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ABOUT COVER

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Successful totally laparoscopic right trihepatectomy following conversion therapy for hepatocellular carcinoma: A case report

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Abstract

BACKGROUND

About 20%-30% of newly diagnosed hepatocellular carcinoma (HCC) patients are surgically feasible due to a variety of reasons. Active conversion therapy may provide opportunities of surgery for these patients. Nevertheless, the choice of surgical procedure is controversial after successful conversion therapy. We report a patient with HCC who underwent successful laparoscopic right trisectionectomy after conversion therapy with portal vein embolization and transarterial chemoembolization.

CASE SUMMARY

A 67-year-old male patient presented to our hospital with epigastric distention/discomfort and nausea/vomiting for more than 1 mo. Contrast-enhanced computed tomography scan of the abdomen demonstrated multiple tumors (the largest was ≥ 10 cm in diameter) located in the right liver and left medial lobe, and the left lateral lobe was normal. The future remnant liver (FRL) of the left lateral lobe accounted for only 18% of total liver volume after virtual resection on the three-dimensional liver model. Conversion therapy was adopted after orally administered entecavir for antiviral treatment. First, the right portal vein was embolized. Then tumor embolization was performed *via* the variant hepatic arteries. After 3 wk, the FRL of the left lateral lobe accounted for nearly 30% of the total liver volume. Totally laparoscopic right trisectionectomy was performed under combined epidural and general anesthesia. The *in situ* resection was performed *via* an anterior approach. The operating time was 240 min. No clamping was required during the surgery, and the intraoperative blood loss was

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300 mL. There were no postoperative complications such as bile leakage, and the incision healed well. The patient was discharged on the 8th postoperative day. During the 3-mo follow-up, there was no recurrence and obvious hyperplasia of residual liver was observed. Alpha-fetoprotein decreased significantly and tended to be normal.

CONCLUSION

Due to the different biological characteristics of the liver cancer and the pathophysiological features of the liver from other organs, the conversion treatment should take into account both the feasibility of tumor downstaging and the volume and function of the remnant liver. Our case provides a reference for clinicians in terms of both conversion therapy and laparoscopic right trisectionectomy.

Key Words: Laparoscopy; Right trihepatectomy; Conversion therapy; Hepatocellular carcinoma; Primary liver cancer; Case report

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Core Tip: Only 20%-30% of newly-diagnosed hepatocellular carcinoma (HCC) patients are feasible for surgical resection. We report a HCC patient who underwent successful laparoscopic right trisectionectomy after conversion therapy with portal vein embolization and transarterial chemoembolization. There are few reports in the literature. Our case provided reference for clinicians in terms of both conversion therapy and laparoscopic right trisectionectomy.

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INTRODUCTION

Primary liver cancer is the fourth most frequently diagnosed malignancy and the second most frequent cause of cancer-related deaths in China[1,2]. Primary liver cancer includes three major pathological types: hepatocellular carcinoma (HCC), intrahepatic cholangiocarcinoma (ICC), and HCC-ICC mixed type, among which HCC accounts for 85%-90%. Surgical resection remains the treatment of choice for HCC patients and the most important strategy for achieving long-term survival. However, as most HCC patients have underlying cirrhosis or are already in the advanced stages when diagnosed, only 20%-30% of newly diagnosed HCC patients are eligible for surgical resection[3]. Compared with other therapies, surgical resection can lead to better quality of life and higher survival rates in liver cancer patients; therefore active conversion therapy to enable subsequent surgical intervention should be a therapeutic goal, and a variety of conversion methods are available.

Surgical resection includes liver transplantation, traditional open partial hepatectomy, and laparoscopic (or robotic) hepatectomy. Liver transplantation is limited by its indications and the availability of donor organs, while partial hepatectomy is the mainstream surgery at present. The past three decades have witnessed advances in laparoscopic liver resection from partial hepatectomy to regular lobectomy and then segmentectomy (resection of segments I, VII, and VIII). Now most liver surgeries can be performed laparoscopically. Compared with conventional open hepatectomy, laparoscopic surgeries can achieve superior short-term outcomes, with equivalent long-term prognosis[4,5]. However, there are few reports on the application of totally laparoscopic anatomical right hepatic trisectionectomy in the treatment of liver cancer, especially for giant HCC.

