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## Case Report

# Hepatectomy in a young patient with advanced hepatocellular carcinoma and poor prognostic imaging features: A case of recurrence-free survival<sup>☆</sup>

Huyen Duy Mai Le, MD<sup>a</sup>, Duc Tan Vo, MD, PhD<sup>a,b</sup>, Hai Trong Do, MD, PhD<sup>c</sup>,  
Hy Nguyen Gia Le, MD, MSc<sup>a,\*</sup>, Chien Cong Phan, MD<sup>a</sup>, Duy Thanh Nguyen, MD<sup>a</sup>,  
Quynh Nguyen Diem Le, MD, MSc<sup>a</sup>

<sup>a</sup>Department of Diagnostic Imaging, University Medical Center, Ho Chi Minh City, Vietnam

<sup>b</sup>Department of Diagnostic Imaging, University of Medicine and Pharmacy, Ho Chi Minh City, Vietnam

<sup>c</sup>Department of General Surgery, University of Medicine and Pharmacy, Ho Chi Minh City, Vietnam

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## ABSTRACT

A 45-year-old male with chronic hepatitis B presented with an advanced hepatocellular carcinoma (HCC) occupying the entire left liver and invading the left portal vein. Despite multiple poor prognostic imaging features, including vascular invasion, corona enhancement, an incomplete capsule, intratumoral necrosis, intratumoral arteries, and irregular tumor borders, the patient elected to undergo a left hepatectomy. Although Barcelona Clinic Liver Cancer (BCLC) staging classified the case as stage C, a resection was successfully performed. Remarkably, 6 years postsurgery, the patient remains recurrence-free. This report highlights a rare, fortunate outcome in a high-risk HCC case and underscores the potential of surgical intervention even in advanced HCC.

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## Introduction

Hepatocellular carcinoma (HCC) remains a leading cause of cancer-related mortality worldwide, particularly in patients with chronic hepatitis virus infection and cirrhosis [1]. Typically, patients with advanced HCC and poor prognostic fea-

tures on imaging are considered candidates for systemic therapy rather than resection [2]. However, in select cases, surgical resection may provide a unique opportunity for extended survival, even in advanced disease stages [3].

We report on a case with BCLC stage C HCC, who, despite extensive tumor involvement and portal vein invasion, underwent a left hepatectomy without postoperative adjuvant

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\* Corresponding author.

E-mail address: [hy.lng@umc.edu.vn](mailto:hy.lng@umc.edu.vn) (H.N.G. Le).

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therapy and remains recurrence-free 6 years postsurgery. This case underscores the importance of individualized treatment decisions and the potential for positive outcomes in high-risk cases.

## Case presentation

A 45-year-old male with a history of chronic hepatitis B virus (HBV) infection presented to our hospital with complaints of epigastric discomfort and weight loss over the past few months. His liver function tests were within acceptable limits (AST 61 U/L, ALT 39 U/L, serum albumin 39.3 g/L, total bilirubin 15.06  $\mu$ mol/L, INR 1.04), placing him in the Child–Pugh A category. Alpha-fetoprotein (AFP) levels were also within the normal range at 6.4 ng/mL. Initial abdominal ultrasound detected a large mass in the left liver, raising suspicion of malignancy. Subsequent multiphase contrast-enhanced CT revealed an extensive HCC occupying the entire left liver with invasion of the left portal vein, along with multiple poor prognostic imaging features. Despite these findings, the patient expressed a strong preference for surgical intervention.

After a multidisciplinary discussion, the decision was made to proceed with a left hepatectomy. The patient tolerated the surgery well, with no postoperative complications. Histopathological examination of the resected liver confirmed a moderate differentiated HCC with vascular invasion and negative resection margins (Fig. 3). He has been closely monitored postoperatively and followed up for 6 years, during which imaging confirmed no evidence of residual or recurrent disease.

## Imaging findings

Multiphase contrast-enhanced CT provided a comprehensive view of the tumor's characteristics, which indicated an advanced stage with poor prognostic markers.

- **Tumor size and location:** Imaging revealed a large hepatic mass occupying the entire left lobe, specifically involving segments II, III, and IV. The tumor measured approximately 12 × 10 × 9 cm and was notably expansive, filling the entire anatomical space of the left lobe (Fig. 1).
- **Vascular invasion:** The mass was seen infiltrating the left portal vein, indicating direct vascular involvement. This invasion of the portal vein appeared as an extension of tumor tissue within and expanding the vessel lumen, presenting as a filling defect with partial enhancement. The tumor, however, did not invade the right and main portal veins (Fig. 1).
- **Corona enhancement:** The arterial phase images demonstrated corona enhancement around the tumor, which appeared as an area of hyperenhancement adjacent to the tumor's outer edges and became isodense in later phases (Fig. 2).
- **Capsular incompleteness:** The lesion displayed incomplete capsulation on imaging, where certain portions of the tumor margin lacked a defined enhancing capsule. The areas without a complete capsule appeared irregular and

less demarcated compared to portions with capsular tissue, giving the tumor a partly uncontained appearance (Fig. 2).

