



Research Letter

Interventional Diagnosis and Treatment of Hepatocellular Carcinoma Complicated by Tumor Thrombus



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Hepatocellular carcinoma (HCC) complicated by tumor thrombus in the hepatic vein and inferior vena cava (IVC), which has a low incidence of approximately 1.4–4.9%, is difficult to treat and has a poor prognosis.¹ Severe hepatic vein tumor thrombus can extend to the IVC or even the right atrium, which could be a very dangerous condition with limited treatment options. Therefore, early diagnosis and timely treatment in clinical diagnosis and management is one of the important ways to improve treatment outcomes.

A 50-year-old man with a 10-year history of hepatitis B and bilateral lower extremity edema (grade 3+) within the past two weeks, with no prior antiviral therapy, was reported. Physical examination of the abdomen suggested mild ascites. The patient had no history of smoking, and no family history of HCC was reported. Laboratory examinations revealed (2021/6/14): alanine aminotransferase 240 U/L, aspartate aminotransferase 192 U/L, albumin 38.8 g/L, urea 11.31 mmol/L, creatinine 132 µmol/L, alpha-fetoprotein 4.52 ng/mL, and carbohydrate antigen 125 64.7 U/mL; no other significant abnormalities were observed. As part of the examinations, he underwent abdominal enhanced computed tomography (CT), which revealed space-occupying lesions in the right liver lobe and hepatic vein/inferior vena cava tumor thrombus (HV/IVCTT) (Fig. 1). Combined with the patient's history of hepatitis B and the form of enhancement, we considered the diagnosis of HCC complicated by HV/IVCTT. However, the IVC is not always enhanced, so the thrombus needs to be ruled out. With informed consent obtained from the patient, a segmental clamp biopsy of the IVC tumor thrombus was performed simultaneously during DEB-TACE (drug-eluting beads measuring 300–500 µm and loaded with 60 mg of tetrahydropyranil were used for embolization) treatment.

IVC angiography was performed via the left femoral vein approach, revealing multiple filling defects within the IVC. Subsequently, a 10-F long sheath was introduced, and two tissue specimens were obtained by clamp biopsy from the middle–lower segment of the IVC and the second hepatic hilum for pathologi-

cal examination (disposable biopsy forceps; JiuHong, Changzhou, China). Pathology confirmed that the upper end of the IVC was a tumor thrombus, and the lower segment was a thrombus (Fig. 2). We performed indwelling catheter thrombolysis (urokinase at 200,000 IU twice daily (BID) was administered for 1 week) for the thrombus in the lower segment. After 5 days of thrombolytic therapy, IVC angiography showed smooth blood flow in the IVC, and the lower thrombus was completely dissolved. His lower extremity edema also disappeared.

At 3 months, hepatic arteriography and tumor thrombus biopsy were performed to assess the pathological response to treatment. Histopathological examination revealed complete necrosis of the tumor thrombus following DEB-TACE, confirming the short-term efficacy of the therapy (Fig. 3). No procedure-related adverse events were observed.

The patient received systemic therapy consisting of camrelizumab 200 mg every 3 weeks (Q3W) combined with lenvatinib 8 mg once daily (QD) as maintenance treatment. Follow-up CT examinations performed at 1, 2, and 3 months after the procedure demonstrated complete response according to the mRECIST (modified Response Evaluation Criteria in Solid Tumors) criteria. As the patient did not return for subsequent follow-up visits, further disease progression could not be assessed. Telephone follow-up revealed that the patient experienced disease progression in December 2022 and died of liver failure in June 2023. The patient's treatment timeline is shown in Figure 4.

Since the imaging diagnosis and tumor markers of liver cancer are characteristic, clinical diagnosis is not difficult. When HCC invades the hepatic vein, IVC, and right atrium, there is occlusion of IVC blood flow, thereby promoting thrombosis. In clinical practice, accurately distinguishing tumor thrombus from bland thrombus remains a major challenge, as it directly influences subsequent treatment selection.^{2,3} Here, we report a case of HCC in which endovascular biopsy successfully differentiated tumor thrombus from bland thrombus, and short-term complete remission was achieved through combined interventional therapy. Ultrasonography revealed echogenic parenchymal masses in the hepatic vein and IVC, sometimes extending to the right atrium, thereby narrowing or occluding IVC blood flow; contrast-enhanced ultrasonography revealed that the masses in the hepatic vein and IVC and the liver cancer lesions showed “fast-in and fast-out” changes synchronously.