Here, we report an HCC patient who underwent successful laparoscopic right trisectionectomy after conversion therapy.

CASE PRESENTATION

Chief complaints

A 67-year-old male patient was presented to our hospital with epigastric distention/discomfort and nausea/vomiting.

History of present illness

The patient's symptoms started 1 mo prior with epigastric distention/discomfort and nausea/vomiting.

History of past illness

He denied any history of hypertension, diabetes, coronary heart disease, and infectious diseases such as hepatitis or tuberculosis.

Personal and family history

He denied any history of personal and family history.

Physical examination

The patient's temperature was 36.3 °C, heart rate was 74 beats per min, respiratory rate was 20 breaths per min, blood pressure was 120/75 mmHg. On physical examination, a fixed, painless and relatively hard abdominal mass with a diameter of 8 cm was palpated in the right upper quadrant.

Laboratory examinations

The results of laboratory examinations at admission are shown in [Table 1](#).

Imaging examinations

Contrast-enhanced computed tomography scan of the abdomen demonstrated variations of the hepatic artery; the left branch of the hepatic artery arose from the abdominal trunk and the right branch of the hepatic artery originated from the superior mesenteric artery, multiple tumors (the largest was ≥ 10 cm in diameter) were located in the right liver and the left medial lobe, and the left lateral lobe was normal. The future remnant liver (FRL) of the left lateral lobe accounted for only 18% of total liver volume after virtual resection on the three-dimensional (3D) liver model ([Figure 1](#)).

MULTIDISCIPLINARY EXPERT CONSULTATION

Yu Lin, MD, The Affiliated Hospital of Inner Mongolia Medical University, Department of Radiotherapy

Radiotherapy is not recommended as the first choice of treatment for patients with diffuse tumor distribution but can be used as a complementary or adjuvant treatment.

Xiao-Juan Qiao, MD, The Affiliated Hospital of Inner Mongolia Medical University, Internal Medicine-Oncology

Surgery is the preferred treatment for HCC. If there is no indication for surgery, targeted therapy or systemic chemotherapy can be considered.

Ze-Xin Wang, MD, The Affiliated Hospital of Inner Mongolia Medical University, Department of Interventional Medicine

Portal vein embolization (PVE) and trans-arterial chemoembolization (TACE) can be considered for follow-up surgery.

Jun-Jing Zhang, MD, The Affiliated Hospital of Inner Mongolia Medical University, Department of General Surgery

Based on experts' advice, we should take the lead in conversion therapy. If successful, we should carry out laparoscopic right trisectionectomy.

Table 1 Laboratory parameters of the patient at first presentation

Parameters	Values	Normal limits
PT	10.8	9-13
ALB	40.6 g/L	35-52 g/L
AFP	≥ 2000 ng/mL	0-9 ng/mL
TBIL	22.1 μmol/L	3-20 μmol/L
DBIL	8.6 μmol/L	0-6.8 μmol/L
AST	32.6 U/L	15-40 U/L
ALT	27.4 U/L	9-50 U/L
HBsAg	Positive	Negative
HBeAb	Positive	Negative
HBcAb	Positive	Negative
Hepatitis B DNA	2.27E+03	< 500
HA	268.7 ng/mL	0-120 ng/mL
CIV	187.5 ng/mL	0-95 ng/mL
Child-Pugh score	5	5
ICGR 15	4.8%	≤ 10%

ALB: Albumin; AFP: Alpha-fetoprotein; ALT: Alanine aminotransferase; AST: Aspartate aminotransferase; DBIL: Direct bilirubin; HA: Hyaluronic acid; HBcAb: Hepatitis B core antibody; HBeAb: Hepatitis B e antibody; HBsAg: Hepatitis B surface antigen; ICGR 15: Indocyanine green 15 min retention rate; PT: Prothrombin time; TBIL: Total bilirubin.

