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HOW I DO IT

Feasibility of Bisegmentectomy 7–8 is Independent of the Presence of a Large Inferior Right Hepatic Vein

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Background: Right superior liver resection or bisegmentectomy 7–8 is defined as the anatomical removal of segments 7 and 8 of the liver. According to recent reports, this type of resection requires the presence of a large accessory right inferior hepatic vein to drain the remaining segment 6. However, anatomic studies have shown that segment 6 has multiple veins presenting several anastomosis with the surrounding hepatic veins. Therefore, the maintenance of the veins from segment 5 that ultimately drain into the middle hepatic vein can be enough to assure venous drainage of both segments.
Methods: Describe an alternative technique for bisegmentectomy 7–8 using intrahepatic glissonian access in patients with absence of a large inferior right hepatic vein.
Results: The technique was successfully performed in four consecutive patients without immediate or long-term venous or venous related complications.
Conclusions: Bisegmentectomy 7–8 may increase resectability rate in patients with bilateral lesions and may also enhance the opportunity to perform repeated resections in cases of tumor recurrence. Our study confirms the anatomical assumption that bisegmentectomy 7–8 did not result in segmental outflow block even in the absence of a thick inferior right hepatic vein and therefore should be performed more often than reported so far. The absence of this vein should not be a straightforward indication for right hepatectomy in cases where a liver-sparing procedure such as bisegmentectomy 7–8 can be safely employed.
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KEY WORDS: liver; anatomy; resection; bisegmentectomy 7–8; glissonian

INTRODUCTION

Surgical resection is the standard treatment for malignant liver tumors. Preservation of liver parenchyma should always be attempted in order to prevent post-operative liver failure and to increase the opportunity to perform repeated resections in cases of recurrent malignancy. The better knowledge of hepatic anatomy and the increased use of intraoperative ultrasound have provided the fundamental basis for segmental liver resection [1].

Right superior liver resection or bisegmentectomy 7–8 is defined as the anatomical removal of segments 7 and 8 of the liver. According to recent reports [2,3], this type of resection requires the presence of a large accessory right inferior hepatic vein to drain the remaining segment 6. However, anatomic studies have shown that segment 6 have multiple veins presenting several anastomosis with the surrounding hepatic veins [4,5]. Therefore, the maintenance of the veins from segment 5 that ultimately

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drain into the middle hepatic vein can be enough to assure venous drainage of both segments.

The authors describe their experience with an alternative technique for bisegmentectomy 7–8 where despite the absence of a large inferior right hepatic vein the procedure was successfully performed without venous complications.

PATIENTS AND METHODS

Four consecutive patients that underwent bisegmentectomy 7–8 using a standardized intrahepatic pedicle approach technique [6], were prospectively evaluated from April 2004 to January 2005. There were three men and one woman with a mean age of 53.9 years (range, 33–74 years). Two patients had liver metastasis, one hepatocellular carcinoma on cirrhosis, and one hepatic adenoma. The surgical procedure, postoperative course, and outpatient follow-up were evaluated and the following data collected prospectively: duration of surgery, average time to inflow pedicles control, presence of an inferior right hepatic vein larger than 5 mm, perioperative transfusions, postoperative complications, and hospital stay. The interval timing to control segments 7 and 8 pedicles was defined by the time between beginning of intrahepatic dissection of glissonian sheaths and establishment of segments 7 and 8 ischemia.

Preoperative Evaluation

Preoperative investigation included liver and renal function tests, complete blood count, and coagulation profile. All patients underwent abdominal CT scan and/or MRI. Patients were selected to right superior resection when the lesion or lesions were located in segments 7 and/or 8 and there was no portal vein invasion and an adequate margin (at least 1 cm) of nontumoral hepatic tissue could be obtained. The absence of a stout inferior hepatic vein was not considered a contraindication for bisegmentectomy 7–8.

Operative Technique

A bilateral subcostal incision extended superiorly in the midline to the xyphoid was performed. Liver was mobilized by sectioning falciform, right triangular, and coronary ligaments, and a self-retaining retractor was used.

