

Vascular Reconstruction in Hepatic Malignancy



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KEYWORDS

- Vascular reconstruction • Ex vivo liver surgery • Portal vein reconstruction
- IVC reconstruction

KEY POINTS

- Increased experience with vascular resection to achieve negative margins with hepatic malignancies has improved short-term outcomes.
- High-quality preoperative imaging with triphasic computed tomography or contrast MRI is required for appropriate planning and decision making.
- Vascular reconstruction requires careful assessment, planning of clamp placement, and a strategy to reconstruct the artery or vein with appropriate grafts if needed.
- Ideally future liver remnant (FLR) volume of 40% of total liver volume is recommended when vascular resection is planned. Portal vein embolization can be used to increase FLR before resection.
- Cold perfusion, whether in situ, ante situm, or ex vivo, are options for resection in otherwise unresectable tumors involving the inferior vena cava and/or hepatic veins.

INTRODUCTION

The best, if not only, option for cure and long-term survival with malignancy in hepatic surgery has always been surgical resection with negative margins. Patients who are unresectable and undergo chemotherapy and/or interventional procedures have substantially worse survival than those who can be resected. Although interpretation of available data has inherent bias that is included in the selection of patients for surgery, it is clear that there remains some truth in the adage that a chance to cut is a chance to cure.

In the past many surgeons have considered liver tumors with vascular invasion or involvement to be unresectable or at least that the risk involved with the surgery outweighs the benefit. Over the last several years there has been an evolution in surgical

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thought. Many surgeons now consider vascular resection in order to achieve negative margins for resection of hepatic malignancies, including hilar cholangiocarcinoma, as well as other primary or secondary liver malignancies. Resections may include resection of the portal vein (PV), hepatic artery, inferior vena cava (IVC), or hepatic veins and may require conduits for vessel reconstruction.¹ Techniques to control hepatic vascular inflow and outflow must be used; adequate preoperative imaging needs to be obtained to ensure appropriate uninvolved vasculature can be found for clamp placement, anastomosis, and subsequent reestablishment of flow. Improving outcomes has made vascular resection in hepatic malignancy more frequent and successful at centers with experience in these techniques.²

General guidelines for liver resections suggest a future liver remnant (FLR) of greater than 20% be obtained to avoid complications of postoperative liver dysfunction.³ Volumetric assessment of the FLR by preoperative imaging is a key component in planning resections that include vascular reconstruction. With vascular resection and the potential increased ischemic injury to the remnant liver, an FLR of 40% is preferred, though not always obtainable.⁴ Preoperative PV embolization (PVE) is an important adjunct to improve outcomes. In cases with borderline FLR or when extremely complex vascular reconstructions may be required, PVE of the side of the liver ipsilateral to the tumor should be performed 4 to 6 weeks before resection to allow hypertrophy of the remaining liver.⁵ In many cases that require vascular reconstruction, PVE is not necessary, however, because the involvement of vessels by tumor may create an atrophy/hypertrophy complex that favors resection. The role of preoperative biliary drainage of the FLR in cases with biliary obstruction is controversial.⁶⁻⁹ The authors' own practice in cases of biliary obstruction is to drain the FLR until bilirubin is less than 2 mg/dL before proceeding with resection; however, this practice may increase the risk of perioperative infectious complications and is not uniform across centers.

PORTAL VEIN RESECTION

- It was first described in the West in 1990 by Blumgart for hilar cholangiocarcinoma.¹⁰
- Variations in anatomy of the PV can make reconstruction challenging, so thorough assessment with preoperative imaging is necessary.
- Vein grafts can come from the left renal vein, gonadal vein, saphenous vein panel grafts, or resected hepatic veins from the side of the liver removed.

PV resection with hepatectomy was first described in the West in 1990 as a method to achieve negative margins and complete tumor resection for hilar cholangiocarcinoma by Blumgart.¹¹ This method was met with skepticism at that time as surgeons thought that the risk of such a procedure did not justify the outcome. Over time, more centers published successful results with combined hepatectomy with PV resection; the technique was used to obtain complete resection and increase the number of resectable patients with cholangiocarcinoma or gallbladder adenocarcinoma. In 1997 Klempnauer and colleagues¹² reported the first combined right trisectionectomy and PV resection in the West, and later in 1999 Neuhaus and colleagues^{13,14} described a no-touch en bloc resection technique for hilar cholangiocarcinoma including PV resection with excellent outcomes. PV resection is now the most common vascular resection performed for hilar cholangiocarcinoma and has become an accepted if not uniformly applied technique.

Outcomes with PV resection in current studies are similar to hepatic resection without PV resection with comparable morbidity and mortality.^{15,16} The most recent reports have shown improvements in perioperative mortality from 8% to 33% in early

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