- **Intratumoral necrosis:** Central regions within the tumor showed areas of necrosis, appearing as nonenhancing zones within the mass. This necrotic tissue presented as a hypodense area on contrast-enhanced imaging, indicating sections where the tumor tissue had undergone degeneration (Fig. 1).
- **Intratumoral arteries:** Multiple intratumoral arteries were identified within the mass, visualized as discrete, branching vessels coursing through the tumor in arterial phase imaging. These arteries appeared hyperdense relative to surrounding tissue and to the lesion's enhancing parts (Fig. 2).
- **Irregular tumor borders:** The tumor margins were irregular and infiltrative, with jagged edges that extended unevenly into surrounding liver tissue. This irregular contour was evident in both axial and coronal planes, giving the mass a less defined and invasive appearance (Fig. 2).

The constellation of these imaging findings painted a picture of an aggressive, high-risk HCC. Nonetheless, a left hepatectomy was performed without postoperative adjuvant therapy, and the patient has maintained a recurrence-free status 6 years postsurgery. A contrast-enhanced CT scan performed 1.5 years postsurgery confirmed the absence of residual disease after left hepatectomy (Fig. 4). Regular follow-up with abdominal ultrasound and AFP monitoring has consistently shown stable and normal results.

## Discussion

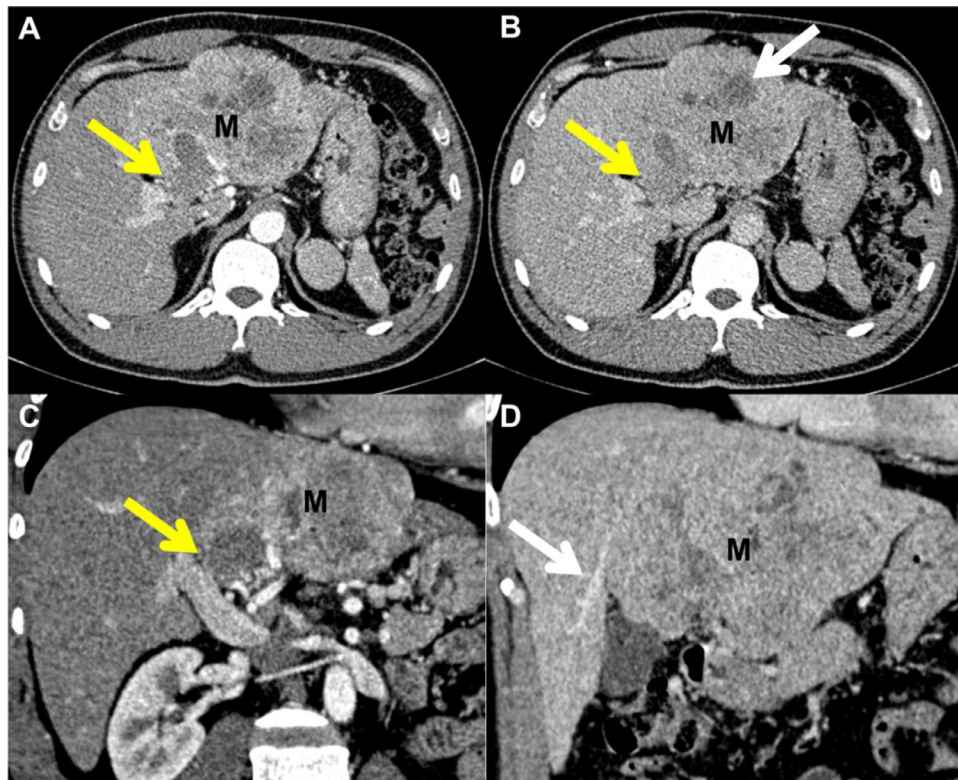
The standard management of advanced HCC, particularly in cases with portal vein invasion and poor prognostic imaging features, typically leans toward nonsurgical options. Surgical resection is generally reserved for cases with confined lesions, preserved liver function, and minimal invasion [2].

This case, however, diverged from conventional guidelines despite multiple poor prognostic indicators on imaging, which predict a high recurrence rate and poor overall survival.