Without employing the Pringle maneuver, a small anterior incision (5 mm) was made in front of the hilum in order to disclose the anterior surface of the right glissonian pedicle. A second incision was performed in the posterior part of segment 7, where it connects to the caudate lobe. A large clamp was inserted through the first incision with a 30° angle reaching the second incision as described elsewhere [6]. A third incision was performed on the right edge of gallbladder bed to permit access to the right anterior pedicle when a large clamp was inserted through the first incision with a 60° angle in order to disclose the right anterior glissonian pedicle (segments 5 and 8). By combining the second and the third liver incisions it is possible to isolate right posterior pedicle (segments 6 and 7). Once encircled, the right posterior pedicle is dissected on its anterior surface for about 10 mm where it is possible to identify the bifurcation of segments 6 and 7. The pedicle of segment 7 is then encircled (Fig. 1). The same maneuver can be employed at the anterior branch of the right glissonian pedicle to reach segment 8 pedicle (Fig. 2). At this time the pedicles of segments 7 and 8 are tied and divided (a vascular stapler may as well be used). The limits of the right superior liver (segments 7 and 8) were clearly defined through an ischemic delineation (Fig. 3). Intraoperative ultrasound was performed to identify the course of middle hepatic vein and its branches with special attention to preserve the segment 5 veins (Fig. 3). The right hepatic vein was dissected free from vena cava without ligature of inferior branches and it was divided between vascular clamps or with endoscopic vascular linear stapler. The liver parenchyma was then transected as usual (Fig. 4).

RESULTS

Four patients underwent bisegmentectomy 7–8. Blood transfusion was not required in any patient. Mean operative time consumed to achieve complete control of pedicles from segments 7 and 8 was 12.8 min (range, 10–18 min) and mean operation time was 260 min (range, 180–440 min). No patient had preoperative or intraoperative diagnosis of a right inferior hepatic vein larger

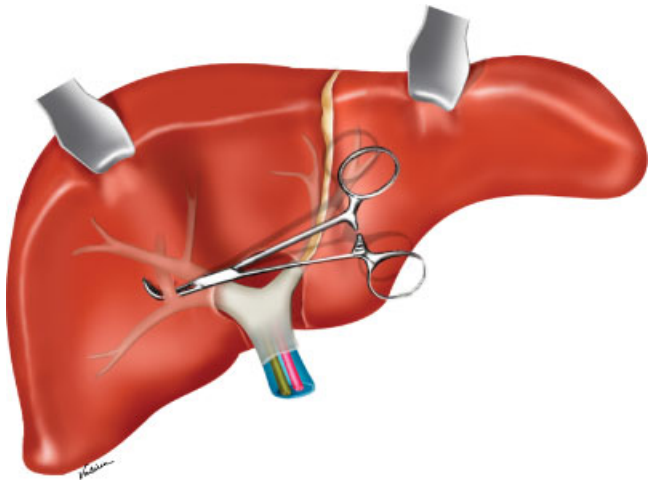

Fig. 1. Schematic view of intrahepatic access of segment 7 glissonian pedicle. [Color figure can be viewed in the online issue, available at www.interscience.wiley.com.]

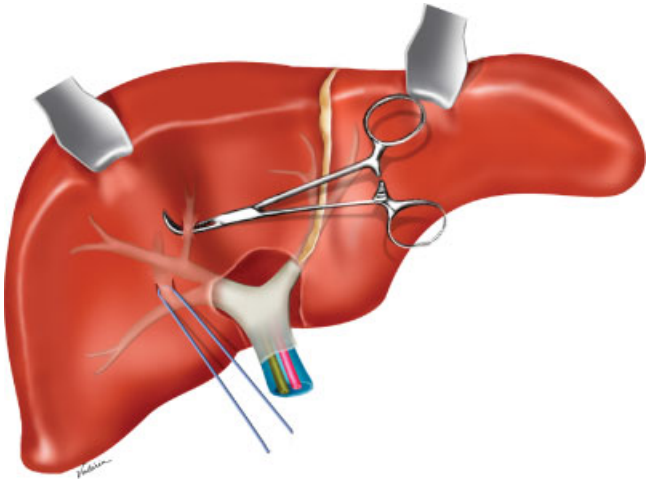

Fig. 2. Schematic view of intrahepatic access of segment 8 glissonian pedicle. Segment 7 pedicle is already encircled. [Color figure can be viewed in the online issue, available at www.interscience.wiley.com.]

