

## Resection of Hepatocellular Carcinoma Recurring in the Diaphragm after Right Hepatic Lobectomy

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### Abstract

We describe a 35-year-old man with hepatocellular carcinoma (HCC) that recurred in the diaphragm after right hepatic lobectomy. The patient had undergone right hepatic lobectomy for HCC with chronic hepatitis B virus infection 1 year previously. On pathological examination, the tumor measured 15 × 14.4 × 11 cm and was moderately well differentiated. The surgical margins were negative. After 1 year, computed tomography of the abdomen revealed a mass extending from the right side of the diaphragm to the retroperitoneal space. The mass was enhanced in the early phase and washed out in the late phase. Extrahepatic recurrence of HCC in the diaphragm was diagnosed. We performed tumor resection with partial resection of the right side of the diaphragm and wedge resection of the right lower lobe of the lung. The diaphragm was reconstructed with a sheet of artificial pericardium. The histopathological diagnosis was recurrence of HCC in the diaphragm with invasion of the right lung. The postoperative course was uneventful, and the patient was discharged on postoperative day 8. He underwent chemotherapy with cisplatin and 5-fluorouracil. After 9 months, the patient died of unresectable recurrence of HCC in the brain. No recurrence was detected in the right subphrenic area.

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**Key words:** extrahepatic recurrence, hepatocellular carcinoma, diaphragm

### Introduction

The clinical features of hepatocellular carcinoma (HCC) with extrahepatic recurrence after curative resection remain poorly understood<sup>1</sup>. Previous studies support an aggressive approach in selected cases of extrahepatic HCC recurrence, associated

with resectable metastases, preserved liver function, absence of intracranial metastasis, and control of the primary tumor<sup>2</sup>. We describe a 35-year-old man with recurrence of HCC in the diaphragm 1 year after right hepatic lobectomy.

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**Case Report**

A 35-year-old man with chronic hepatitis B virus infection was admitted due to recurrence of HCC in the diaphragm. The HCC was extremely large and had invaded the right side of the diaphragm (**Fig. 1**). Right hepatic lobectomy with partial resection of the right side of the diaphragm was performed. The reconstruction of the right diaphragm was sutured primary. The tumor measured 15 × 14.4 × 11 cm. Pathological examination showed a moderately well differentiated tumor, invasion of the second-order branches of the portal vein (Vp2), invasion of the peripheral branches of the hepatic vein (Vv1), and invasion distal to the second-order branches of the hepatic artery (Va1)<sup>3</sup>. No lymph node metastases were detected, and the surgical margins were

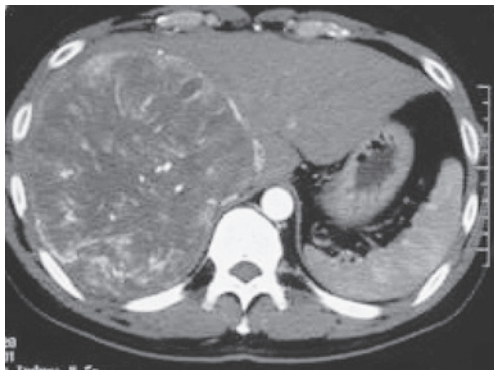


Fig. 1 An abdominal computed tomographic scan, showing a large HCC that had invaded the right side of the diaphragm.

negative. One year later, computed tomography (CT) of the abdomen with contrast enhancement revealed a mass extending from the right diaphragm to the retroperitoneal space. The mass was enhanced in the early phase and washed out in the late phase (**Fig. 2**). Abdominal angiography showed that the feeding arteries of the tumor were the right inferior phrenic artery and inferior suprarenal artery (**Fig. 3**). Upper gastrointestinal endoscopy revealed esophageal varices (LiCwFIRC0: according to the General Rules for Recording Endoscopic Findings of Esophagogastric Varices<sup>4</sup>) The serum concentration of  $\alpha$ -fetoprotein was 10.0 ng/mL (normal, <2.5 ng/mL), and that of PIVKA-II was 29 mAU/mL (normal, <37 mAU/mL). Extrahepatic recurrence of HCC in the right diaphragm was diagnosed.

