J Hepatobiliary Pancreat Sci (2012) 19:225–229
DOI 10.1007/s00534-011-0500-8

TOPICS

Highly advanced surgery in the hepatobiliary and pancreatic field (Biliary Section)

Hepatic S4a + S5 and bile duct resection for gallbladder carcinoma

Masaru Miyazaki · Hiroaki Shimizu · Masayuki Ohtsuka · Hiroyuki Yoshidome · Atsushi Kato · Hideyuki Yoshitomi · Katsunori Furukawa · Fumio Kimura

Published online: 29 February 2012

Abstract In the surgical treatment of gallbladder cancer, segment 4a + 5 hepatic resection and bile duct resection is usually recommended for T2 and/or T3 gallbladder cancer involving hepatic parenchyma without hepatic biliary confluence. This procedure does not affect liver function excessively, provided there is correct identification of hepatic S4a and S5, the most important aspect of this procedure. In this paper, the technique of hepatic S4a + 5 and bile duct resection is described in detail. This surgical procedure could be a useful option for the surgical treatment of the hepatobiliary pancreatic malignancies. Surgeons should therefore master the surgical techniques for this procedure.

Keywords Hepatic S4a + S5 resection · Hepatic central inferior resection · Gallbladder cancer · Bile duct resection

Introduction

In the surgical treatment of gallbladder cancer, segment 4a + 5 hepatic resection and bile duct resection is usually indicated for T2 and/or T3 gallbladder cancer [1–3]. This surgical procedure might also be indicated for liver cancer involving segments 4a and/or 5 without the involvement of hepatic hilar duct confluence. In gallbladder cancer, this surgical procedure could be suitable for T2 and/or T3 involving hepatic parenchyma but not the hepatic biliary confluence [2]. If the gallbladder cancer invades the hepatic hilar confluence, a right hemihepatectomy or extended right hepatectomy should be considered [4]. In cases with involvement of the portal vein and right hepatic artery, surgical resection using a right hemihepatectomy or extended right hepatectomy should be considered provided it is resectable [4]. However, even in cases with involvement of the right hepatic artery, a hepatic S4a + 5 resection could be applicable as long as there is minimal biliary invasion by gallbladder cancer. In hepatic S4a + 5 resection, the left hepatic artery could play a role in supplying hepatic arterial blood flow to the right liver lobe via interlobar arterial communication in the absence of blood supply from the right hepatic artery [5].

Furthermore, when hepatopancreaticoduodenectomy is used to achieve curative resection, the extent of resected liver volume might give concern for the occurrence of postoperative liver failure [4]. Therefore, hepatic S4a + 5 resection could be a useful option, in combination with pancreaticoduodenectomy, for avoidance of postoperative liver failure. For these reasons, hepatobiliary pancreatic surgeons should master the surgical techniques of this procedure.

Surgical procedures

Skin incision and laparotomy

Laparotomy is performed by upper abdominal subcostal skin incision.

This article is based on studies first reported in Highly Advanced Surgery for Hepato-Biliary-Pancreatic Field (in Japanese). Tokyo: Igaku-Shoin, 2010.

Electronic supplementary material The online version of this article (doi:10.1007/s00534-011-0500-8) contains supplementary material, which is available to authorized users.

M. Miyazaki (✉) · H. Shimizu · M. Ohtsuka · H. Yoshidome · A. Kato · H. Yoshitomi · K. Furukawa · F. Kimura
Department of General Surgery, Graduate School of Medicine, Chiba University, Chiba, Japan
e-mail: masaru@faculty.chiba-u.jp

A longitudinal skin incision is not required to obtain a sufficient operative field for surgery; instead, make a subcostal incision bilaterally on the upper abdomen.

Kocher maneuver

The pancreaticoduodenum is mobilized away from the retroperitoneum, and the retroperipancreatic lymph nodes are dissected.

Identification and isolation of the bile duct

Hepatoduodenal ligament is skeletonized, and the common bile duct is identified. The bile duct is encircled and is taped with a yellow vessel loop in the middle of the common bile duct. The bile duct is then tracked down to the lower bile duct in the pancreatic parenchyma. The lower bile duct is dissected after its ligation as low as possible in the pancreas.