At the early stage of tumor thrombus formation, it is difficult to determine the nature of the thrombus by enhanced CT; magnetic

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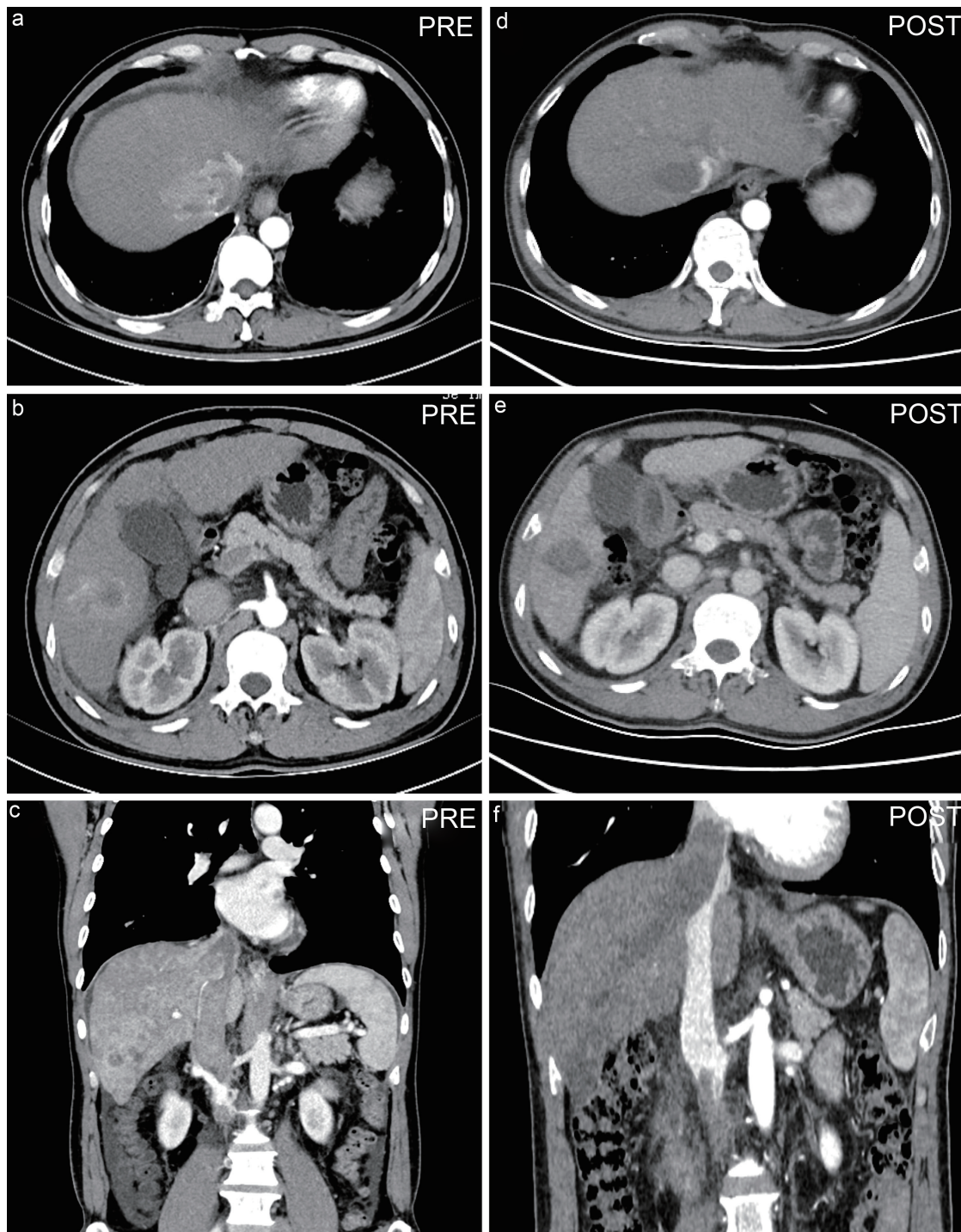


Fig. 1. Preoperative and 3-month postoperative CT images. Contrast-enhanced CT revealing multiple nodules in the right liver lobe in the arterial phase, moderate enhancement in the arterial phase, and filling of low-density shadows in the inferior vena cava and hepatic vein in the coronal plane (a, b, c). At 3 months after DEB-TACE, CT showed no enhancement of the liver cancer lesions and tumor thrombus, and the thrombus disappeared (d, e, f). CT, computed tomography; DEB-TACE, drug-eluting beads transarterial chemoembolization.