Surgery was performed, and severe adhesion in the upper abdomen due to the previous operation was detected. The tumor was posterior to the inferior vena cava and had spread from the right diaphragm to the retroperitoneum. Tumor resection was performed with partial resection of the right diaphragm and wedge resection of the left lower lobe of the lung. The diaphragm was reconstructed with a sheet of artificial pericardium (**Fig. 4**). The operation time was 481 minutes. Blood loss was 1,550 mL. Histopathological examination showed moderately well differentiated HCC in the right side of the diaphragm and confirmed the recurrence of HCC in the diaphragm. The postoperative course was uneventful, and the patient was discharged on postoperative day 8. He underwent chemotherapy

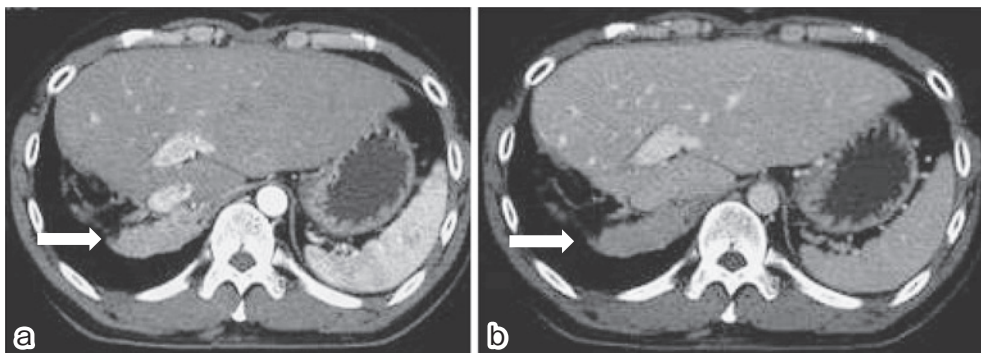


Fig. 2 An abdominal contrast-enhanced computed tomographic scan, showing a mass extending from the right side of the diaphragm to the retroperitoneal space. The mass was enhanced in the early phase (a) (arrow) and washed out in the late phase (b) (arrow).

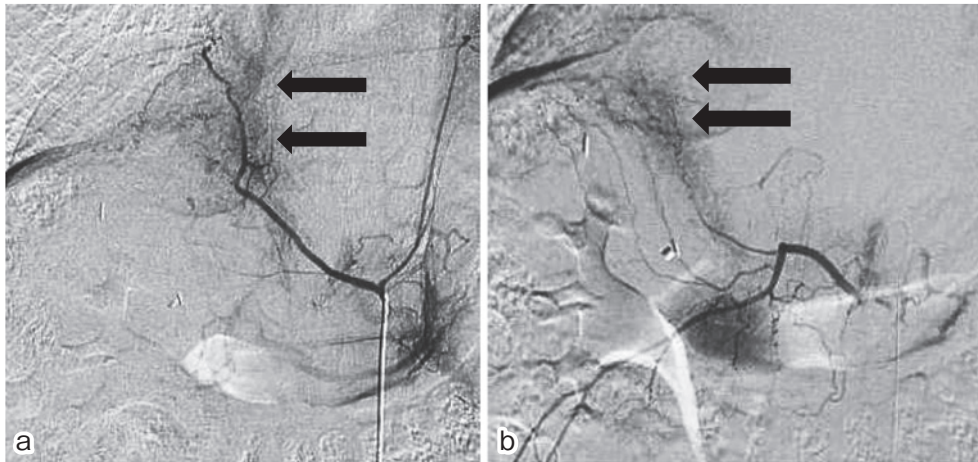


Fig. 3 Inferior phrenic arteriography revealed that the feeding artery of the tumor was the right inferior phrenic artery (a) (arrows). Right suprarenal arteriography revealed that the other feeding artery of the tumor was the inferior suprarenal artery (b) (arrows).

