

Right atrial metastatic tumor with an occult primary malignancy complicated by secondary Budd-Chiari syndrome

Mekonnen Hailemichael Gebremichael*, Yue-Heng FENG*, Jie REN, Yu-Jiao PAN, Hai-Long CUI, Wen-Biao ZHANG, Jian-Qiang LI✉

Department of Cardiology, The First Affiliated Hospital of Harbin Medical University, Harbin, China

*The authors contributed equally to this manuscript

✉ Correspondence to: betterbetterman@126.com

<https://doi.org/10.26599/1671-5411.2026.08.001>

Cardiac masses are uncommon and encompass a broad differential diagnosis, including thrombi, primary cardiac tumors, and metastatic malignancies. Primary cardiac tumors are rare, occurring in approximately 1 in 10,000 individuals. Among those, atrial myxomas account for around 50% of the cases. In contrast, secondary cardiac tumors and intracardiac thrombi are encountered more frequently, particularly in patients with underlying malignancy.^[1] Of all the cardiac chambers, a mass in the right atrium (RA) presents a unique diagnostic challenge because anatomical variants, thrombi, and tumors may share overlapping imaging features. However, RA masses may lead to severe complications such as venous obstruction, arrhythmia, cardiomyopathy, and heart failure.^[2] In this case report, we present a patient with an atypical RA mass that was ultimately confirmed as metastatic malignancy of unknown primary origin, accompanied by secondary Budd-Chiari syndrome (BCS) and an anomalous origin of the right coronary artery.

A 61-year-old female patient was admitted with chest tightness and chest pain for six months, with worsening symptoms over the past ten days. The patient reported no prior history of chronic illness. Upon admission, the patient's vital signs were within the normal range and no abnormalities were detected during physical examination. Laboratory tests revealed mildly elevated liver enzymes, slightly elevated D-dimer levels, thrombocytopenia, positive platelet antibody IgG, and weakly positive platelet antibody IgM. In addition, a slightly elevated tumor marker carbohydrate antigen 125 was shown in the laboratory assessment, while other tumor markers were within the normal range. Evaluation with electrocardiography demonstrated sinus rhythm with no abnormal

ST-segment changes. Subsequent assessment with transthoracic echocardiography (TTE) revealed a large heterogeneous mass occupying the RA measuring approximately 55 mm × 41 mm (Figure 1A). Contrast-enhanced echocardiography demonstrated rich vascularity within the mass, along with a focal non-enhancing area in its superior portion, suggestive of intratumoral necrosis (Figure 1B). These findings strongly supported a tumor rather than thrombus. Furthermore, the mass involved the orifice and hepatic segment of the inferior vena cava (IVC) (Figure 1C), accompanied by distal IVC dilatation, reduced venous flow, and decreased collapsibility (Figure 1D & 1E), findings consistent with hepatic venous outflow obstruction and secondary BCS.

Given the elevated D-dimer level and the presence of chest pain, coronary and pulmonary computed tomography angiography (CTA) was performed, which excluded pulmonary embolism and significant coronary stenosis. However, CTA also demonstrated the RA mass with extension into the hepatic segment of the IVC (Figure 2A–2E). Incidentally, an anomalous origin of the right coronary artery was identified, arising from the aortic root rather than the right coronary sinus (Figure 2F). In the absence of coronary stenosis, this anatomical variant was not considered to have adverse clinical impact. To further characterize the intracardiac mass, cardiac magnetic resonance (CMR) imaging was performed, which demonstrated a lobulated mass occupying the RA chamber (Figure 3A). T2-weighted fat-suppressed sequences revealed heterogeneous hyperintensity with internal septations and extension into the IVC (Figure 3B). Late gadolinium enhanced imaging showed mild enhancement of the mass and internal septations, with persistent IVC involvement (Figure 3C & 3D).