resonance imaging is superior to CT in differentiating benign and malignant thrombi. Positron emission tomography/CT can diagnose tumor thrombus earlier than the development of morphological changes; however, the false-positive rates of septic thrombus

and inflammatory thrombosis in peripheral blood vessels are relatively high.^{4,5}

Pomoni *et al.*⁶ reported that endovascular forceps biopsy is safe and feasible in clinical application, with a high positive rate and no

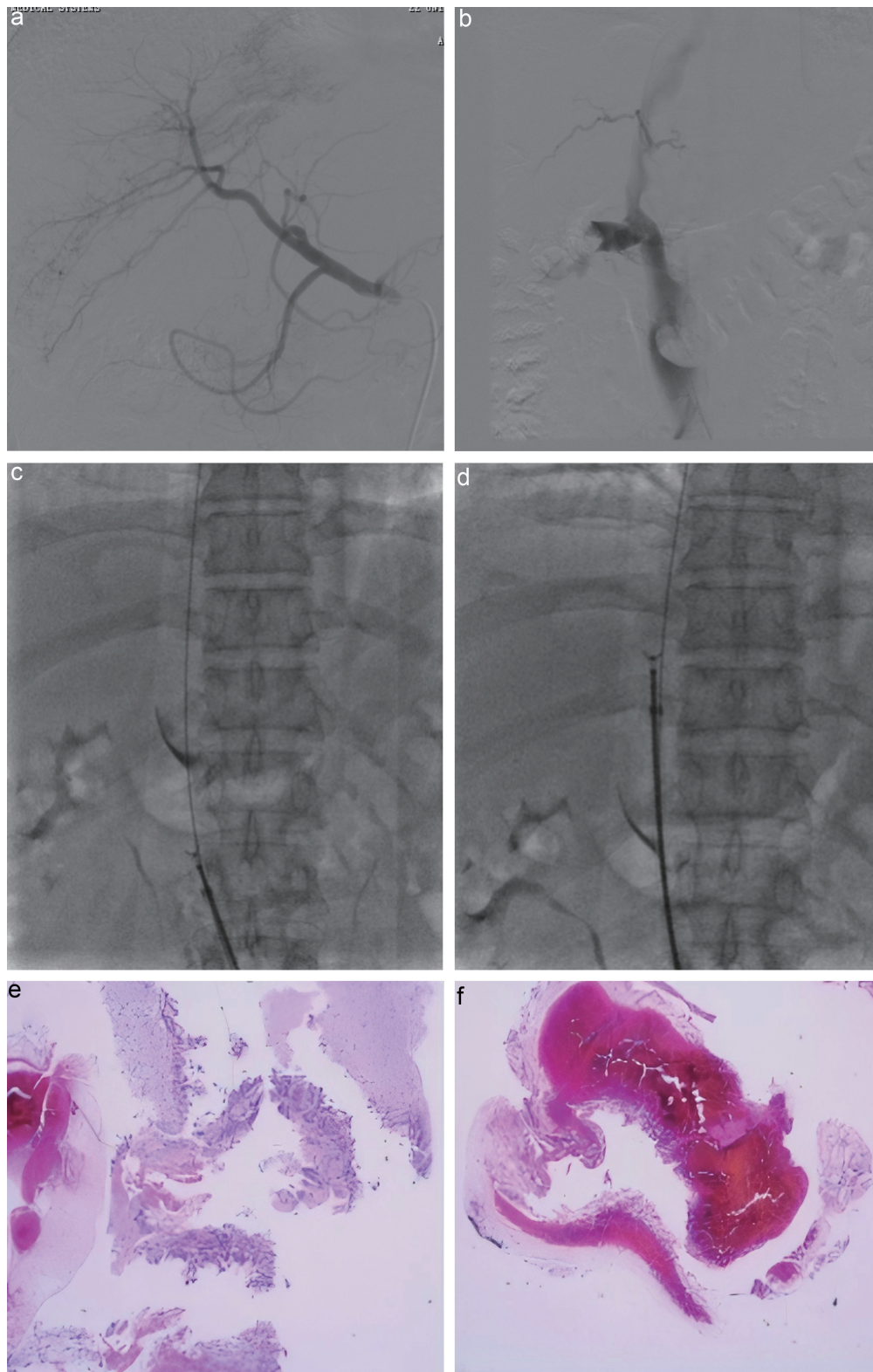


Fig. 2. Intraoperative angiography and biopsy processes. Staining of the tumor in the right lobe and the “stripe sign” of the tumor thrombus in the right hepatic vein (a). IVC angiography revealed multiple filling defects (b); a segmental clamp biopsy of the IVC was performed (c, d). Pathological examination of the superior IVC showed tumor thrombus (e, HE $\times 100$), and pathological examination of the lower segments of the IVC showed thrombus (f, HE $\times 100$). IVC, inferior vena cava; HE, hematoxylin-eosin staining.

