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MULTIMEDIA ARTICLE

Pure Laparoscopic Anatomical Resection of the Ventral Area of the Right Anterior Section Using the Transfissural Glissonean Approach

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Abstract

The introduction of the anatomical concept of classifying the right anterior section (RAS) into the ventral and dorsal areas enabled the development of limited resection of the ventral or dorsal area. Anatomical resection of the ventral area of the RAS is technically demanding because it requires determination of the boundary of the ventral area and two large of transection planes. We present a technique for laparoscopic anatomical resection of the ventral area of the RAS using a transfissural Glissonean approach.

In the transfissural Glissonean approach, the portal or umbilical fissure is opened after liver parenchymal dissection, and then, the surgeon can confirm the Glissonean pedicles and territory. The procedure was as follows: (1) dissection of the right anterior portal pedicle (RAPP) for the identification of the main portal fissure, (2) opening of the main portal fissure, (3) dissection and clamping of the ventral branch of the RAPP, and (4) transection of the borderline of the ventral and dorsal areas.

The transfissural Glissonean approach is a feasible and effective technique for laparoscopic anatomical resection of the ventral area of the RAS. Opening the main portal fissure allows easy and direct access to the ventral branch of the RAPP.

Keywords Laparoscopic liver resection · Anatomical liver resection · Glissonean approach · Ventral area

Introduction

Accumulation of experience in laparoscopic surgery and advancements in laparoscopic instruments technology have resulted in the rapid and widespread implementation of laparoscopic liver resection.[1] However, pure laparoscopic anatomical segmentectomy is rarely reported because it is a technically demanding procedure.[2–4]

Limited resection of the ventral and dorsal areas of the right anterior section (RAS) has been proposed because the RAS can be divided into the ventral and dorsal areas.[5–8] The most difficult and critical step of the anatomical resection of the ventral area of the RAS is the determination of the ventral area boundary.[7, 8] The Glissonean approach is a widely used, effective technique for anatomical segmentectomy that uses both the open and laparoscopic approaches.[9–11] The deep tertiary ventral branches of the right anterior portal pedicle (RAPP), which originate from the deep portions of the secondary branches, may be difficult to approach from the hepatic hilum.[11] The transfissural Glissonean approach is a useful technique for the dissection of the deep tertiary branch.[11–13]

Here, we present the surgical technique for and a video on anatomical resection of the ventral area of the RAS using the transfissural Glissonean approach.

Methods

A 56-year-old woman was diagnosed with rectosigmoid cancer with liver metastasis. The patient underwent Hartmann's operation followed by chemotherapy (cetuximab plus fluorouracil, leucovorin, and irinotecan [FOLFIRI]).

After the chemotherapy, she was referred to our department for surgical treatment of the liver metastatic tumor. The metastatic tumor was located in the ventral RAS, and a 7-mm

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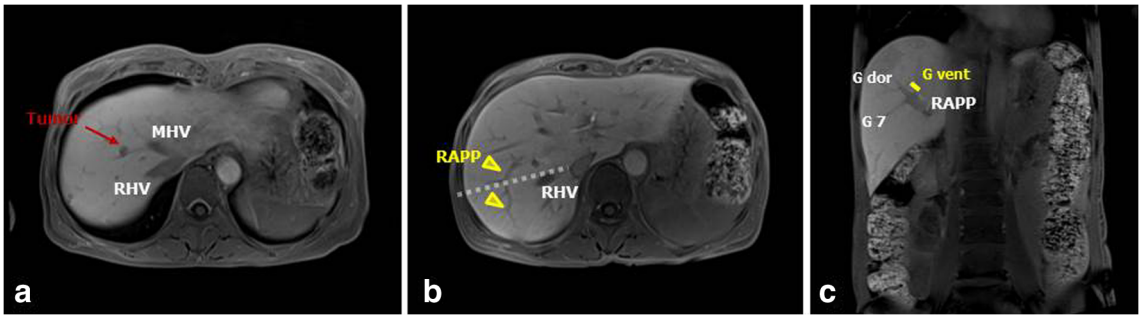

Fig. 1 Preoperative liver MRI. **a** The metastatic tumor was located in the ventral area, and a 7-mm tumor was found to be invading segment 8 hepatic vein. **b** Some branches of the right anterior portal pedicle (yellow arrowheads) crossed over to the right hepatic vein. **c** Regarding the ramification pattern of right anterior section, the ventro-dorsal type was found and the dorsal branch of the RAPP extended to the right posterior section. MHV, middle hepatic vein; RHV, right hepatic vein; RAPP, right anterior portal pedicle; G vent, ventral portal pedicle; G dor, dorsal portal pedicle; G7, segment 7 portal pedicle

tumor was found to be invading segment 8 of the hepatic vein (Fig. 1a). We performed parenchyma-sparing anatomical resection of the ventral RAS to secure the resection margin because of the depth and small size of the tumor.

