Preoperative Optimization of the Liver for Resection

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12.1 Introduction

Hilar cholangiocarcinoma (HCCC) usually presents with jaundice, indicating involvement of the right and/or left bile ducts at their confluence. Even when the tumor is small, it is often infiltrative and is difficult to be managed surgically. Its unique location frequently results in involvement of the portal vein, the hepatic artery and/or the parenchyma of the liver around the hepatic hilum. Long-term survival rates depend on complete tumor clearance with extensive hepatic resection, which is risky in jaundiced patients; several large series reported mortality rates up to 20 % and morbidity rates of up to 67 % [1–14]. Parenchymal transection in the cholestatic liver is associated with more bleeding and a high risk of biliary fistula, sepsis, and also results in impaired liver regeneration [3]. Therefore, preoperative preparation is necessary for a major hepatectomy in jaundiced patients [15]. In an attempt to improve perioperative outcomes, many centers have advocated preoperative biliary drainage (BD) and ipsilateral portal vein embolization (PVE) of the hemi-liver to be resected to improve the functions of the future liver remnant (FLR) [4, 7, 11, 12, 14]. In addition, early assessment to look for distant metastases or peritoneal involvement is worthwhile. Laparoscopic staging avoids extensive preparation for inoperable patients. In this chapter, we describe the surgical planning and preparation for major hepatectomy for HCCC, focusing on preoperative treatment such as BD, PVE and laparoscopic staging.

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12.2 Preoperative Biliary Drainage

Liver resection in patients with obstructive jaundice is associated with increased risks of intraoperative bleeding, postoperative biliary fistula and liver failure. The aims of BD are: (a) to decrease bilirubin level, (b) to treat biliary infection, (c) to assess the intraductal extent of carcinoma and (d) to optimize hypertrophy of the liver if PVE is performed. The major risks of BD include: (a) tumor seeding which occurs in about 5 % of cases after percutaneous BD; (b) infection; and (c) bleeding. The risk of cholangitis caused by BD can be minimized by avoiding preoperative cholangiography [16]. As there have been no prospective randomized studies to evaluate the role of preoperative BD prior to extend liver resection, this practice is widely variable [17–19]. However, most centers would use BD under the following three situations: (a) when the FLR is less than 40 % of the total liver volume and when PVE is used; (b) when cholangitis caused by endoscopic injection of contrast media fails to respond to antibiotics; and (c) in the presence of malnutrition, renal failure or hypoalbuminemia. In principle, unilateral drainage of the future remnant lobe is sufficient [18].

The beneficial effects of BD should, however, be balanced with the prolongation of hospital stay and increase in cost [17]. Rarely, patients with HCCC with short duration of jaundice are directly referred to specialized surgical units for management. These patients can be subjected to curative surgical exploration without any preoperative optimization. In our experience, these patients have a good tolerance to major hepatectomy [15]. In a recent French nationwide study (2009) which included 595 HCCC patients, serum bilirubin level (SBL) was found to be correlated with the mortality which ranged from 9 % when the SBL was <50 U to 27 % when the SBL was >300 U. The mortality was higher in patients who had preoperative BD, particularly when the SBL was higher than 100 U. The mortality rate after extended