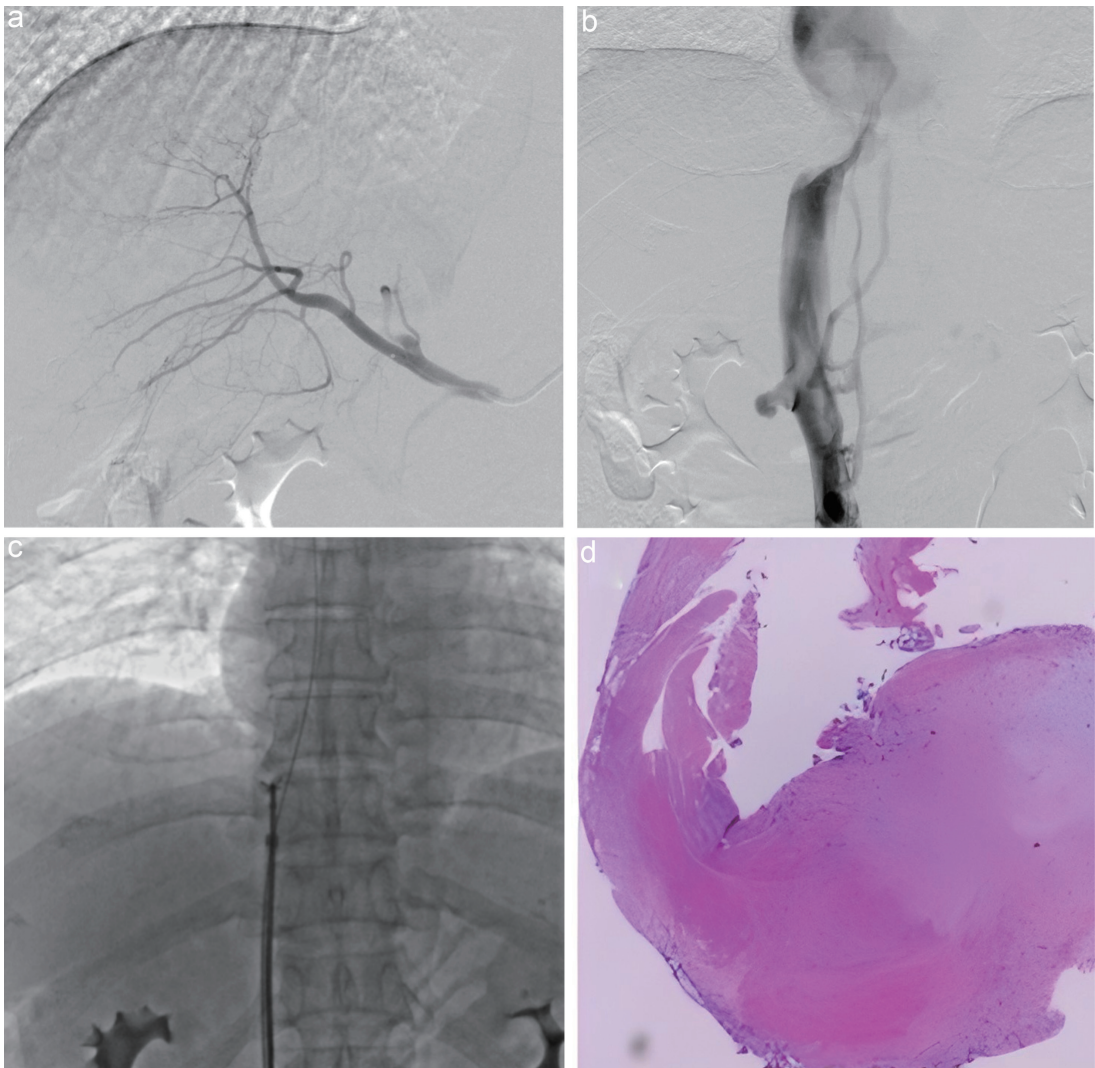


Fig. 3. Angiography and follow-up biopsy findings obtained at 3 months postoperatively and following thrombolytic therapy. At 3 months after treatment, hepatic arteriography revealed no tumor staining (a). After 5 days of thrombolytic therapy, inferior vena cava angiography showed smooth blood flow in the inferior vena cava, and the lower thrombus was completely dissolved (b). Forceps biopsy was performed again on the tumor thrombus (c). Pathological examination showed the following results: fibrous connective tissue and massive necrotic cells were found; however, no viable cancer cells were found (d).