Surgical Technique (Video)

1) Dissection of the right anterior portal pedicle

After dissection of the cystic artery and duct, the gallbladder was attached to the liver. The posterior projection of the cystic plate was isolated and cut to expose the right anterior Glissonean pedicle. The right anterior Glissonean pedicle was dissected meticulously (Fig. 2a). After clamping the anterior portal pedicle, the territory of the RAS was delineated (Fig. 2b). The left-sided ischemic demarcation line was the main portal fissure.

2) Opening the main portal fissure

The parenchymal dissection was performed along the main portal fissure. Segment 5 and 8 hepatic veins were dissected and transected. Liver parenchymal dissection was performed to expose the middle hepatic vein into the inferior vena cava (Fig. 3a). After opening of the main portal fissure, the hilar plate was fully exposed (Fig. 3b).

3) Dissection and clamping of the ventral pedicle

The ventral pedicle from the RAPP appeared on the cutting surface of the right hemiliver (Fig. 4a). After clamping the ventral branch of the RAPP, the ischemic demarcation line of the ventral area appeared (Fig. 4b). The borderline between the ventral and dorsal areas was marked with electrocautery.

4) Transection of the borderline of the ventral and dorsal areas

Next, right-side parenchymal transection was performed along the demarcation line between the ventral and dorsal areas. Parenchymal dissection was continued cranially up to the inferior vena cava. Finally, at the end of the parenchymal transection, the ventral pedicle was transected using a vascular stapler (Fig. 5a). After dissection of ventral area, the stump of ventral pedicle and the RAPP were exposed on the cutting plane (Fig. 5b).

Results

The operation time was 280 min. The estimated blood loss was 60 mL. Transfusion was not required. The intermittent

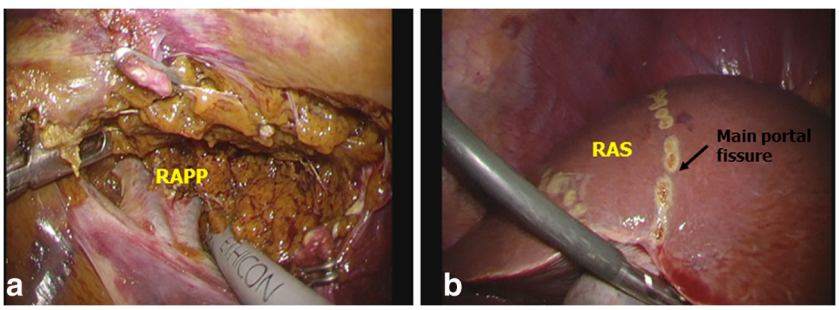

Fig. 2 Dissection of the right anterior portal pedicle. **a** The right anterior portal pedicle was dissected meticulously. **b** After temporary clamping the right anterior portal pedicle, the territory of the right anterior section was delineated. RAPP, right anterior portal pedicle; RAS, right anterior section

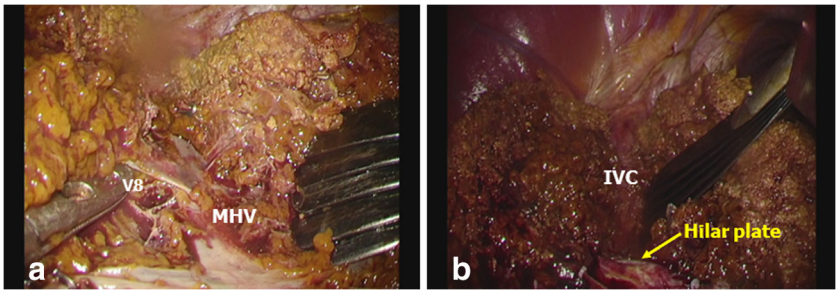

Fig. 3 Opening the main portal fissure. **a** Liver parenchymal dissection along the main portal fissure was performed to expose the middle hepatic vein. **b** After opening of the main portal fissure, the hilar plate was fully exposed. V8, segment 8 hepatic vein; MHV, middle hepatic vein IVC, inferior vena cava

Pringle maneuver (15 min clamping and 5 min declamping) was applied, and the total Pringle time was 55 min. The final pathology was a 7-mm metastatic tumor from colorectal cancer with a 10-mm surgical margin. No bile leakage was found postoperatively. The patient was discharged on the seventh day after the operation, without complications.

Discussion

The introduction of classifying RAS into ventral and dorsal areas allowed the development of limited resection of the ventral or dorsal area.[5–8] For anatomical resection of the ventral area of the RAS, the most important step is the identification of the ventral area boundary. Two surgical techniques for the identification of the ventral area boundary have been proposed in the open approach.[7, 8]

One is a venous drainage-guided approach.[7, 8] The venous drainage territory of the right hepatic vein (RHV) is usually in the right posterior section and the dorsal area of the RAS. This procedure requires encircling the RHV extrahepatically, which is technically difficult with the laparoscopic approach.