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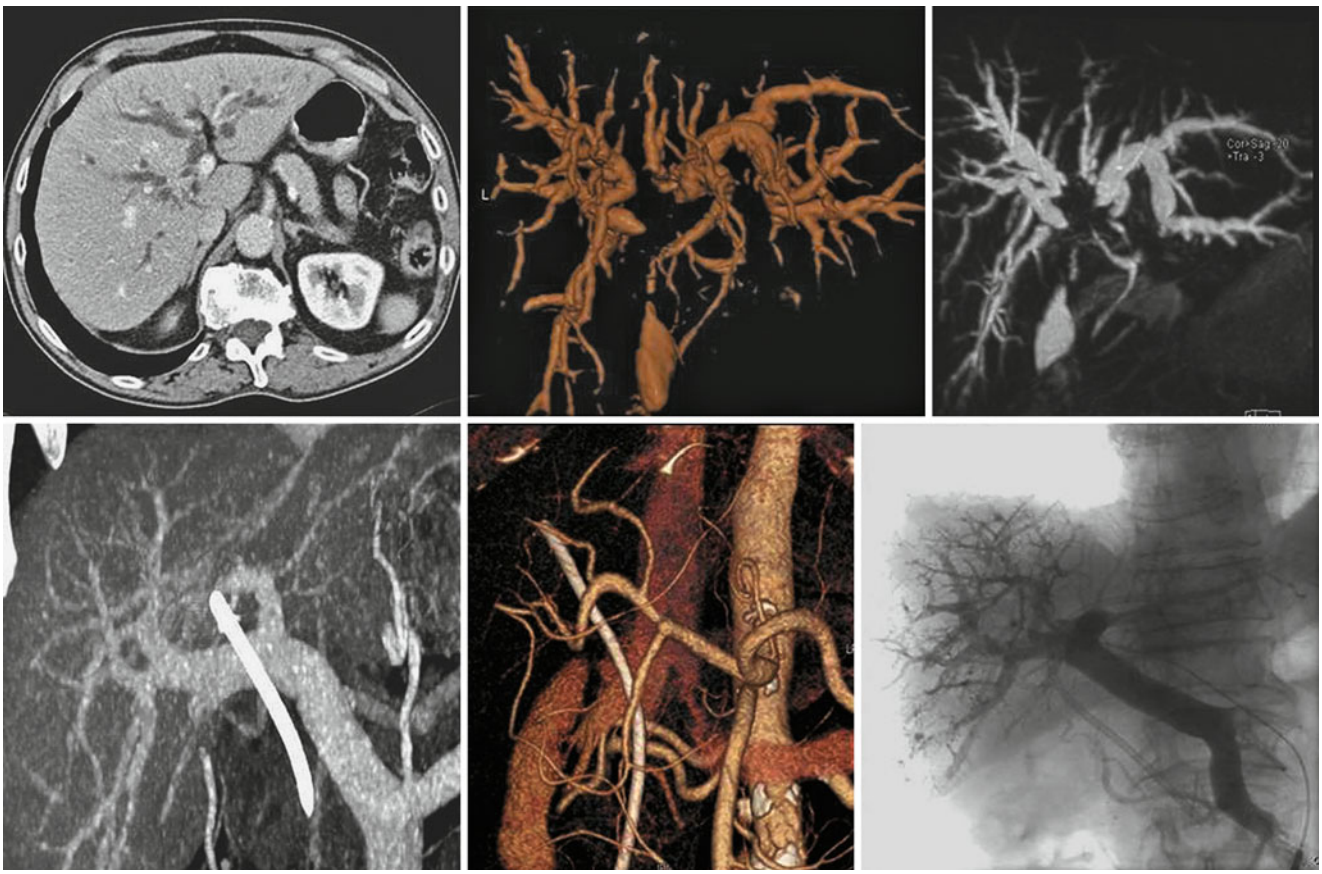

Fig. 12.1 CT and MRI reconstruction permits excellent visualization of hepatic parenchymal abnormalities, as well as visualization of the biliary tree and vascular structures

right hepatectomy was significantly lower in patients who had preoperative BD. The mortality in patients without BD increased exponentially with the SBL. However, the preoperative SBL was not related to the mortality in left hepatectomy. These unpublished results suggest that BD prior to surgery is useful only for right hepatectomy.

The choice of the route for preoperative BD has been debated controversial. A successful endoscopic retrograde biliary drainage (ERBD) using a plastic stent achieves an efficient drainage with a low morbidity and short hospital stay [20], and avoids the risk of tumor cell implantation in the percutaneous catheter tract [21]. However, the endoscopic approach is often technically difficult in patients with complete obstruction, especially when the left duct requires drainage. Regardless of the location of the biliary obstruction, either percutaneous transhepatic or endoscopic BD can be used and the choice depends on the availability of the local expertise. Cholestatic jaundice induces an increase in gut permeability due to altered villous morphology, activation of the gut components of the gut-associated lymphoid tissue and enterocytes, and a heightened acute phase response when exposed to endotoxin [22]. It has been shown that internal drainage is superior to external drainage by preventing bile loss from the gastrointestinal tract [23].