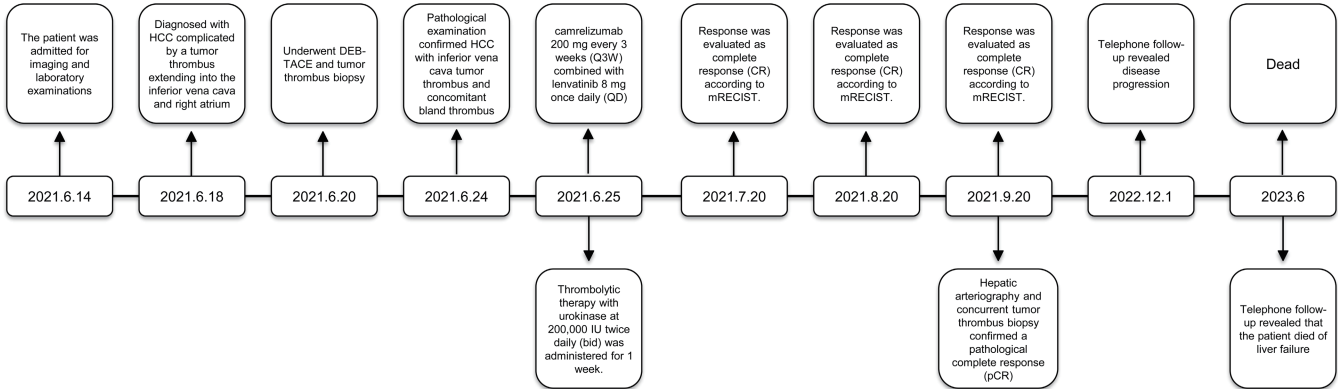


Fig. 4. Clinical timeline of the patient. HCC, hepatocellular carcinoma; IU, international unit; mRECIST, modified Response Evaluation Criteria in Solid Tumors.

serious complications. It has been widely used in the pathological diagnosis of obstructive diseases of the superior vena cava, IVC, portal vein, and iliac vein.

For HCC complicated by vascular tumor thrombus, especially tumor thrombus in the right atrium, radical resection is difficult.⁷ TACE-based therapy, surgical resection/thrombectomy, molecular targeted therapy, immunotherapy, and other multidisciplinary treatment strategies have been used in selected patients, which could prolong the overall survival of these patients to varying degrees.^{8,9}

Although this combined treatment strategy achieved a short-term complete radiological response, its long-term efficacy remains to be further validated. This strategy also has several limitations, including the potential risks of vascular injury, bleeding, and thrombus dislodgement associated with the clamping procedure.

In conclusion, during the interventional diagnosis and treatment, endovascular forceps biopsy was used in this patient to elucidate the nature and scope of the tumor thrombus. Based on the different pathological findings, individualized treatment measures were implemented, resulting in a favorable short-term radiological response. This case suggests that endovascular forceps biopsy may have potential value in distinguishing tumor thrombus from bland thrombus and in guiding individualized treatment strategies. However, further studies are warranted to validate its safety and long-term efficacy.

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Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

Conception and design (YZ, SY, ZL), literature review (YZ, SY, ZL), collection and assembly of data (YZ, SY, ZL), pathology imaging and interpretation (YZ, ZL), radiology imaging and interpretation (YZ, ZL), care of patient described (YZ, SY), and manuscript writing (YZ, SY, ZL). All authors have approved the final version and publication of the manuscript.

Ethical statement

The study was performed in accordance with the ethical standards

of the institutions with which we are affiliated and with the Declaration of Helsinki (as revised in 2024). Written informed consent was obtained from the patient for publication of this report. All imaging and pathology materials were fully de-identified in accordance with journal guidelines and ethical standards. The requirement for ethics approval was waived by the Ethics Committee of the First Affiliated Hospital of Zhengzhou University for this retrospective report.

Data sharing statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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