



# Peritoneal patch for retrohepatic vena cava reconstruction during major hepatectomy: how I do it

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## Introduction

Resection of large hepatic malignancies involving inferior vein cava (IVC) have long considered overly challenging and discouraged.

However, improvements in surgical techniques, developments of supporting devices as well as the growing expertise in both anesthesiology and surgery have led to question this attitude.

Vascular *en-bloc* resection during major hepatectomy offers the only possibility of cure or, at least, the only way to palliate symptoms and prolong survival (1-4).

Nowadays, locally advanced liver tumors involving the retro hepatic IVC can be curatively approached with complete resection and vascular reconstruction by expert surgeons. Accordingly, an adequate post-reconstruction vessel patency must be assured in order to avoid a tough porto-mesenteric venous outflow and problems related. So, when direct suture of the venous defect result in narrowing the vascular lumen, a replacement graft is inlaid to restore the adequate patency.

Many prosthetic and allo-autologous venous grafts have been used with good results (5). However, they present, nevertheless, the inconvenience of requiring a permanent anticoagulation or presuppose the sacrifice of a regional venous discharge.

Since first reports (6), convincing experiences on the use of peritoneal patches to reconstruct IVC recently emerged in literature (7,8).

The authors report their experience on retro hepatic IVC resection et reconstruction using a parietal peritoneal

patch (PPP), performed during right hepatectomy for colorectal liver metastases.

## Case description

A 71-year-old man in good general conditions, presenting with multiple right-sided liver metastases in contact with retrohepatic IVC and infiltrating the origin of the median hepatic vein, was considered for curative surgery after multidisciplinary discussion.

His medical history started in 2015, when he was diagnosed with an obstructive colic lesion along with multiple synchronous right-sided liver metastases. An extended right colectomy was performed, and the analysis of the specimen revealed the presence of two advanced colon cancers, staged respectively pT3N1 and pT4N1, along with localized peritoneal carcinosis. Twelve cycles of FOLFOX-based adjuvant chemotherapy associated to Panitumumab were then administered. At the end of the medical treatment, the re-evaluation imaging showed a mild response on the hepatic disease. Considering the risk of postoperative hepatocellular insufficiency in case of extended right hepatectomy for inadequate future liver remnant, an intensification of the medical treatment was planned. Other 8 cycles of FOLFOX-based regimen associated to Panitumumab and 3 effective cycles of intra-arterial hepatic chemotherapy were, therefore, administered.

After radiologic re-evaluation and multidisciplinary discussion, a right extended hepatectomy along with an *en-bloc* IVC vascular resection was undertaken.

## Technique

A bilateral sub costal incision was performed.

After the meticulous exploration of the peritoneal cavity looking for other neoplastic implants contraindicating the preoperative plan, liver mobilization was realized sectioning the falciform and the left coronary ligaments. The right triangular ligament was partially dissected as the diaphragm was infiltrated on the right side of the IVC.

An intraoperative ultrasound evaluation was then performed to assess the extension of the disease and confirm the feasibility of the surgical intervention. Neoplastic lesions were localized in right liver with a minor involvement of the segment IV. The neoplastic masses partially encircled the retrohepatic IVC, enclosing, as well, the origin of the median hepatic vein.

Main hepatic pedicle was encircled using a vessel loop in order to obtain prompt inflow vascular control in case of major bleeding. The same maneuver was realized on the right and on the left hepatic veins, using an intrahepatic glissonian approach.

Wherever possible, the retrohepatic inferior vena cava was exposed sectioning all the tributaries veins.

The elements of the right hepatic pedicle were then controlled and sectioned. The hanging maneuver was then performed to guide parenchyma transection which was realized combining the effect of Cavitron Ultrasonic Surgical Aspirator (CUSA) device and of the bipolar energy. The median hepatic vein was sectioned at the origin. Biliary and vascular structures were isolated and separately ligated. After completing the parenchymal transection on the context of segment IV, the neoplastic attachment to the diaphragm was removed *en-bloc* with the infiltrated muscle using the linear stapler seam-section.