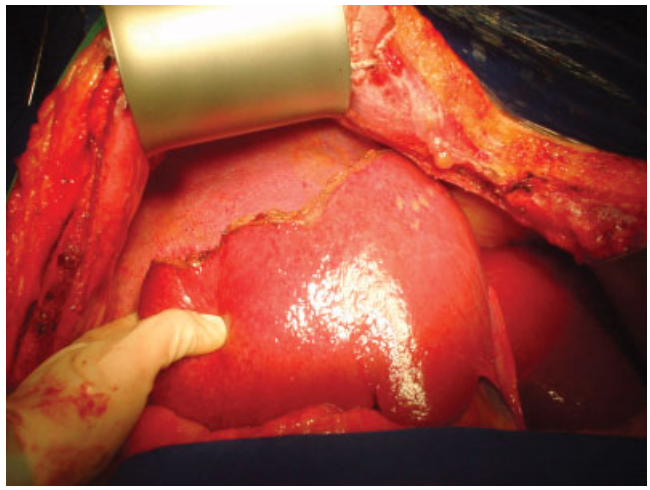

Fig. 4. Intraoperative view of the liver after right superior liver resection (bisegmentectomy 7–8). [Color figure can be viewed in the online issue, available at www.interscience.wiley.com.]

than 5 mm. No patient had intraoperative signs of segmental outflow block such as tumescent or discolored segment 6 or major bleeding from raw surface after bisegmentectomy 7–8.

The median hospital stay was 7 days (range, 5–8 days). One patient developed pleural effusion that was treated conservatively. No patient had postoperative signs of liver failure. No postoperative mortality was observed.

One patient was operated on for benign hepatic adenoma while the remaining three were operated on due to malignant primary or secondary tumors. These three patients had negative surgical margin, and was >1 cm in all patients. One patient exhibited moderate steatosis, two had mild steatosis, and another one had hepatocarcinoma on cirrhotic liver. Intraoperative liver ultrasound confirmed the site and size of the lesions diagnosed by CT scan and/or MRI. In one patient with hepatocarcinoma, a satellite lesion was observed within segment 7 and this finding did not alter the planned liver-sparing resection. The mean follow-up was 12 months. No late complications were observed during follow-up. Postoperative CT scan showed complete regeneration of the remnant right liver in all patients (Figs. 5 and 6).

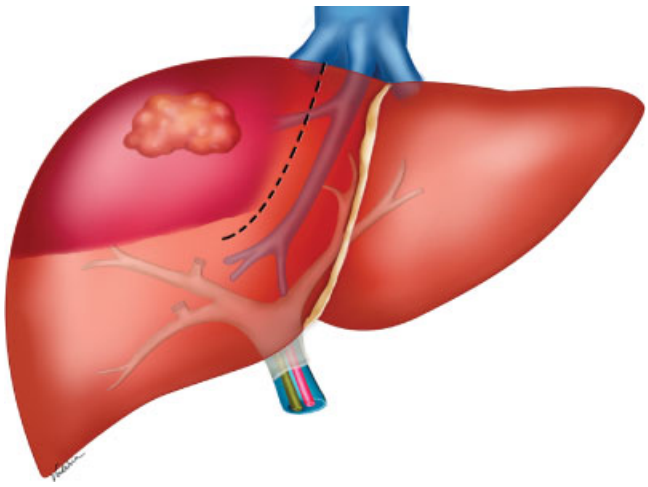

Fig. 3. Schematic view shows ischemic delineation of right superior liver (segments 7 and 8). A safe line (dotted line) is to be positioned 1 cm away from the middle hepatic vein and the segment 5 branches in order to preserve them. [Color figure can be viewed in the online issue, available at www.interscience.wiley.com.]