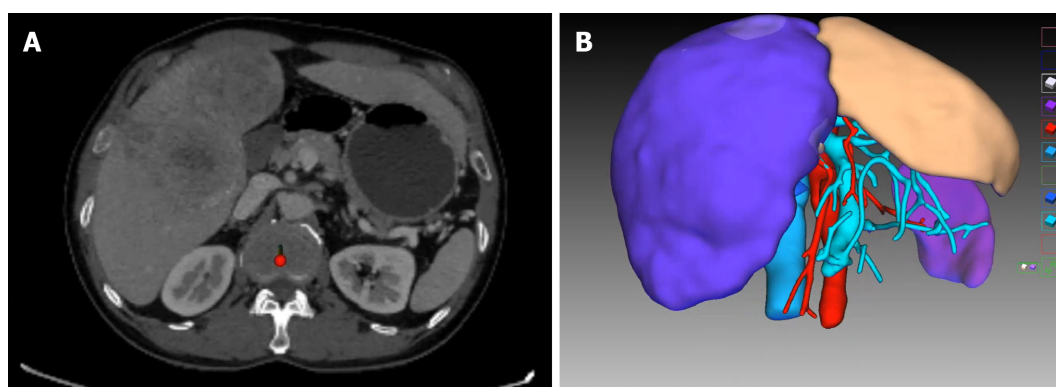


Figure 1 Computed tomography result and three-dimensional reconstruction of the patient at first presentation. A: Venous phase contrast-enhanced computed tomography shows huge space-occupying lesions in the left medial lobe and right liver, and the left lateral lobe is normal; B: Virtual resection on the three-dimensional liver model.

FINAL DIAGNOSIS

The final diagnosis of the presented case was HCC.

TREATMENT

After multidisciplinary evaluation, conversion therapy was adopted after orally administered entecavir for antiviral treatment. The right portal vein was embolized first; after the liver function returned normal 1 wk later, tumor embolization was performed *via* the variant hepatic arteries (Figure 2). After 3 wk, a second abdominal CECT revealed obvious hyperplasia of the left lateral lobe, and the FRL of the left lateral lobe accounted for nearly 30% of the total liver volume (Figure 3). The results of laboratory examinations before surgery are shown in Table 2. The Child-Pugh score

Table 2 Laboratory parameters of the patient prior to surgery

Parameters	Values	Normal limits
PT	10.7	9-13
ALB	41.7 g/L	35-52 g/L
AFP	3000 ng/mL	0-9 ng/mL
TBIL	16.8 μ mol/L	3-20 μ mol/L
DBIL	8.8 μ mol/L	0-6.8 μ mol/L
AST	42.6 U/L	15-40 U/L
ALT	54.3 U/L	9-50 U/L
Hepatitis B DNA	< 500	< 500
HA	149.20 ng/mL	0-120 ng/mL
CIV	161.49 ng/mL	0-95 ng/mL
Child-Pugh score	5	5
ICGR 15	10.1%	10%

ALB: Albumin; AFP: Alpha-fetoprotein; ALT: Alanine aminotransferase; AST: Aspartate aminotransferase; DBIL: Direct bilirubin; HA: Hyaluronic acid; ICGR 15: Indocyanine green 15 min retention rate; PT: Prothrombin time; TBIL: Total bilirubin.