### Prognostic implications of imaging features

Recent studies have shown that specific imaging markers can serve as predictors of early recurrence after resection in HCC [4–7], many of which were observed in this case. These findings indicated an advanced HCC with a high likelihood of aggressive behavior and poor prognosis.

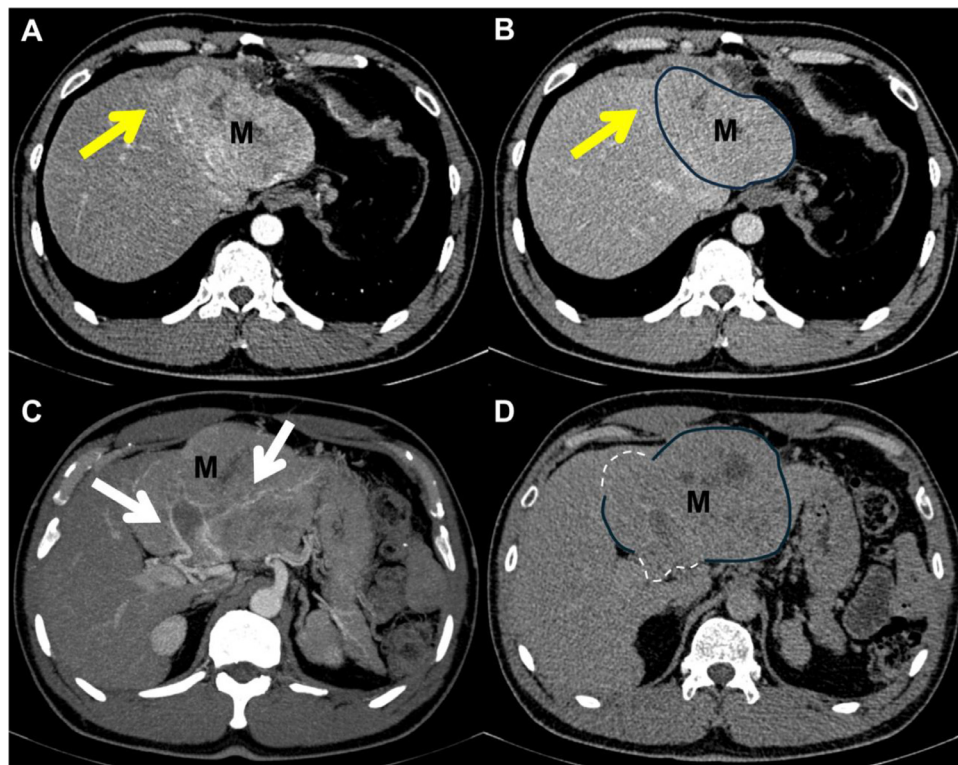
- **Large tumor size:** Tumor size is a critical factor in HCC prognosis, as larger tumors are typically associated with poorer outcomes due to an increased likelihood of vascular invasion, intrahepatic spread, and challenges in achieving complete resection [8]. Large HCCs often reflect a higher tumor burden and correlate with an increased risk of early recurrence following surgical intervention [9]. In this case, the tumor occupied the entire left liver lobe, significantly increasing the risk for both intrahepatic and extrahepatic metastasis.



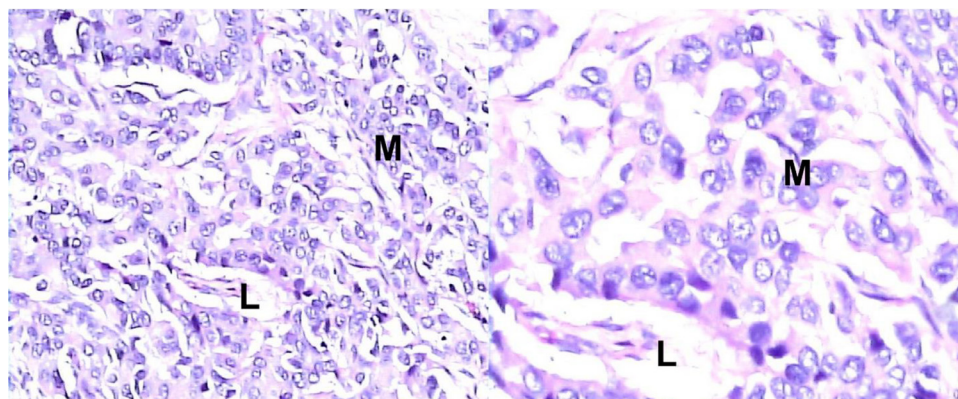
**Fig. 1** – Contrast-enhanced CT scan revealed a large, necrotic HCC occupying the entire left liver lobe with invasion into the left portal vein. Axial (A, B) and coronal (C, D) reconstructions depicted the arterial phase (A, C) and portal venous phase (B, D). The mass (M) demonstrated characteristic features of HCC, including arterial phase hyperenhancement and washout, consistent with LI-RADS 5. Tumor invasion was evident within the entire left portal venous system (yellow arrow, A–C), sparing the right and main portal veins. Despite its size, the tumor remained confined to the left liver lobe, displacing the middle hepatic vein towards the right (white arrow, D). Areas of necrosis within the tumor were apparent as nonenhancing hypodense regions (white arrow, B). Additionally, a structure adjacent to the left adrenal gland, presumed to be residual splenic tissue from a prior splenectomy, was visible (A, B) and remained stable in postoperative imaging, ruling out metastasis.