DISCUSSION

The study of the functional anatomy of the liver permits the description of a hepatic segmentation based upon the distribution of the portal pedicles [1]. Anatomical hepatectomies are defined by the resection of a portion of liver parenchyma following one or several anatomical landmarks. Respect of these anatomical limits during segmental liver resections prevents impairment of the vascularization of the remaining parenchyma and excessive bleeding.

Among several types of anatomical liver resection, bisegmentectomy 7–8 is rarely seen in the literature. The main reason for this is that bisegmentectomy 7–8 involves the ligature of the main right hepatic vein and the current concept that the remaining right liver segments 5 and 6 would lack venous drainage if a large inferior right hepatic vein is not present. Indeed, the only two reports regarding bisegmentectomy 7–8 stated that this procedure demands the presence of a thick inferior hepatic vein or otherwise it could not be performed safely [2,3]. However, the common fear about the importance of this vein may not be justified based on anatomical studies [4,5]. The present paper reports the feasibility of this involving procedure even with absence of a large

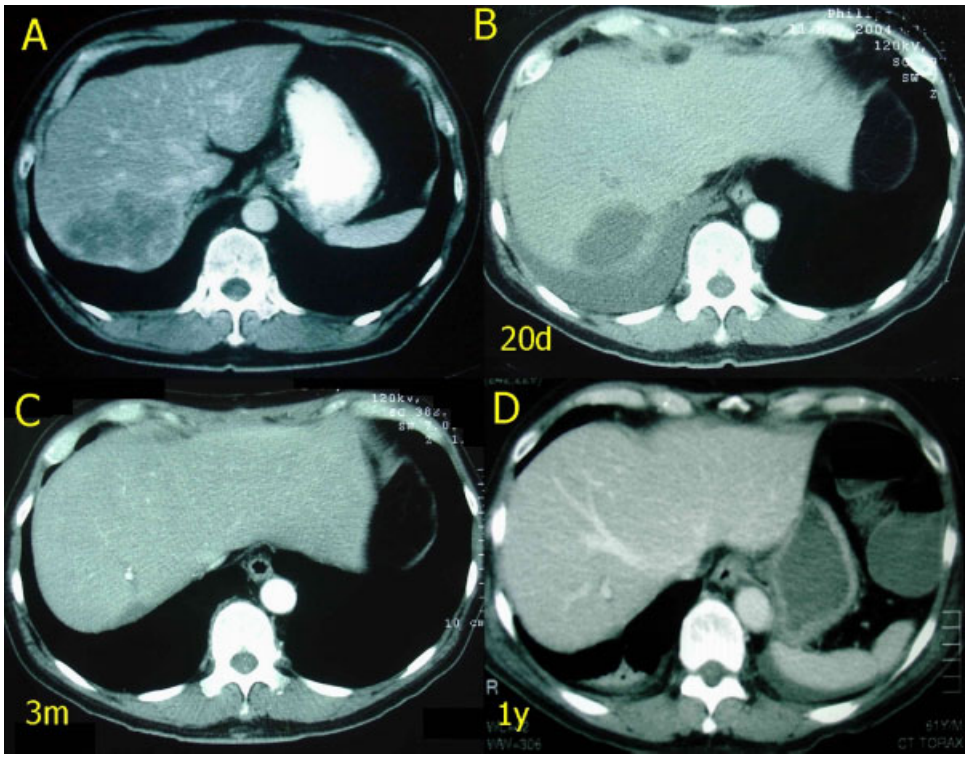

Fig. 5. Case # 1. **A**: Preoperative CT scan shows a large tumor involving segments 7 and 8 of the liver. **B**: CT scan on the 20th postoperative day shows mild regeneration of the liver; the area of bisegmentectomy 7–8 is apparent. **C**: Late CT scan (3 months) showing complete regeneration of the liver; the area of resection is still present. **D**: CT scan 1 year after liver resection showing complete regeneration of the liver; segments 5 and 6 are hypertrophied as expected.

accessory inferior hepatic vein in four consecutive patients with lesions localized in segments 7 and 8.