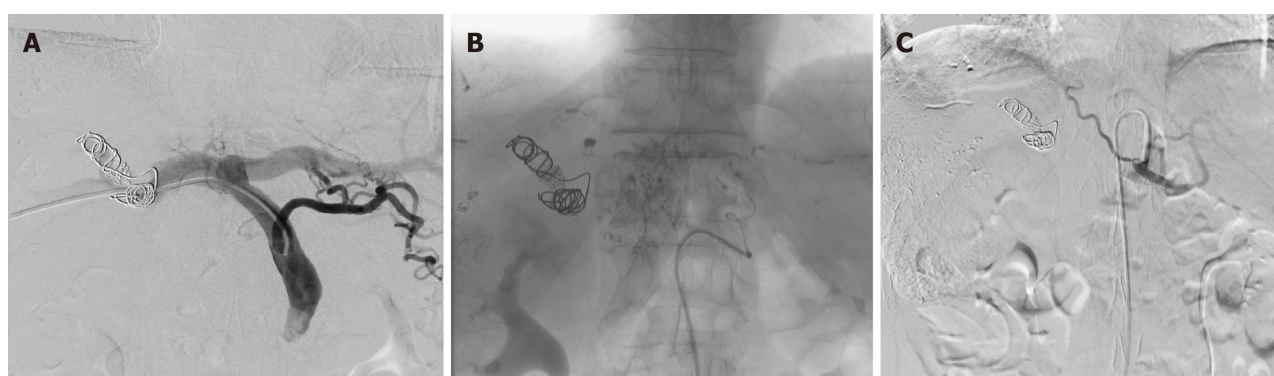


Figure 2 Conversion therapy. A: Embolization of the right portal vein; B: Chemoembolization of the tumor in left medial lobe via left hepatic artery and abdominal trunk; C: Chemoembolization of tumors in the right liver via right hepatic artery and superior mesenteric artery.

was still A.

Totally laparoscopic right trisectionectomy was performed under combined epidural and general anesthesia, and the technique was approved by the ethics committee of our hospital. The *in situ* resection was performed *via* an anterior approach. The first porta hepatis was first exposed. The clamping band was reserved. The liver parenchyma was dissected along the right side of the sagittal branch of the portal vein, and the middle hepatic vein and the root of the right hepatic vein were exposed in turn. After the right hepatic artery in the first hepatic hilum and the right branch of the portal vein were dissected, the middle hepatic vein and the right hepatic vein were dissected with a cutting stapler under laparoscope. Finally, the third hepatic hilum and the perihepatic ligament were proceeded (Figure 4). The operating time was 240 min. No clamping was required during surgery, and the intraoperative blood loss was 300 mL. The resected specimens were observed with the naked eye and under microscope (Figure 5).

OUTCOME AND FOLLOW-UP

There were no postoperative complications such as bile leakage, and the incision healed well. The patient was discharged on the 8th postoperative day (Figure 6A and B). TACE was applied prophylactically once after surgery. During the 3-mo follow-up,

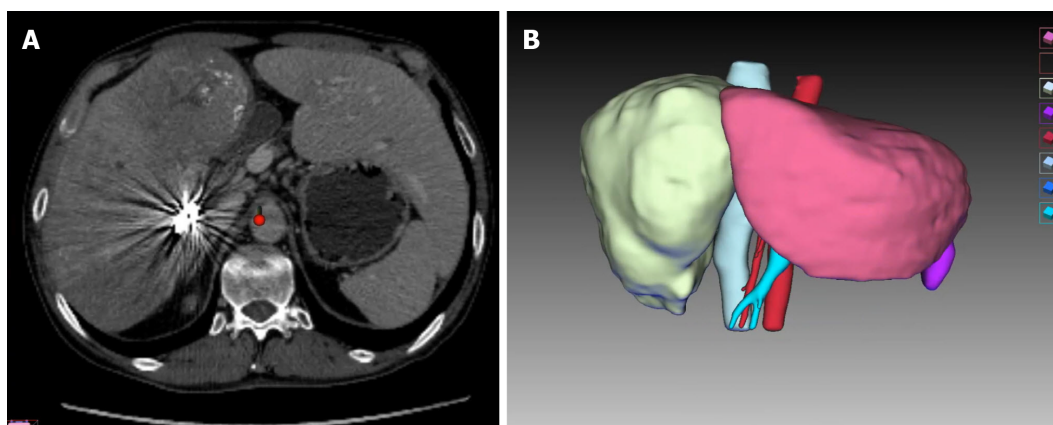


Figure 3 Computed tomography result and three-dimensional reconstruction of the patient prior to surgery. A: Pre-operative venous phase contrast-enhanced computed tomography shows huge space-occupying lesions in the left medial lobe and right liver and obvious hyperplasia in the left lateral lobe; B: Virtual resection on the three-dimensional liver model.