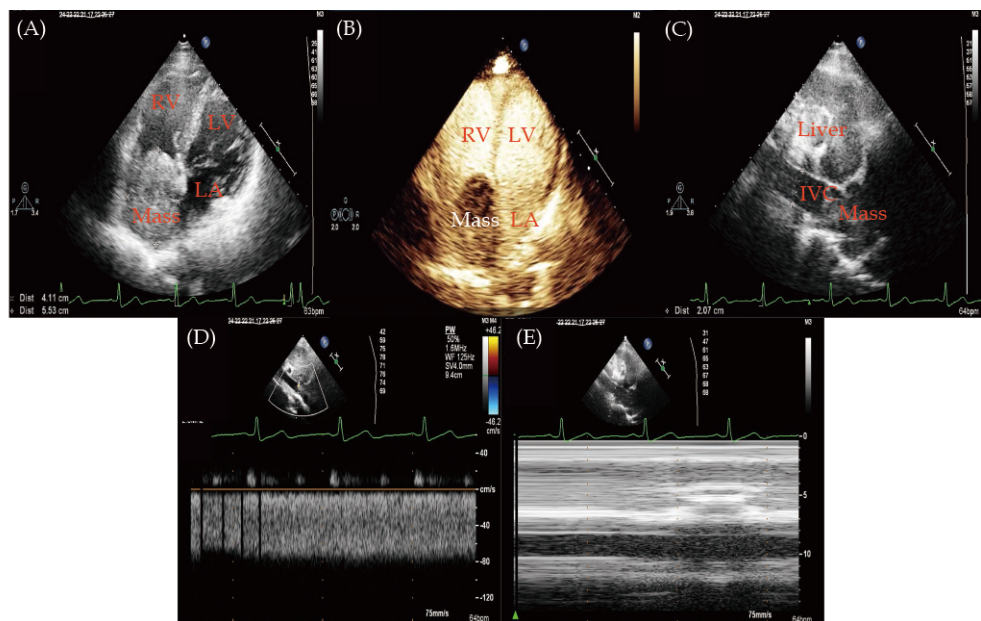


Figure 1 Transthoracic echocardiographic findings. (A): A heterogeneous echogenic mass measuring 55 mm × 41 mm was detected in the RA; (B): myocardial contrast echocardiography revealed rich vascularity within the mass; (C): the mass involved the IVC orifice and the hepatic segment of the IVC; and (D & E): the distal IVC was dilated with reduced blood flow velocity, a flattened Doppler spectral waveform, and decreased collapsibility, findings consistent with BCS. BCS: Budd-Chiari syndrome; IVC: inferior vena cava; LA: left atrium; LV: left ventricle; RA: right atrium; RV: right ventricle.

Based on multimodality imaging findings, including abundant vascularity, internal septations, infiltrative features, and extension into the IVC, thrombus was considered unlikely. Furthermore, the imaging characteristics were atypical for common primary cardiac tumors, raising suspicion for a cardiac metastatic malignancy. However, the primary site of malignancy remained unclear. Comprehensive systemic evaluation, including head, chest, abdominal, pelvic imaging, and gynecological ultrasonography, failed to identify a definite primary malignancy, although splenomegaly, ascites, and perihepatic and pelvic effusions were observed.

Following multidisciplinary discussion, comprehensive diagnostic evaluation of the intracardiac mass, and preoperative assessment of thrombocytopenia, the patient underwent surgery three weeks after admission. Intraoperatively, the mass originated from the IVC orifice and obstructed both the IVC and hepatic venous inflow. Histopathological examination revealed a malignant tumor with trabecular and nested architecture and marked atypia. Immunohistochemistry demonstrated positive staining for Hepatocyte, Glypican-3, CK, and CK8/CK18, supporting a metastatic tumor of possible hepatic origin. Subsequent triple-phase contrast-enhanced liver computed tomography (CT) revealed gallstones, cholecystitis, splenomegaly, and mild peritoneal effusion; however, no abnormal enhancement within the liver parenchyma or de-

finite hepatic mass was identified. Further examination with 18F-fluorodeoxyglucose positron emission tomography imaging was recommended but declined due to financial concerns. The postoperative course remained uneventful. Before discharge, TTE showed a normal RA diameter, unobstructed venous inflow, slightly decreased right ventricular wall motion, and preserved left ventricular ejection fraction (57%). However, the corresponding TTE images were unavailable for inclusion in this report. Despite initial clinical stabilization, the patient died of multi-organ failure seven months after surgery.