Isolation of the hepatic artery and portal vein

After dissection of the lower bile duct, the skeletonization of the hepatoduodenal ligament is continued to the hepatic hilus, and the portal vein and hepatic artery are identified and isolated. During these procedures, the right gastric artery, which usually branches from the proper hepatic artery or the left hepatic artery, is ligated and divided. The portal vein should be isolated as far as the second-order branch. The hepatic artery should also be isolated up to the right second-order branch and the left, middle hepatic arteries.

Lymph node dissection around the common hepatic artery

Perihepatic arterial lymph node dissection follows lymph node dissection around the proper hepatic artery. At the celiac axis, the origin of the splenic artery and the left gastric artery can be identified easily after lymph nodal dissection around the common hepatic artery.

Dissection of the hepatic hilus

Hepatic hilar skeletonization has to be performed carefully with preservation of the caudate vessels because combined caudate lobe resection is not required in this procedure. The middle hepatic artery should be preserved even when the middle hepatic artery branches from the right hepatic artery unless the tumor invades the middle hepatic artery.

Dissection of the S4a portal vein branch

The left portal vein is dissected and isolated from the horizontal portion to the umbilical portion. The branches of the portal vein into the hepatic S4a originate from the right-hand wall of the umbilical portion of the portal vein. The S4a branch veins are only divided after the area of the liver fed by its branch vein has been confirmed (Fig. 1). Confirmation can be obtained easily by injecting indigocarmine blue dye into the branch vein directly (Fig. 2). The dissection and dye injection of the S4a branch vein reveals a clear demarcation on the liver surface. The hepatic S4a area can be easily identified by these procedures. The border of the S4a should be marked on the liver surface by electrocautery (Fig. 3).

Identification of S4a + 5

Following identification of the S4a portion as described above, the portal vein and hepatic artery branches into the right posterior segment of the liver are clamped with a vascular clip, which might reveal the demarcation line between the right anterior and the right posterior segments (Fig. 4). This border is also marked by electrocautery (Fig. 4). The hepatic S5 area can be identified by extending the upper border of S4a to the right until reaching the border between the right anterior and posterior segments (Figs. 5, 6).