PTBD can be unilateral or bilateral, but most centers prefer a unilateral PTBD on the side of the FLR. If segmental cholangitis is not controlled after a technically successful hemi-hepatic BD, additional percutaneous BD can be used to drain the septic territory [9, 13, 16]. The duration of BD is not standardized but surgery is usually scheduled when the SBL is less than two or three times the upper limit of normal value (after 4–6 weeks) to restore the disturbances induced by jaundice. MRI permits excellent visualization of the hepatic parenchymal abnormalities, as well as the biliary tree and the vascular structures (Fig. 12.1) [24]. As MRI is non-invasive and it does not involve any radiation exposure, it may replace CT, angiography and cholangiography via PTBD.

12.3 Preoperative Portal Vein Embolization (PVE)

Extensive liver resection increases the chance of negative surgical resection margins [13]. However, chronic biliary obstruction restricts the tolerance of patients with HCCC to major parenchymal resection [11, 17]. Resection of more than 60 % of the total liver volume is associated with increased risks of major complications, postoperative liver failure, and mortality [25]. The aim of preoperative PVE is to initiate a compensatory hypertrophy of the FLR and thus minimizes postoperative liver dysfunction and liver failure [4, 11, 12, 26]. Although there has been no randomized controlled series to show the beneficial role of PVE in extended hepatectomy for HCCC, there are several arguments in favor of PVE before right extended resection, especially when vascular reconstruction is anticipated [26]. It has been shown that the mortality after liver resection for HCCC was significantly lower in patients with good hypertrophy of the FLR compared to patients without hypertrophy (3 % vs. 21 %) [1]. Also, hypertrophy of the FLR was more rapid when the SBL was lower than twofold of the normal value. Thus, for efficient hypertrophy of the FLR, PVE should be performed following BD and when the SBL has decreased to 50 IU. Liver resection can be performed between 2 and 3 weeks after PVE, although this wait is usually longer in Western countries [3–5, 15, 25]. Often, the FLR volume is overestimated due to the increase in volume of the biliary dilatation. Thus, the FLR volume should be measured only after sufficient biliary decompression.

The potential disadvantages of PVE are the risk of cholangitis in patients with extensive portal thrombosis, and sometimes the difficulty in determining the side of resection in patients with centrally placed tumor at the hilum. In extended right hepatectomy, supplemental embolization of segment 4 is not mandatory because the high part of segment 4 can be preserved. In addition, embolization of segment 4 is technically difficult and can result in migration of the thrombosis to the portal branches of the FLR. There have been some series which reported the experience of additional arterial embolization to improve the results of PVE [27]. This arterial embolization is performed 3–6 weeks after PVE and is more risky (infection) than PVE because the arterial branches are larger after PVE. Additional embolization of the hepatic vein was reported in very few series but it would increase the hypertrophy of the FLR [28].

In the French survey, about 33 % of right hepatectomy and 3 % of left hepatectomy received preoperative PVE. The mortality was lower in patients who underwent four or five segments of liver resection after PVE. Interestingly, in patients who underwent left hepatectomy after PVE, none died postoperatively suggesting that even in extended left hepatectomy, the risk of liver failure is very low.