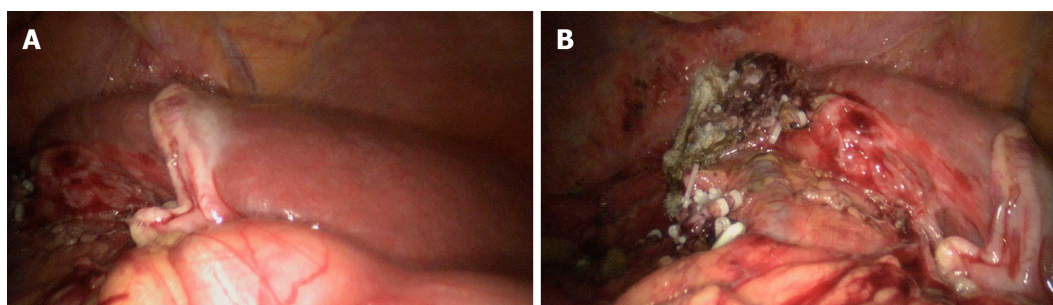


Figure 4 Intraoperative observation. A: Liver remnant of the left lateral lobe, with normal color; B: Liver cutting surface, with intact Glisson sheath covering the left lateral lobe.

there was no recurrence and obvious hyperplasia of residual liver was observed (Figure 6C). Alpha-fetoprotein (AFP) decreased significantly and tended to be normal (Figure 7).

DISCUSSION

For patients with Barcelona Clinic Liver Cancer stage B or China Liver Cancer Staging stage IIb liver cancer[3], surgical resection is not superior to non-surgical treatments (*e.g.*, TACE). However, for tumors confined to the same segment or the ipsilateral half of the liver, surgical resection may achieve better outcomes than other treatment modalities[6,7]. In the present case, as the tumor was not only located in the right lobe but also in the left medial lobe (Figure 5A), an anatomical right trisectionectomy was required. Since there was an inadequate volume of FRL, successful conversion therapy was the only way to enable the subsequent surgery. Due to the different biological characteristics of the liver cancer and the pathophysiological features of the liver from other organs, the conversion treatment should take into account both the feasibility of tumor down staging and the volume and function of the remnant liver.

Tumor downstaging can be achieved using a variety of techniques, which can be applied in a combined or sequential manner. Among them, TACE is the most commonly used treatment and is considered to have the highest success rate[8]. In addition, TACE also allows the early detection of undetectable lesions by other imaging modalities. In the present case, if TACE revealed the presence of a lesion in the remaining left lateral lobe, surgery would have a limited value. Solutions for the inadequate volume of FRL include the associating liver partition and portal vein ligation for staged hepatectomy (ALPPS), a two-stage hepatectomy, and PVE. ALPPS can induce rapid hypertrophy of FRL and provide a high resection rate; however, it is associated with high complication and mortality rates and should be performed with caution. After multidisciplinary consultations, PVE combined with TACE was applied