The other method is the Glissonean approach which could be divided into two categories such as the extrafascial or the trasnfissural approach.[11–13] In the extrafascial Glissonean approach, the deep tertiary ventral branch of the RAPP may be difficult to dissect from the liver hilum.[11] In the present study, we used the transfissural Glissonean approach instead of the extrafascial Glissonean approach for identification of the ventral area boundary. The transfissural Glissonean approach is the

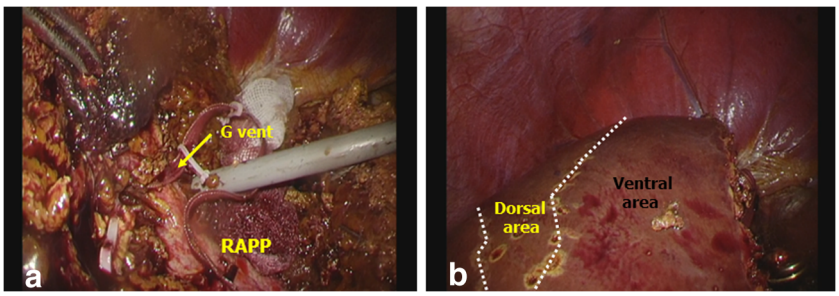

Fig. 4 Dissection and clamping of the ventral pedicle. **a** The ventral branch of the right anterior portal pedicle appeared on the cutting surface of the right hemiliver. **b** After clamping the ventral branch, the ischemic demarcation line of the ventral area appeared. RAPP, right anterior portal pedicle; G vent, ventral portal pedicle

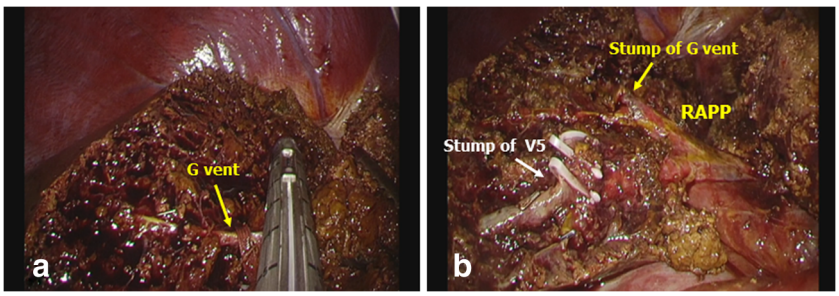

Fig. 5 Transection of the borderline of the ventral and dorsal areas. **a** The ventral pedicle was transected using a vascular stapler. **b** The stump of ventral pedicle and the RAPP were exposed on the cutting plane. G vent, ventral portal pedicle; RAPP, right anterior portal pedicle; V5, segment 5 hepatic vein

Glissonean pedicle approach with the parenchymal transection through the main portal or umbilical fissure.[11–13] After opening the main portal fissure, a surgeon can identify and confirm the deep tertiary ventral branch of the RAPP directly.

In our patient, some branches of the RAPP crossed over to the RHV and were thus distributed in the right posterior section (Fig. 1b). After clamping the RAPP, ischemic demarcation lines crossed over to the RHV. Resection of the ischemic area (extended right anterior sectionectomy with resection of the RHV) would result in congested areas of the remaining right posterior section. Regarding the ramification pattern of the portal vein in the right anterior section, the ventro-dorsal type was found in our patient and the dorsal branch of the RAPP extended to the right posterior section (Fig. 1c). Thus, we decided to perform anatomical resection of the ventral area of the RAS instead of a right anterior sectionectomy. In this patient, anatomical resection of the ventral area of the RAS was the appropriate surgical option in terms of inflow and outflow of the remnant liver.

A right-sided Glissonean pedicle has many variations, not only in the number of branches but also in the sliding of origin.[13, 14] The transfissural Glissonean approach can overcome these variations and preserve the sliding of origin to dissect the more distal ligation of the pedicle after opening of the main portal fissure.[13]

In conclusion, the transfissural approach through the main portal fissure is a feasible and effective technique for laparoscopic anatomical resection of the ventral area of the RAS. The transfissural Glissonean approach is extremely useful in the case of anatomical variations in the Glissonian pedicle and dissection of a deep-seated tertiary Glissonean pedicle. Opening of the main portal fissure allows for easy and direct access to the ventral branch of the RAPP.

Author Contribution Ji Hoon Kim was involved with study conception and design, acquisition of data, analysis and interpretation of data, drafting of manuscript, and critical revision.

Compliance with Ethical Standards

Conflict of Interest The author declares no competing interests.

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