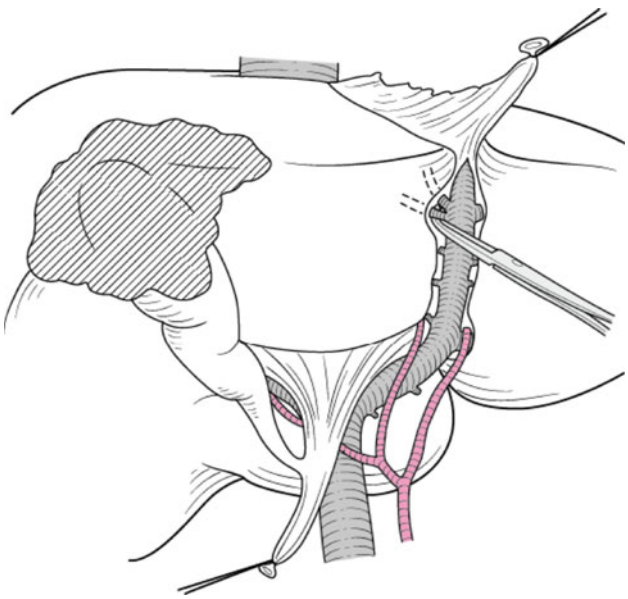

Fig. 1 Identification of the portal vein branch of S4a and its division

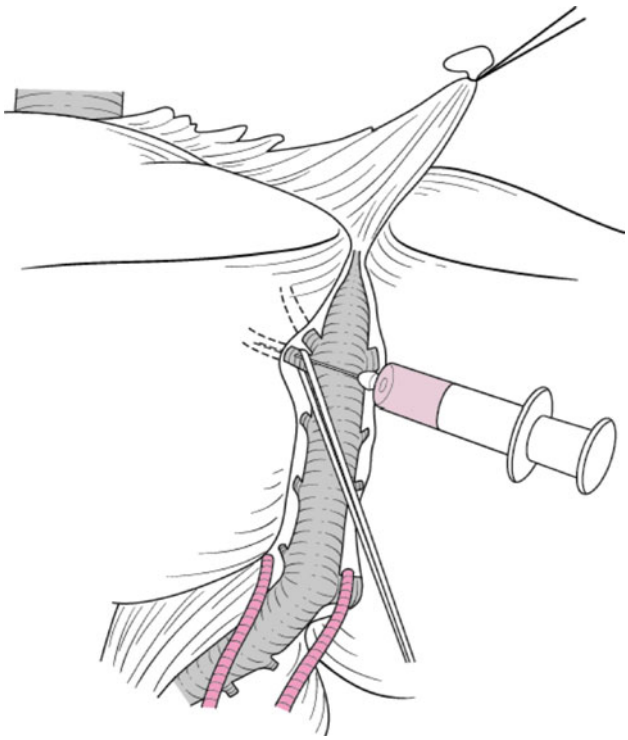

Fig. 2 Dye injection method for the identification of S4a using indigocarmine

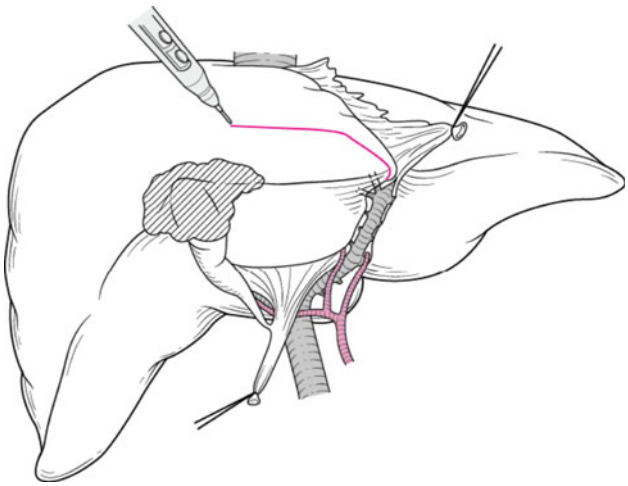

Fig. 3 Marking the border between S4a and S4b by electrocautery after its identification

Transection of the hepatic parenchyma

With vascular control achieved by clamping the main portal vein and the proper hepatic artery, the liver parenchymal transection is started. The liver transection can be started from either the right or the left side. I usually prefer to start from the left side. It is very important to avoid injury to the left hepatic duct during liver transection.

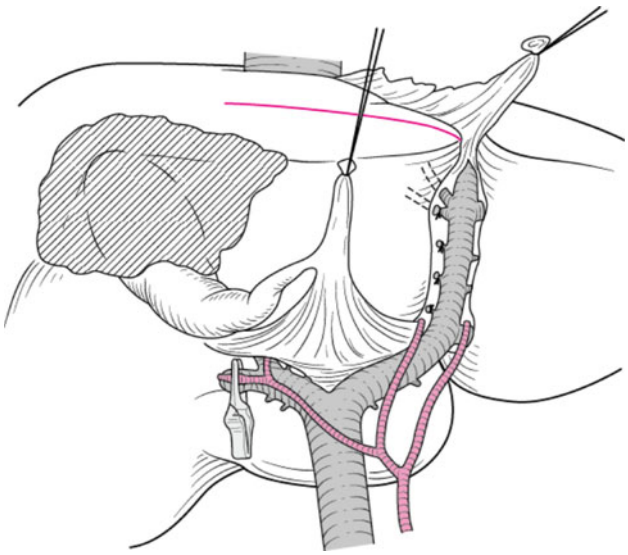

Fig. 4 Clamping the inflow vessels into the right posterior segment of the right lobe for the identification of the border between the right anterior and posterior segments

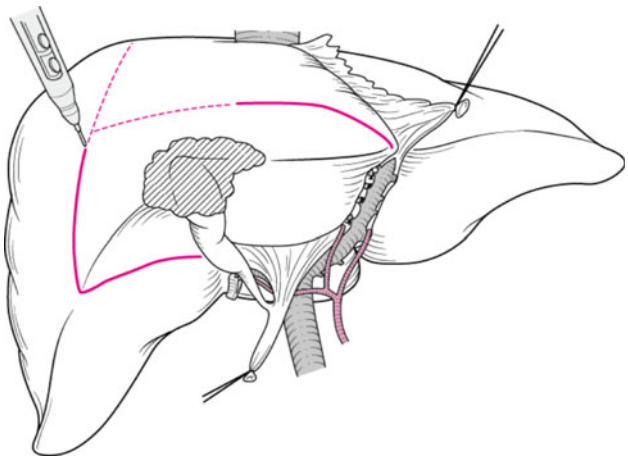

Fig. 5 Marking the border between S5 and S6 by electrocautery according the disclosed demarcation line between the right anterior and posterior segments

Dissection of the middle hepatic vein

During liver transection between S4a and S5, the middle hepatic vein could be exposed, when it is doubly ligated and divided (Fig. 7).