12.4 Preoperative Staging Laparoscopy

It usually takes over 4 weeks for jaundice to resolve after BD, and sufficient hypertrophy of the FLR after PVE takes an additional 2 weeks. Unresectable HCCC can be formed at surgical exploration despite extensive preoperative evaluation including CT scan, ultrasonography, cholangio-MRI and cholangiography via PTBD. Peritoneal carcinomatosis and/or small intrahepatic metastases are not detectable by conventional preoperative investigations [29]. Of the patients who are surgically explored with a curative intent, only 40–50 % are ultimately resected. This has motivated the use of staging laparoscopy for patients with HCCC. The yield and accuracy of staging laparoscopy for patients with HCCC are between 25 and 42 %, and 42 and 53 %, respectively [30]. We perform staging laparoscopy before the above-mentioned preoperative preparation. Staging laparoscopy on patients who are initially assessed by conventional investigations to be resectable allowed us to discover peritoneal and distant metastasis in up to 20 % of patients. This policy of routine staging laparoscopy led to a shorter hospital stay and a more rapid and efficient treatment of these patients with metallic stents.

Recently, an innovative strategy has been described by German authors. The treatment involves a two-step procedure: transection of the liver parenchyma along with ligation of the biliary and portal branches while leaving the hepatic artery and vein intact. Liver resection is completed 1 week after regeneration of the FLR [31]. This novel technique dramatically shortened the long preparation of HCCC patients.

In conclusion, the resectability and the results of resection of HCCC can be improved with proper preoperative optimization of patients. Biliary drainage is indicated in patients with severe and prolonged jaundice. PVE improves resectability in patients with a marginal FLR and preoperative staging laparoscopy excludes patients who are not suitable for preoperative optimization (Fig. 12.2).

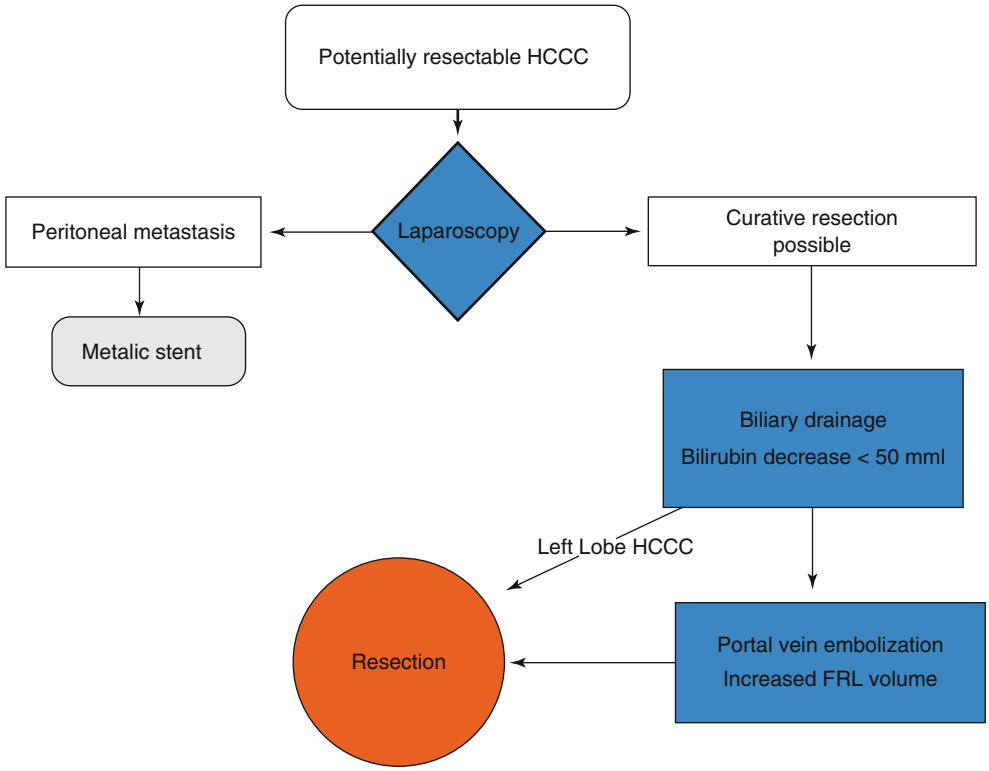

Fig. 12.2 Management protocol of HCCC requiring major hepatectomy

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