The last residual connection to complete right extended hepatectomy was then the encasement of the retrohepatic IVC. We could minimize the time of vascular clamping on IVC leaving this phase as the last one during surgical dissection.

A lateral clamping of the IVC was applied in order to obtain clear surgical margins. Patient received intraoperative heparin anticoagulation (50 UI/kg) just before the vascular clamping. Complete resection of the vascular involvement was then performed.

To provide caval reconstruction, we procured a rectangular peritoneal patch of the same dimension of the venous defect (6 cm × 4 cm). The peritoneum was

withdrawn on the right lateral diaphragmatic surface, where it is normally thicker.

Great attention was carefully paid to peritoneal patch manipulations and to gently remove all the fat tissue attached. The mesothelial side was then applied to the vessel lumen and the graft was sewn using a running 5/0 polypropylene suture.

Vascular clamping was removed at the end of the reconstruction, verifying the good fitting and the seal of the graft.

## Results

Surgery lasted 215 minutes and no adverse events occurred. Intraoperative blood loss accounted for 300 mL.

No intraoperative nor postoperative blood transfusion were required.

Postoperative therapeutic dose of low-molecular-weight heparin was administered starting after 6 hours from the operation.

An abdominal Doppler ultrasound was provided on second postoperative day (POD) to assess IVC blood flow: no venous aneurism nor thrombus formation were detected.

Hospital stay lasted 9 days and was uneventful. Patient was discharged home with therapeutic anticoagulation therapy to continue for 1 month.

The specimen analysis showed the presence of two hepatic metastatic lesions measuring 4 and 9.7 cm on the right hepatic lobe. Moreover, the 80% of the tumor tissue was characterized by necrosis. Surgical resection was complete (R0).

On 23rd postoperative day, the patient was readmitted for fever and anorexia. A complete blood loss was realized showing an elevated inflammatory response and a mild cholestasis with mild hyperbilirubinemia. A contrast-enhanced abdominal computer tomography was undertaken showing the regular patency of the IVC, the absence of intraabdominal venous thrombosis and the presence of a sub phrenic collection compatible with biloma formation.

The drainage of the bile collection was radiologically performed at re-admission and an endoscopic biliary sphincterotomy was performed the day after, with regression of the collection and resolution of the biloma.

Patient was discharge on the eighth post re-admission day after removing the drainage et subsequent negative ultra-sonographic control.

## Discussion

Hepatic resection for malignancies invading the IVC remains a major surgical challenge for hepatobiliary surgeons. Despite the risks of major bleeding and gas embolism, hepatectomy combined with major vascular resection are increasingly performed in expert hands.

Complete surgical resection allows, indeed, prolonged survival (1-4).

When caval venous resection is necessary for tumor involvement, to achieve tumor-free margins, a reconstruction strategy is required in order to provide complete restoration of the IVC blood flow. The long-established preoperative complete occlusion of the IVC is the only situation in which vessel reconstruction is not mandatory (1).

As far as the reconstructive techniques are concerned, many solutions have been proposed and can be adopted. Very limited lateral or circumferential resections can be managed without graft interposition (9). Despite this, when vascular involvement is not confined, vessel patency must be guaranteed using a graft. Dacron or PTFE synthetic graft have been used with good results (5-10). However, synthetic grafts present a higher rate of thrombotic complications and require permanent anticoagulation.

Allografts and autologous graft have been successfully tested and were recognized to be burdened by fewer thrombotic complications when compared to synthetic patches (11,12). Furthermore, they do not require prolonged anticoagulation. However, their usage entails disadvantages linked to the need for preoperative planning, availability and conservation, as well as sometimes to the sacrifice of venous discharge of another anatomical region.

Peritoneal patches have been successfully used to replace venous defects since recent reports (7,8). Peritoneal patches are, indeed, effective venous graft, rapidly available and resistant. Moreover, they do not require preoperative planning which is useful in case of unexpected major venous involvement and do not need prolonged anticoagulation.

In our experience, peritoneal parietal patch is a valid and safety tool for hepatobiliary surgeons to provide vessel reconstruction during major hepatectomies.

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## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

*Informed Consent:* Participant gave informed consent for therapeutic procedures and research.

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