Completion of S4a + 5 resection

The liver transection proceeds to the right side between S5 and S8. The Glisson sheath of S5 is exposed where it branches from the right anterior Glisson sheath, and is divided. After releasing the vascular clamp on the portal vein and the hepatic artery, the demarcated area of S4a + 5 can be seen more clearly on the liver parenchymal surface.

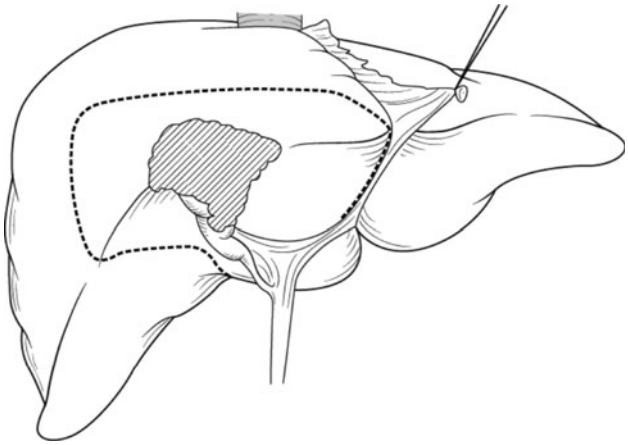

Fig. 6 Completion of the marking of the S4a + S5 portion before liver transection

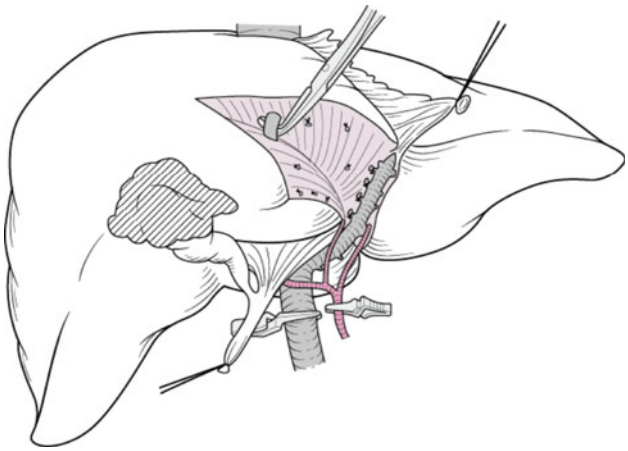

Fig. 7 The middle hepatic vein is ligated and divided during liver transection

Bile duct resection

After the hepatic resection of S4a + 5 is complete, the extrahepatic bile duct is still connected to S4a + 5. The proximal bile duct is divided at the confluence of the right and left hepatic bile ducts. The surgical specimen can be taken at this stage. The bile duct stump might be exposed as two orifices. The two bile duct stumps should be changed to a single stump by bile duct plasty if possible (Fig. 8).

Bilioenteric bypass

By using the jejunum loop, a biliojejunostomy is performed in an end-to-side fashion using an interrupted suture of the whole layer. The biliary stent tube is placed via a transhepatic approach or transenteric approach. A jejunum Y anastomosis is also made 40 cm distal from the bilioenteric anastomosis in the usual way.

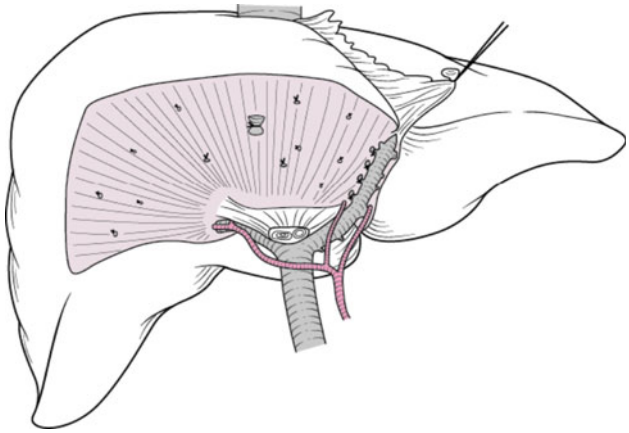

Fig. 8 Completion of hepatic S4a + 5 and bile duct resection

Leak test of the bilioenteric anastomosis

Evaluation of the bilioenteric anastomosis is performed by injection of saline and air through the biliary stent tube.

