



Case Report

Surgical Treatment of Tumor Thrombus Extending into the Right Atrium in Hepatocellular Carcinoma: Case Report

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Abstract

Hepatocellular carcinoma (HCC) stands as a primary contributor to cancer-related mortality across the globe. While intrahepatic vascular invasion is a frequent finding in individuals with HCC, the progression of a tumor thrombus through the inferior vena cava (IVC) and into the right atrium is an infrequent event. This report details the surgical handling of a 72-year-old male patient diagnosed with HCC in the right hepatic lobe, which was complicated by a tumor thrombus extending into the inferior vena cava and approaching the right atrium. The patient successfully underwent a right hepatectomy combined with thromboendovenectomy and had an unremarkable postoperative course. At a 10-month follow-up, no signs of recurrence were detected. This case underscores the beneficial effect of meticulously planned surgical procedures on the survival of patients with advanced HCC and brings attention to the value of employing aggressive surgical strategies.

Keywords: Inferior Vena Cava, Hepatocellular Carcinoma, Right Atrial Invasion, Tumor Thrombus

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Constituting around 90% of all primary liver cancers, hepatocellular carcinoma (HCC) represents a major factor in cancer-related deaths worldwide.^[1] Key risk factors predisposing individuals to HCC development include cirrhosis, chronic infections from hepatitis B and C, and non-alcoholic fatty liver disease. From a clinical standpoint, HCC may not show any symptoms, or in some cases, it can manifest with signs like abdominal pain, fatigue, encephalopathy, or ascites.^[2]

Although intrahepatic vascular invasion is observed in 10–40% of HCC cases, a tumor thrombus that extends into the IVC and right atrium is present in merely 1–4% of these patients.^[3, 4] The presence of such a widespread thrombus

carries the risk of life-threatening events, including right heart failure and pulmonary embolism. In these situations, palliative treatments are generally the standard recommendation; however, surgical intervention has the potential to markedly enhance the prognosis for carefully chosen patients.^[5–9] This case report outlines the successful surgical management, involving right hepatectomy and thromboendovenectomy, of an individual with primary HCC whose tumor thrombus extended into the right atrium.

Case Report

A 72-year-old male sought medical attention with complaints of fatigue and pain in the right upper quadrant. A

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mass measuring $140 \times 130 \times 115$ mm, consistent with HCC, was identified in the right hepatic lobe via triphasic dynamic tomography. The imaging further revealed a tumor thrombus that progressed from the right hepatic vein and IVC up to the level of the right atrium (Fig. 1).

Laboratory analyses indicated a serum Alpha-fetoprotein level of 19.6 ng/mL, with the normal range being 0.9–9.0 ng/mL. Preoperative levels of other tumor markers were also within normal limits, including CEA at 1.1 ng/mL (normal range: 0–3) and CA 19-9 at 21.4 U/mL (normal range: 0–35). Tests for viral hepatitis came back negative, while esophagogastroduodenoscopy and colonoscopy yielded normal findings. The patient's medical history included benign prostatic hyperplasia, with no familial background of cirrhosis or cancer. A sufficient remnant liver volume (%35.4) in the left lobe was confirmed by radiological evaluation. Classified as Child-Pugh A and American Society of Anesthesiologists physical status of 2, the patient was considered a suitable candidate for surgery.

Surgical Technique

The procedure was conducted under general anesthesia using a median and right lateral incision. Mobilization of the right lobe was achieved by carefully dividing the right hepatic triangular and coronary ligaments. To clearly define the anatomical relationship between the liver and the IVC, the hanging maneuver was utilized. A foremost objective during the operation was to mitigate the embolic risk posed by the tumor thrombus.

The suprahepatic and infrahepatic portions of the IVC were prepared with great care for clamping. Following this, the right hepatic artery and right portal vein were dissected, ligated, and then transected. The CUSA system was used to transect the liver parenchyma, effectively separating the right and left lobes, and the specimen was then removed as a single block. Subsequent to the transection of the right hepatic vein, the tumor thrombus was meticulously extracted from the IVC and right atrium by means of thromboendovenectomy (Fig. 2). After ensuring hemostasis was complete, the procedure was concluded with the placement of a single drain.



Figure 1. CT image showing tumor in the right lobe of the liver and extension of tumor thrombus from the IVC to the right atrium, delineated by red lines.

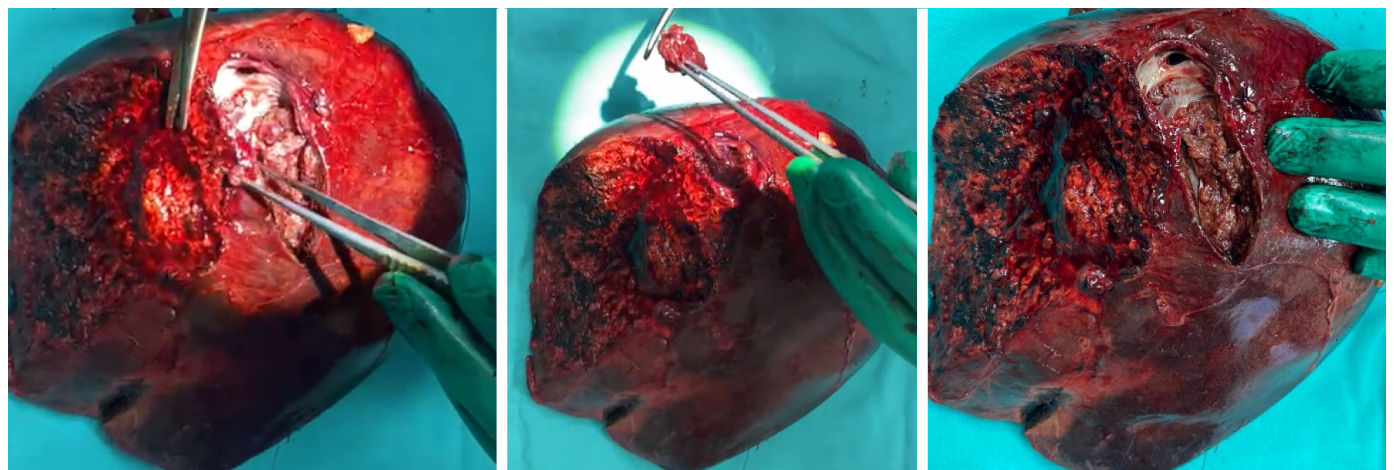


Figure 2. Tumor thrombus invasion in the right hepatic vein in the specimen.