Experience with right lobe living donor liver transplantation has shown that venous drainage from anterior segments substantially depends on tributaries of the middle hepatic vein [7–9]. This finding along with other anatomical and postoperative ultrasonographic studies [9] has shown that the middle hepatic vein can provide adequate venous drainage for the remnant right liver after bisegmentectomy 7–8 and ligation of right hepatic vein. Long-term consequence of poor drainage is atrophy of the remnant right liver. However, this finding was not present in any of our patients during long-term follow-up, confirming the intraoperative impression that the remnant right liver segments did not suffer from outflow block.

Several articles have shown that the number of hepatic segments resected is a predictor of perioperative morbidity and mortality, since immediate complications

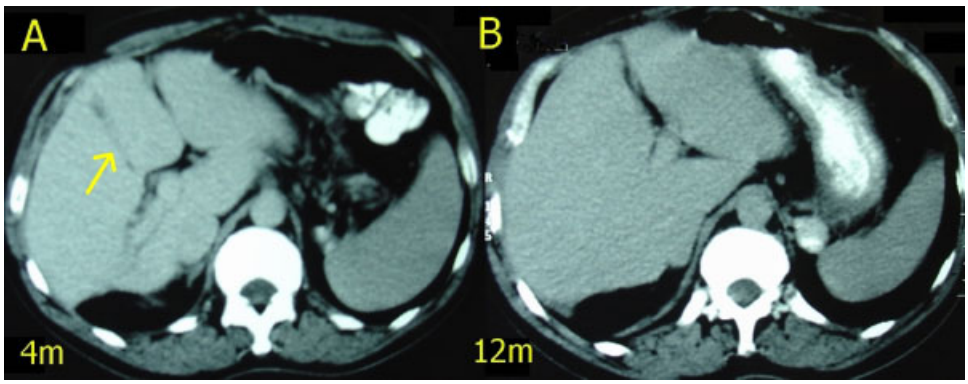

Fig. 6. Case # 2. **A**: Late CT scan (4 months) showing regeneration of the remaining right liver segments 5 and 6. Note that the gallbladder bed is apparent (arrow) indicating the limit between the left liver and the remnant right lobe hypertrophied. **B**: CT scan 1 year after bisegmentectomy 7–8 showing complete regeneration of the liver.

are directly related to the extension of liver resection [10–13]. Therefore, the choice for segmental hepatectomy rather than right hepatectomy is fully justified. This fact is of particular importance in patients with underlying liver disease or in those who undergo an operation after many cycles of neoadjuvant chemotherapy. Indeed, Rubbia-Brandt et al. [14] have shown that 78% of the patients treated with oxaliplatin-based neoadjuvant chemotherapy developed histologic signs of sinusoidal injury. No patient from the present series has received neoadjuvant chemotherapy; however one patient had hepatocarcinoma on cirrhosis and three had some degree of liver steatosis. We did not observe any clinical or biochemical signs of postoperative liver failure.

Bisegmentectomy 7–8 is technically demanding and may require surgical or intraoperative ultrasound expertise [2,3]. Intrahepatic access avoid the difficult and/or tedious hilar dissection without the need of Pringle or digital maneuvers; however, special care must be taken to avoid middle hepatic vein branches injuries as they run on the line of liver transection and should be preserved to provide adequate venous drainage of remaining right liver segments 5 and 6. Intraoperative ultrasound should be used to identify those branches.

Bisegmentectomy 7–8 may increase resectability rate in patients with bilateral lesions and may also enhance the opportunity to perform repeated resections in cases of tumor recurrence. Conversely with other authors our study confirms the anatomical assumption that bisegmentectomy 7–8 did not result in segmental outflow block even in the absence of a thick inferior right hepatic vein and therefore should be performed more often than reported so far. The absence of this vein should not be a straightforward indication for right hepatectomy in cases where a liver-sparing procedure such as bisegmentectomy 7–8 can be safely employed.

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