- **Portal vein invasion:** This is often regarded as a primary contraindication to resection due to its association with systemic dissemination and poor outcomes [2,10]. Portal invasion suggests a compromised vascular architecture, which can facilitate intrahepatic spread and recurrence. Studies have demonstrated significantly lower survival rates in patients with portal invasion, as it indicates advanced tumor stage and a substantial risk of microvascular metastasis [8].
- **Corona enhancement:** Corona enhancement is frequently seen in highly vascular HCCs and has been linked to early venous drainage from the tumor [11]. This phenomenon is a surrogate marker for microscopic tumor spread into the surrounding liver parenchyma. This feature's presence often translates to early recurrence risks postresection, as micrometastatic disease can remain undetected on preoperative imaging [12].
- **Capsular incompleteness:** The absence of a complete fibrous capsule suggests a loss of structural containment, which allows for an infiltrative growth pattern. Incomplete capsulation, especially in HCC, correlates with a poorer prognosis [13]. It limits the “barrier” that might contain malignant cells, increasing the likelihood of recurrence.
- **Intratumoral necrosis:** Areas of intratumoral necrosis often arise due to rapid tumor growth outpacing its blood supply, leading to cell death within the tumor. Necrosis indicates high-grade malignancy and is frequently associated with aggressive behavior and poorer outcomes [14], as it is commonly seen in tumors with high proliferative indices.
- **Intratumoral arteries:** The presence of multiple intratumoral arteries is a hallmark of hypervascularity, reflecting the tumor's high arterial blood supply. This feature often accompanies larger, more aggressive tumors and increases the risk of hemorrhage within the tumor. Additionally, hypervascularity is commonly associated with increased angiogenesis, a factor contributing to more aggressive spread and recurrence potential [15].
- **Irregular borders:** Irregular, infiltrative tumor borders are characteristic of HCCs with a higher recurrence rate [5]. These irregular contours indicate an invasive growth pattern, often correlating with a higher likelihood of microvascular invasion and tumor spread beyond the visible mar-