Figure 3. Control CT image at 5th months postoperatively.

Pathology Findings and Follow-Up

The patient was moved from the intensive care unit to the ward on the first day after surgery. The abdominal drain was taken out on the third day, and on the fifth day, the patient was discharged without any complications. The pathological analysis identified a poorly differentiated HCC (nuclear grade 3) of 16.5 × 14 × 9.5 cm in size, accompanied by two satellite tumors measuring 2.8 and 0.7 cm. The tumor was situated adjacent to the liver capsule but did not invade it. An examination of the surgical margins showed no evidence of tumor infiltration.

During the follow-up at the 5th month, the patient's serum Alpha-fetoprotein level had fallen to 3.8 ng/mL, and imaging scans revealed no indication of recurrence (Fig. 3). The patient is currently in his 10th month of follow-up, which is proceeding without any issues.

Discussion

The extension of a tumor thrombus into the right atrium is an uncommon yet severe complication associated with HCC. A Japanese study documented the incidence of HCC-related tumor thrombus affecting the IVC and right atrium to be 2.9% on imaging studies, 0.7% in surgical cohorts, and 18.2% in autopsy findings.^[9]

Typically, cases of advanced HCC are addressed with non-surgical methods like conservative therapy, transarterial chemoembolization, or radiotherapy. Nevertheless, for patients with a tumor thrombus that involves the right atrium, these treatments often result in poor outcomes, and the prognosis continues to be bleak.^[10, 11] When metastatic disease extends to the IVC and right atrium, survival is typically between 2 days and 3 months with palliative care or

no treatment; however, surgical resection has been linked to a notably longer median survival of 9 to 33 months.^[2, 12, 13] Published reports show survival durations of 5–56 months following surgical resection and thrombectomy.^[6, 14]

Patients with HCC frequently manifest with a range of symptoms, including pain in the right upper quadrant, fatigue, anorexia, weight loss, abdominal swelling, jaundice, pruritus, or encephalopathy.^[15] Although 70–90% of HCC instances arise in cirrhotic livers, a notable 10–30% develop in livers without cirrhosis.^[16] The patient in this report did not have a cirrhotic history and presented with symptoms of fatigue and right upper quadrant pain.

In HCC cases involving a tumor thrombus, surgical intervention can markedly enhance progression-free survival rates. One particular study highlighted a 40% 1-year survival rate achieved with surgical treatment, underscoring the necessity of prompt surgical action. Such operations can avert life-threatening events like right ventricular out-flow obstruction, cardiac valve failure, and pulmonary embolism, thus offering a distinct survival benefit.^[9, 13, 17]

HCC accompanied by a tumor thrombus is categorized into three types based on its anatomical relationship to the heart: type I refers to a thrombus located within the inferior vena cava (IVC) below the diaphragm; type II describes a thrombus situated in the IVC above the diaphragm but still external to the right atrium; and type III, known as the intracardiac type, involves the tumor thrombus being located above the diaphragm and having penetrated the right atrium.^[18] In the case of our patient, the tumour thrombus was classified as type II and was positioned in the IVC above the diaphragm, but had not reached the right atrium.

For non-cirrhotic HCC patients who have adequate remnant liver, surgical resection continues to be a practical treatment choice. In the present case, the decision to proceed with resection was bolstered by preoperative imaging, which verified that the upper portion of the IVC thrombus was accessible for clamping. Although brachytherapy can be considered as an alternative treatment option in selected HCC cases with vascular invasion, previous studies have reported an increased risk of embolic events associated with intravascular tumor thrombus and lower treatment efficacy compared to surgery.^[19] Similarly, while external beam radiotherapy (EBRT) has shown promising results, with reported 1-year and 2-year overall survival rates of 53.6% and 36.9%, respectively, in comparable patient populations, its effectiveness is often limited in the presence of large tumor burdens or extensive vascular invasion.^[20] Moreover, EBRT may not prevent catastrophic events such as pulmonary embolism or cardiac obstruction caused by tumor thrombi. In the present case, given the patient's favorable anatomy, adequate future

liver remnant, and absence of extrahepatic disease, surgical resection was considered the most appropriate and potentially curative treatment approach.

The role of adjuvant chemotherapy in HCC has been extensively investigated. Recent evidence indicates that adjuvant immunotherapy, particularly the combination of atezolizumab and bevacizumab, may improve recurrence-free survival in patients undergoing curative-intent resection for HCC (20). In our patient, no adjuvant chemotherapy was administered during follow-up at our institution, as no evidence of recurrence or metastasis was detected in radiological imaging or alpha-fetoprotein (AFP) levels. However, since the patient continued follow-up at another center after the tenth postoperative month, it remains unknown whether adjuvant systemic therapy was subsequently administered.

In summary, while advanced HCC with a right atrial thrombus presents an aggressive condition, it can be managed effectively with surgical treatments in appropriately selected patients. It is advisable that these high-risk surgical procedures be carried out in transplant centers where donor availability is assured.

Disclosures

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

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