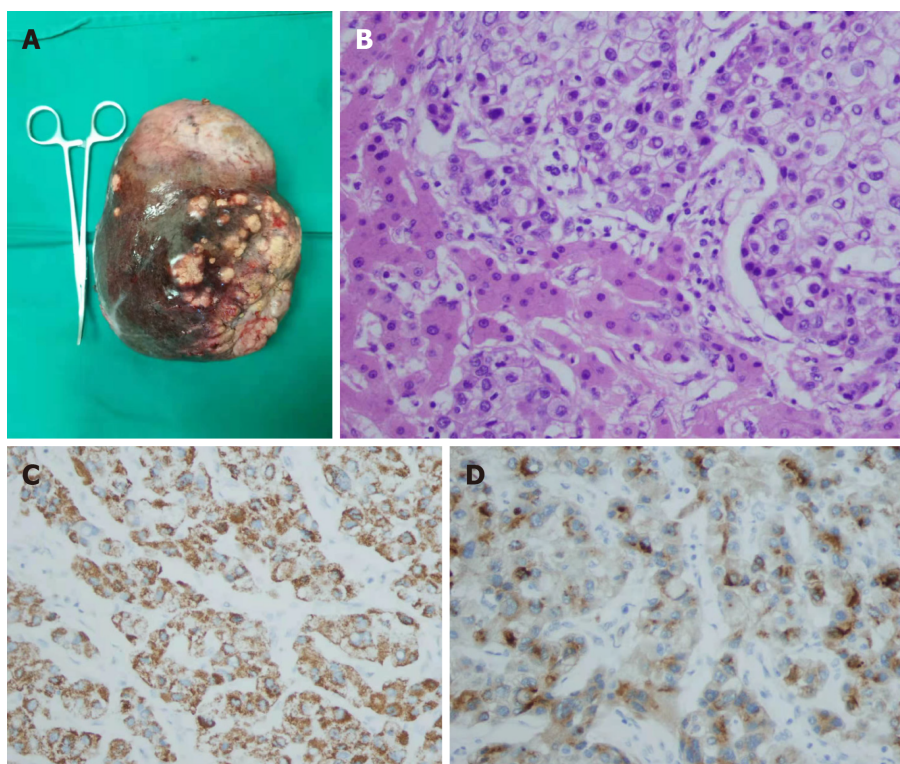


Figure 5 Resected specimen (diaphragmatic surface of liver). A: Microscopic findings. Hematoxylin and eosin (H&E) staining showing polygonal tumor cells in a trabecular arrangement, H&E $\times 400$; B-D: Immunohistochemistry showing a strong and diffuse cytoplasmic (B) positivity with Hep Par 1 (C) and glypican 3 (D), $\times 400$. The tumor cells were negative for cytokeratin 7 and cytokeratin 20.

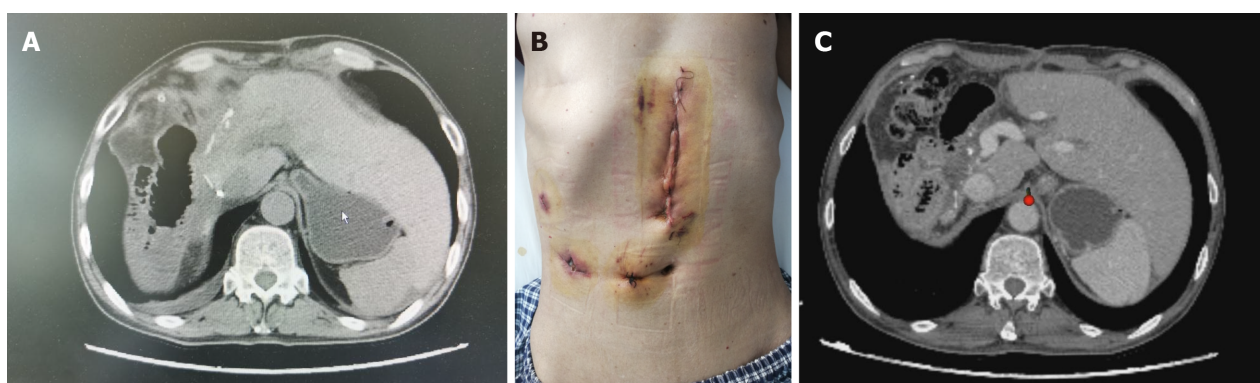


Figure 6 Postoperative recovery and short-term follow-up. A: Abdominal plain computed tomography (CT) at discharge showed no accumulation of fluid in the abdominal cavity, whereas there was hyperplasia of the left lateral lobe; B: Abdominal incision at discharge; C: A recent CT scan showed that there was no tumor recurrence, and the hyperplasia of the left lateral lobe was obvious.

in our case, with the aim of achieving radical resection. Compared with PVE alone, PVE plus TACE accelerates the regeneration of FRL tissue while avoiding or delaying the growth of tumors in the left medial lobe. The interval from PVE to surgery was nearly 4 wk, during which the ratio of FRL to standard liver volume increased from 18% to 30%. Despite the successful conversion, tumors progressed during the waiting period; AFP increased from ≥ 2000 ng/mL at admission to ≥ 3000 ng/mL before surgery, which might be related to the varying tumor diameters and the extensive distribution of the tumors in liver tissue (Figure 5A). TACE combined with systematic drug administration may help to address this problem.

