two cut-lines are marked in Fig. 1. A 10-Fr nasogastric tube was inserted between the RHV and MHV and was passed through the dissecting space. A further tube was placed between the MHV and LHV along the Arantius ligament (Fig. 2A). At the hepatic hilum, tubes were passed between the...
liver parenchyma and Glisson’s pedicles. The right end was fixed between the right anterior and posterior Glisson’s pedicles and the left end was fixed on the inside of the umbilical pedicle. Replacement of the tubes between the hepatic parenchyma and the major Glisson’s pedicle failed because of severe inflammatory adhesions and bleeding. Glisson’s pedicles were hung together as shown in Fig. 2A, B. The left tube was used for hanging the cut plane between the left lateral and medial sections along the Arantius ligament. However, liver parenchyma of segment 1 was not completely dissected. The right tube was used for hanging at the cut plane along the right hepatic vein. The double LHM using the two nasogastric tubes was then prepared for parenchymal transection at two scheduled cut planes. Glisson’s pedicles in the right anterior section and segment 4 were divided. An adequate transection plane can be obtained along the umbilical pedicle and along the RHV using this technique (Fig. 3A, B), because the remnant liver (segments 6 + 7 and 2 + 3) was rotated to the side opposite the resected liver, including the tumour, upon lifting the nasogastric tube during transection (Fig. 4). The hanging tube was always pulled up during transection and the direction of transection was always targeted towards the tube. The adhesive space between tumour and vessels was carefully dissected. Finally, Glisson’s pedicle at the right paramedian sector and MHV was cut and divided and resection of segments 4, 5 and 8 was accomplished (Fig. 5). Total transection time was 62 min.

**Discussion**

In central liver resections, the key markers for transection lines are the hepatic veins and Glisson’s pedicles. As described above, the LHM is applicable for various hepatic resections. We have already reported using the double LHM for the central resection of segments 4, 5 and 8 for a benign liver tumour, in which repositioning the hanging tube between the liver parenchyma and Glisson’s pedicles was possible. In a malignant liver tumour, mobilization of the remnant liver should be avoided because liver rotation may facilitate tumour dissemination. At the area of tumour compression in the paracaval portion of the caudate lobe, the line of dissection is very narrow and careful dissection is necessary. Dissection of these spaces was expected to be difficult using conventional procedures. The LHM appears to be adequate to resolve
any problems and the surgeon can always target the hanging tube and cut an adequate plane. During transection with this technique, the liver on the tumour side is rotated to the opposite side and the narrow cut space is gradually widened, as in Fig. 5. In our previous reports, tubes were inserted by passing between Glisson’s pedicle and the liver parenchyma and this procedure is generally advisable. However, in the present case, placing the tubes was quite difficult as a result of severe inflammation and related bleeding and, therefore, a hanging of Glisson’s pedicle was applied by a gentle pulling upwards to avoid injury to Glisson’s vessels.

Conflicts of interest
None declared.

References