Abdominal lavage and placement drains

Before closure of the abdomen, the intra-abdominal space is lavaged with 3000 ml saline. Surgical drains are placed in the subphrenic space, Morrison pouch, and the retro-bilioenteric bypass space.

Closure of the abdominal wall

The abdomen is closed, and each drain tube is attached to the abdomen.

Discussion

The surgical procedure of hepatic segment 4a + 5 and bile duct resection is usually performed for T2 and/or T3 gallbladder carcinoma [1–3]. This procedure should not be selected for patients with T1 gallbladder cancer: T1 gallbladder carcinoma can be excised radically by whole-layer cholecystectomy without bile duct and liver resection [3]. A advanced T4 gallbladder carcinoma can sometimes be resected by extended right hepatectomy and bile duct resection [4].

There are several technical points in the hepatic resection of S4a + S5. Identification of the borders of S4a and S5 in the liver is the most important aspect of this procedure. The dye injection method is useful for identification of the portal vein branch into the S4a, especially to identify the portal vein branch of S4b. There are several portal vein branches of hepatic S4. These veins for S4 originate from the umbilical portion of the left portal vein. There are

usually 2 or 3 portal vein branches . There are also 2 or 3 portal vein branches for S4b. The branches for S4a usually originate from the dorsal side of the wall of the umbilical portion and can therefore be identified easily. In order to identify the border of S5, the posterior Glisson sheath should be clamped revealing the posterior segment of the right lobe. It is also easy to identify the border between the anterior and posterior segments. Therefore, the right-hand border of S5 can be identified by this procedure. Then, by extending the line of the upper border of S4a to the right side, the upper border of S5 can be obtained. After transecting the liver parenchyma, the right anterior Glisson sheath should be carefully identified and preserved. Only the Glisson sheath of S5 should be excised, avoiding any injury to the right anterior Glisson sheath.

If the tumor has invaded the right hepatic artery, a right hepatic arterial resection could be applicable in this surgical procedure, without its reconstruction as the left hepatic artery could play a role in supplying hepatic arterial flow to the right liver lobe via the interlobar arterial communication [5]. In order to preserve the interlobar artery, the bile duct has to be resected at the confluence of the bilateral hepatic ducts.

Furthermore, when hepatopancreaticoduodenectomy is used for curative resection, the amount of resected liver volume might cause concern for the occurrence of postoperative liver failure [4]. Hepatic S4a + 5 resection could therefore be a useful option, in combination with pancreatiocoduodenectomy, for the avoidance of postoperative liver failure. For these reasons, hepatobiliary pancreatic surgeons should master the surgical techniques of this procedure.

References

1. Miyazaki M, Itoh H, Ambiru S, Shimizu H, Togawa A, Gohchi E, et al. Radical surgery for advanced gallbladder carcinoma. Br J Surg. 1996;83:478–81.
2. Miyazaki M, Ito H, Nakagawa K, Ambiru S, Shimizu H, Okuno A, et al. Does aggressive surgical resection improve the outcome in advanced gallbladder carcinoma? Hepatogastroenterology. 1999;46:2128–32.
3. Kondo S, Takada T, Miyazaki M, Miyakawa S, Tsukada K, Nagino M, et al. Guidelines for the management of biliary tract and ampullary carcinomas: surgical treatment. J Hepatobiliary Pancreat Surg. 2008;15:41–54.
4. Shimizu H, Kimura F, Yoshidome H, Ohtsuka M, Kato A, Yoshitomi H, et al. Aggressive surgical approach for stage IV gallbladder carcinoma based on Japanese Society of Biliary Surgery classification. J Hepatobiliary Pancreat Surg. 2007;14:358–65.
5. Miyazaki M, Ito H, Nakagawa K, Ambisu S, Shimizu H, Yoshidome H, et al. Unilateral hepatic artery reconstruction is unnecessary in biliary tract carcinomas involving lobar hepatic artery: implications of interlobar hepatic artery and its preservation. Hepatogastroenterology. 2000;47:1526–30.