For patients with giant HCC (> 10 cm in diameter) requiring anatomical right trisectionectomy, surgical resection by laparoscopic approach alone is rarely reported in the literature. Safety is the first concern during a laparoscopic procedure, followed by the “tumor-free” principle[4,5]. In 2014, Ban *et al*[9] developed a difficulty scoring system (DSS-BAN) based on 90 patients undergoing laparoscopic surgery for HCC at three

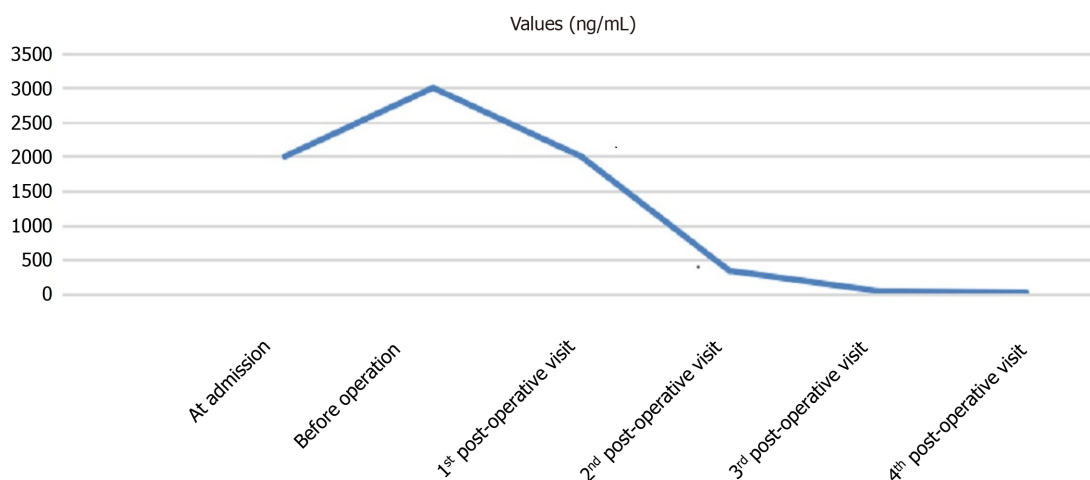


Figure 7 Change in alpha-fetal protein level.

medical centers according to the extent of liver resection, tumor location, tumor size, preoperative liver function, and tumor proximity to major vessels. In DSS-BAN, performing laparoscopic liver resection with a difficulty score of 10 requires experience with more than 50 cases of laparoscopic liver resection. Our team had experience with more than 100 cases, which ensured the successful operation in our current case[10]. Another technical challenge during the operation is to ensure sufficient tumor margin to prevent tumor rupture. The preoperative 3D reconstruction, precise evaluation and intraoperative ultrasound if necessary can help determine the resection margin. If the resection margin is close to important vessels/ducts, removal of the tumor exactly along the resection margin is not required, but a pathologically negative margin should be ensured. Laparoscopic *in situ* liver resection was performed *via* an anterior approach to avoid compression of tumors. During the operation, the liver parenchyma between the left lateral lobe and left medial lobe was divided firstly, followed by the division of right hepatic pedicle, middle hepatic vein, right hepatic vein, and vessels at the third porta of liver. Finally, the perihepatic ligament was transected to remove the specimen. These steps were expected to avoid the iatrogenic hematogenous spread of cancer cells. Postoperative morphological examination showed that the resected specimen was intact and unbroken, and the pathological examination showed that the resection margin was negative for tumor cells. The surgical procedure adhered to the tumor-free principle, and the results were equivalent to traditional open surgery.

Our case provided reference for clinicians in terms of both conversion therapy and laparoscopic right trisectionectomy. No recurrence has been noted, but the follow-up period is still short. The patient has been treated with prophylactic TACE once after surgery. There is no evidence on whether additional TACE sessions or other techniques are required to prevent recurrence. In addition, there are also controversies on the treatment options for potential recurrence. In conclusion, there are still many concerns about this case, and follow-up will be continued.

CONCLUSION

In this case, as the tumor was not only located in the right lobe but also in the left medial lobe (Figure 5A), an anatomical right trisectionectomy was required. Since there was an inadequate volume of FRL, successful conversion therapy was the only way to enable the subsequent surgery. Due to the different biological characteristics of the liver cancer and the pathophysiological features of the liver from other organs, the conversion treatment should take into account both the feasibility of tumor downstaging and the volume and function of the remnant liver. Our case provided reference for clinicians in terms of both conversion therapy and laparoscopic right trisectionectomy.

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