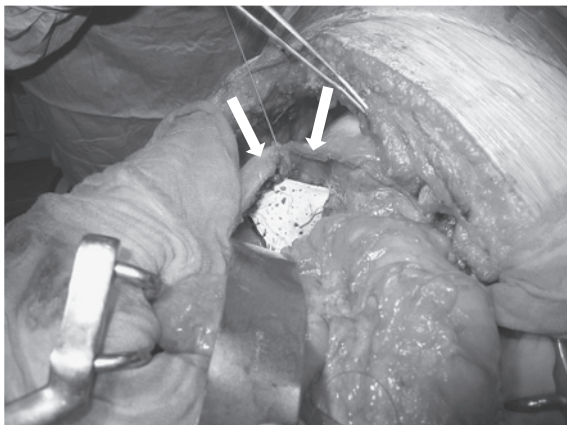


Fig. 4 The diaphragm (arrows) was reconstructed with a sheet of artificial pericardium.

with cisplatin and 5-fluorouracil. After 9 months, the patient died of an unresectable recurrence of HCC in the brain. No recurrence was detected in the right subphrenic area.

### Discussion

The number of patients with distant metastatic recurrence has been increasing because of improved multidisciplinary regimens for the management of the intrahepatic recurrence of HCC. To improve overall survival in HCC, outcomes must be improved for patients who have distant metastatic recurrence after hepatic resection<sup>5</sup>. The lungs, abdominal lymph nodes, and bone are the most common sites of extrahepatic recurrence of HCC<sup>6,7</sup>. Peritoneal

dissemination is found in 18% of patients at autopsy<sup>8</sup>. Hematogenous dissemination is considered the main mechanism for extrahepatic spread. Hematogenous spread of tumor cells through variceal collateral pathways may cause peritoneal implantation; direct invasion from exophytic tumors is also possible<sup>9</sup>. Occasionally, peritoneal dissemination also occurs after rupture of the HCC<sup>10</sup>. In the case of ruptured HCC and direct invasion of HCC, the risk of peritoneal dissemination is thought to increase, because both cancer cells and blood are directly disseminated into the peritoneal cavity<sup>11</sup>.

In the present patient, a possible cause of the recurrence in the right side of the diaphragm is the dissemination of cancer cells during the initial operation. Although the surgical margins were negative, the HCC invaded the right diaphragm directly. Therefore, we believe that the HCC had already disseminated to the diaphragm.

Treatment of extrahepatic metastasis after hepatic resection has not been pursued actively in patients with HCC, because HCC is considered an aggressive neoplasm<sup>12</sup>. Some investigators consider any extrahepatic metastasis from HCC to be a contradiction for further treatment<sup>13,14</sup>. However, surgical resection has been reported to be effective for controlling extrahepatic disease in selected patients with extrahepatic metastatic lesions and sometimes offers the only chance for long-term survival<sup>13-16</sup>. In our patient, we performed tumor

resection because there was no evidence of other distant metastases or intrahepatic recurrence.

We used a sheet of artificial pericardium to reconstruct the diaphragm. Reconstruction of the diaphragm has been performed with various techniques. Primary reconstruction of the diaphragm is performed with nonabsorbable suture material wherever possible. However, if the defect is large, various natural and synthetic alternatives can be used to reconstruct the diaphragm<sup>17</sup>. Gore-Tex and Prolene meshes are frequently used because they are readily available and technically easy to use<sup>18</sup>.

Esophageal varices were detected in our patient. There are various treatments for esophageal varices<sup>19-22</sup>. However, because the esophageal varices in our patient were mild (LiCwF<sub>1</sub>RC<sub>0</sub>)<sup>4</sup>, they were left untreated.

We have described a patient with HCC who had early recurrence in the diaphragm. The recurrent tumor was successfully resected, and the diaphragm was repaired with an artificial mesh. In patients with extrahepatic recurrence of HCC, tumor resection is a feasible strategy, if the HCC does not recur elsewhere.

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