

REVIEW ARTICLE

Radical surgery of left-sided klatskin tumors

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Left-sided cholangiocarcinoma includes hilar cholangiocarcinoma (HC), predominantly involving the left hepatic duct, and intrahepatic cholangiocarcinoma (ICC) in the left liver. Left hepatectomy, or left hepatic trisectionectomy, is indicated as radical surgery of left-sided HC or ICC with or without hilar bile duct invasion. Left lateral sectionectomy, or left medial sectionectomy, is performed for the small mass-forming type ICC. Left hepatic trisectionectomy is indicated for left-sided HC with further cancer progress along the right anterior sectional duct or left-sided ICC involving the right anterior section over the middle hepatic vein and/or the right anterior pedicle. Combined caudate lobe and extrahepatic bile duct resection are mandatory in cases of HC or ICC involving the hepatic confluence. Preoperative biliary drainage should be performed not only for jaundiced patients but also for non-icteric patients with right-sided biliary dilatation of the future remnant liver. Preoperative left trisegment portal vein embolization after biliary drainage of the right posterior section should be carried out prior to left hepatic trisectionectomy. Left hepatectomy has been used as a radical and safer surgical procedure, but in European countries has still been associated with higher morbidity and about 10% operative mortality. Japanese surgeons have had no hospital deaths after carrying out left hepatic trisectionectomy done after preoperative biliary drainage followed by left trisegment portal vein embolization to increase safety and to prolong postoperative survival for patients with locally advanced left-sided cholangiocarcinoma.

Introduction

“Left-sided cholangiocarcinoma” includes hilar cholangiocarcinoma (HC) predominantly involving the left hepatic duct and intrahepatic cholangiocarcinoma (ICC) in the left liver. The first successful operation, which was performed by Altemeier at the Cincinnati General Hospital, was on a marked jaundiced lady (serum total bilirubin; 34 mg/dl) with left-sided HC. A staged operation was scheduled and was first performed on 11 January 1962 with a T-tube being inserted into the right hepatic duct to relieve obstructive jaundice. Radical left hepatectomy with extrahepatic bile duct resection and right hepaticojejunostomy were carried out 39 days after internal and external biliary drainage. After the second operation, serum total bilirubin eventually dropped from 19.4 mg/dl to normal [1]. From this memorable case, we have learned that preoperative biliary drainage can be performed prior to cholestatic liver resection. However, left hepatectomy can actually be carried out even in the icteric condition, and jaundice is

relieved safely after definitive surgery for left-sided HC [2].

Indications

Left hepatectomy, or left hepatic trisectionectomy, is indicated as radical surgery of left-sided HC or ICC with or without hilar bile duct invasion. Left lateral sectionectomy, or left medial sectionectomy, is performed for small mass-forming types of ICC; the latter is indicated for localized HC involving the hepatic confluence and the left medial sectional duct [3–6]. Left hepatectomy is also indicated for HC with predominant cancer involvement in the left hepatic duct or ICC located in the left liver with or without periductal cancer progression to the hepatic confluence. As there has been some confusion between American “left hepatic trisegmentectomy” [1] and European “extended left hepatectomy” [7], the terminology committee of the International Hepato-Pancreato-Biliary Association (IHPBA) proposed the

term “left hepatic trisectionectomy” for the above surgical procedures [8]. Left hepatic trisectionectomy is indicated for left-sided HC with further cancer progression along the right anterior sectional duct. When left-sided ICC involves the right anterior section over the middle hepatic vein (MHV) and/or the right anterior pedicles, left hepatic trisectionectomy is indicated. As bilateral biliary branches of the caudate lobe are confluent with the right hepatic duct, the left hepatic duct, the confluence of those and/or the right posterior hepatic duct, they are also involved by HC separating the hepatic confluence. Therefore combined caudate lobe and extrahepatic bile duct resection is mandatory in cases of HC or ICC involving the hepatic confluence [3,9].

Preoperative management

Preoperative biliary drainage, preferably percutaneous transhepatic biliary drainage (PTBD) and/or endoscopic nasobiliary drainage (ENBD, should be performed not only for jaundiced patients but also for non-jaundiced patients with right-sided biliary dilatation of the future remnant liver. It is recommended that major hepatectomy should be done when serum total bilirubin falls to within the normal range [3,10]. Preoperative portal vein embolization (PVE) is not necessary with left hepatectomy but is useful with major hepatectomy larger than right hepatectomy [11–14]. Left trisegment PVE should be carried out prior to left hepatic trisectionectomy to increase safety in cases of risky hepatobiliary resection and reconstruction in biliary cancer patients with biliary drainage of the right posterior section [15,16].