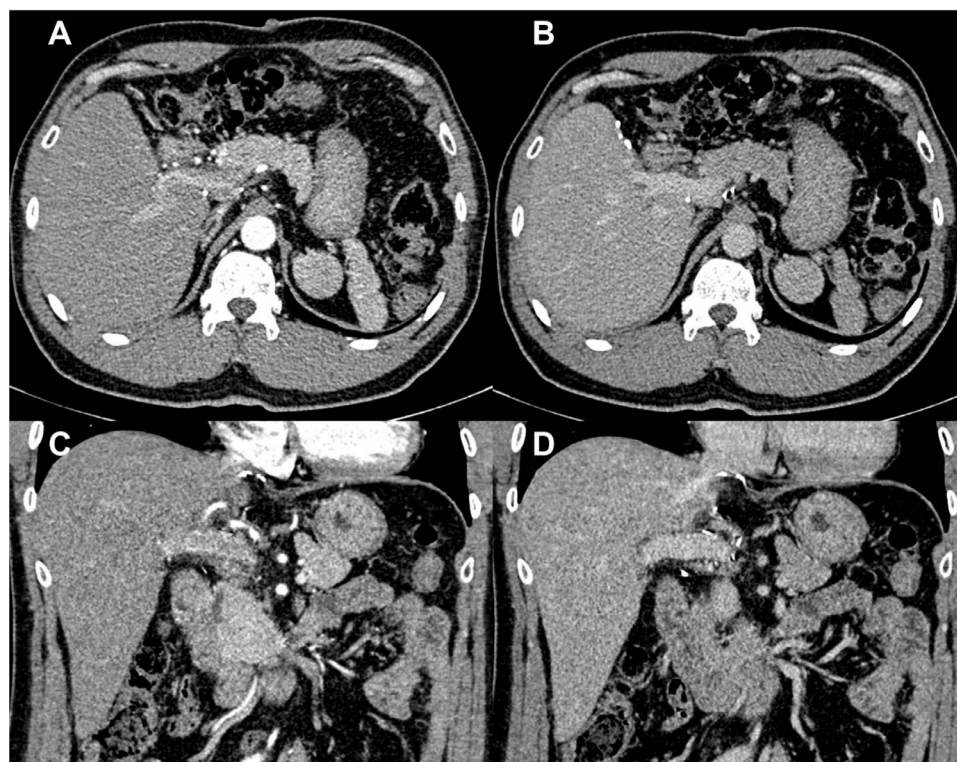




**Fig. 2** – Axial contrast-enhanced CT scan illustrated additional prognostic imaging features, including corona enhancement, intratumoral arteries, irregular borders, and incomplete capsulation. Corona enhancement appeared as a hyper-enhanced area adjacent to the tumor (M) in the arterial phase (yellow arrow, A), becoming isodense in the portal venous phase (yellow arrow, B). Tumor borders were better depicted in portal venous phase images (solid blue line, B). Maximum intensity projection imaging in the arterial phase revealed multiple intratumoral arteries (white arrow, C). Delayed-phase imaging showed regions of enhancing tumor capsule (solid blue line, D) alongside areas with irregular borders and incomplete capsulation (dashed white line, D).



**Fig. 3** – Postoperative pathological examination revealed features consistent with moderately differentiated HCC. The tumor is composed of hepatocytes with hyperchromatic, pleomorphic nuclei, prominent nucleoli, and abundant, granular eosinophilic cytoplasm (M). Numerous mitotic figures are observed. These tumor cells are arranged in trabecular or solid patterns. Lymphovascular invasion is present (L). No malignant cells are observed at the resection margin. No evidence of cirrhosis is present in the nontumorous liver tissue.



**Fig. 4 – Contrast-enhanced CT scan performed 1.5 years postsurgery confirmed the absence of residual disease after left hepatectomy. Axial (A, B) and coronal (C, D) reconstructions depicted the arterial phase (A, C) and portal venous phase (B, D).**

gins, further complicating surgical resection and increasing the risk of residual disease postoperatively.

Other noteworthy imaging features that are generally associated with poor prognosis in HCC but were absent in this case include rim enhancement (classified as LI-RADS M) and satellite nodules. Rim enhancement, characterized by a peripheral ring of enhancement surrounding the lesion in the arterial phase, is often associated with poor differentiation and worse prognostic subtypes of HCC [16]. In this case, however, postoperative pathology revealed a moderately differentiated HCC of the conventional subtype, and preoperative imaging showed an enhancement pattern typical of HCC, classified as LI-RADS 5. Satellite nodules, appearing as small tumor foci adjacent to the primary lesion, are indicative of microscopic vascular invasion and present a higher risk for early recurrence due to multifocal disease [17]. Although the tumor in this case presented as a single large mass, it is possible that microscopic nodules were present but undetectable on CT, as the detection sensitivity for satellite nodules on CT imaging remains limited [13].

**Surgical decision and outcomes** Despite the high-risk features, the patient was relatively young and motivated for curative resection, also had good baseline liver function and a normal level of tumor biomarker. This case underscores the importance of individualized treatment, where patients' preferences, age, and physical status play a critical role in decision-making. The absence of early recurrence is an exceptional outcome and suggests that, in certain cases,

aggressive resection may be beneficial, even for advanced HCC with vascular invasion and multiple poor prognostic indicators.

**Literature and clinical implications** While resection in BCLC stage C HCC remains controversial [2], recent literature has suggested that selected patients with good liver function and minimal extrahepatic disease may derive survival benefits from resection [3,18,19]. This case contributes to this discourse, indicating that even in cases with advanced imaging features, surgical resection might be pursued under careful evaluation. This report emphasizes that further studies are needed to define criteria more precisely for surgical candidacy in advanced HCC cases.

## Conclusion

This case report presents a rare instance of a young male with advanced HCC, exhibiting numerous poor prognostic imaging features, who achieved disease-free survival following a left hepatectomy. Despite unfavorable imaging characteristics, the patient has remained recurrence-free for 6 years, underscoring the potential for surgical intervention in select advanced HCC cases. This case contributes to the ongoing discourse regarding surgical resection's role in advanced HCC and emphasizes the potential for favorable outcomes in carefully chosen cases.

## Patient consent

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

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