Surgical techniques

Surgical techniques for left-sided hepatectomy with caudate lobectomy and extrahepatic bile duct resection are described below.

Left hepatectomy

As the first step in left hepatectomy, regional lymph node and connective tissue dissection is performed [17] and the distal bile duct is divided in the pancreas with a histologically free margin. The left hepatic artery, middle hepatic artery, and caudate lobe branches (A1) are ligated and divided. The left portal vein is ligated and divided after the caudate lobe branches (P1) of the portal vein have been ligated and divided. A demarcation then appears along the Cantlie line and between the caudate process and the right posterior section.

Next, the left liver is mobilized to the right. The left caudate lobe is also mobilized, while all short hepatic veins are ligated and divided to expose the anterior wall of the retrohepatic inferior vena cava (IVC). The distal portion of the Arantius ligament is also ligated

and divided, and the left hepatic vein (LHV) or the common trunk of the left and MHVs is taped.

Next, the liver is transected along the demarcation of the Cantlie line and the MHV is exposed on the raw surface of the liver. The LHV vein is divided and sutured at the confluence of the MHV or the IVC. Liver dissection between the caudate process and segment 7 is progressed cranially behind the right portal vein and along the right edge of the IVC. Finally, the right anterior and posterior sectional ducts are isolated and detached from the portal branches and divided with a free margin, respectively, and the left liver, caudate lobe, and extrahepatic bile duct are resected *en bloc* [3,9].

Left hepatic trisectionectomy

In addition to the above procedure, connective tissue dissection of the hepatoduodenal ligament is progressed more right cranially and the anterior branch of the right hepatic artery is ligated and divided. The anterior branch of the right portal vein is carefully ligated and divided. A demarcation that now appears along the right portal fissure should be confirmed by intraoperative ultrasonography. The right liver is also mobilized and the extrahepatic portion of the right hepatic vein (RHV) is exposed. Short hepatic veins should be divided from the left as described above. Liver is transected along the demarcation on the right portal fissure and the RHV is exposed on the raw surface of the liver; the common trunk of the LHV and MHV is clamped, divided, and sutured. Finally, the right posterior sectional duct is isolated and divided cranially to the right portal vein, and the left liver, anterior section, caudate lobe, and extrahepatic bile duct are resected *en bloc* [3,18].

Biliary reconstruction

Bilio-enteric anastomosis is performed using a Roux-en-Y jejunal limb via the retrocolic and retrogastric route after establishing hepaticoplasty to minimize the number of hepatic duct reconstructions [19]. Although an interrupted suture and/or a continuous suture of 5-0 PDS is used for this meticulous reconstruction, the latter is easier and more convenient than the former. A biliary drainage catheter is introduced in each reconstructed duct and a jejunal feeding tube is placed by some surgeons.

Inferior RHV-preserving procedures

If the RHV is involved by a left-sided ICC or caudate lobe tumor, left hepatic trisectionectomy is usually not indicated. However, in the case of marked RHV stenosis, we sometimes find a large inferior RHV (IRHV), which is a key vein for successful left hepatic trisectionectomy preserving sufficient venous drainage. However, in cases of large RHV and small-sized

IRHV, left hepatic trisectionectomy with RHV resection may be risky. In this instance, preoperative RHV embolization makes it possible to enlarge the IRHV and to perform left hepatic trisectionectomy with RHV resection while preserving the IRHV safely [20]. In the case of insufficient outflow of the segment 6 hepatic vein (IRHV), venous allograft or cryopreserved vein graft is used to maintain outflow of the preserved right posterior section [21].

Results

The left hepatectomy has been used predominantly for HC as a radical and safer surgical procedure; however, left hepatic trisectionectomy is seldom indicated. In 1990, both Nimura (4 cases) [3] and Miyazaki (1 case) [5] described their surgical experiences with this procedure in HC. Nimura's patients survived this difficult operation, but the outcome of Miyazaki's patient is not described. Recent progress in perioperative management and surgical techniques has made it possible to pursue this difficult surgery and some reports have been published [16,22,23]. Encountering about 10% of operative mortality, European surgeons concluded that this procedure remains a challenge and is associated with higher operative morbidity and mortality than less-extensive resections, especially in cases of obstructive jaundice [22,23]. However, Japanese surgeons have not had any hospital deaths on their hands after left hepatic trisectionectomy with preoperative biliary decompression and PVE [16].

Conclusions

Left hepatectomy can be performed safely as radical surgery for left-sided cholangiocarcinoma, but left hepatic trisectionectomy is more major surgery carrying a risk of high postoperative morbidity and mortality. Preoperative biliary drainage followed by PVE should therefore be carried out prior to definitive surgery to increase the safety of this difficult surgery.

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