Multimodality imaging played a critical role in the diagnosis and characterization of the RA mass in this patient. TTE served as the initial imaging modality, identifying the intracardiac mass and its hemodynamic consequences. Contrast-enhanced echocardiography demonstrated abundant vascularity with focal non-enhancement suggestive of intratumoral necrosis, favoring a neoplastic lesion over thrombus. CMR and CTA further characterized the mass by demonstrating internal septations, infiltrative features, and extension into the IVC, findings more suggestive of a malignant tumor. Although primary cardiac tumors were included in the differential diagnosis, the imaging characteristics were not typical of common primary RA tumors. Specifically, the absence of a well-circumscribed, pedunculated intracavitary morphology made atrial myxoma less likely, whereas the lack of predominant RA

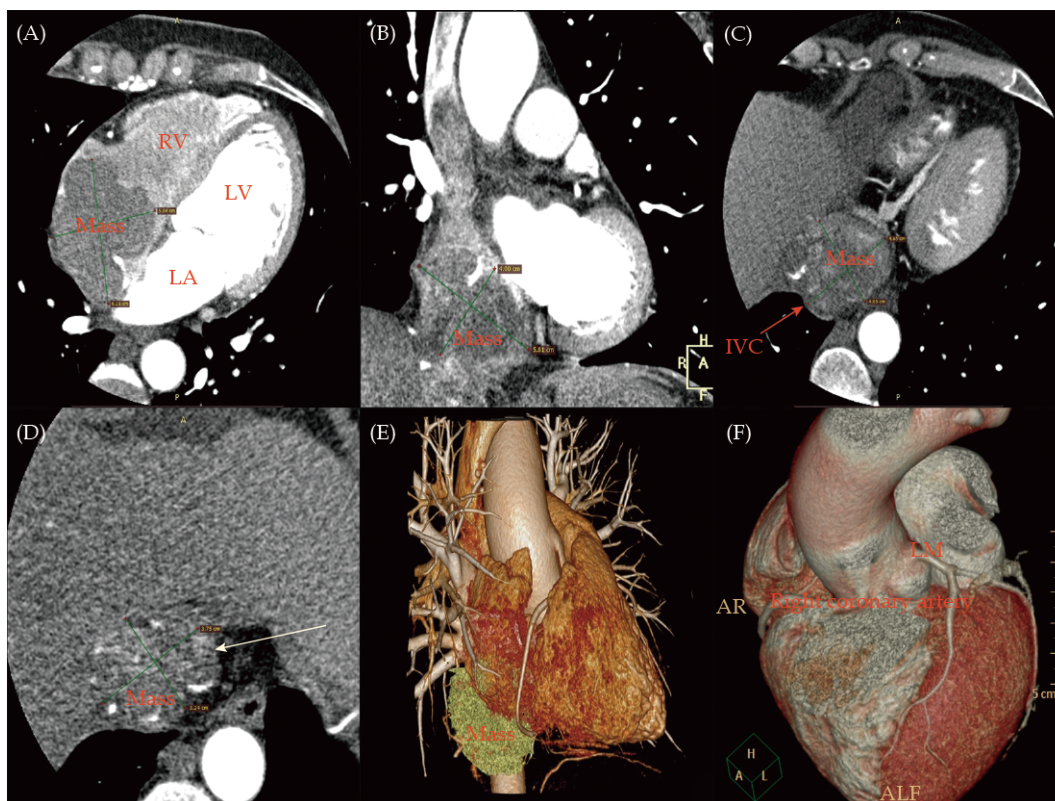


Figure 2 Coronary computed tomography angiography findings. (A & B): Coronal and four-chamber views demonstrated a low-density mass in the RA; (C & D): the mass involved the IVC orifice and extended into the hepatic segment of the IVC; (E): three-dimensional reconstruction of the RA mass; and (F): the right coronary artery showed an anomalous origin from the aortic root. IVC: inferior vena cava; LA: left atrium; LM: left main artery; LV: left ventricle; RA: right atrium; RV: right ventricle.

free-wall invasion or pericardial involvement argued against angiosarcoma. Importantly, multimodality imaging also identified secondary BCS, which developed due to tumor invasion of the suprahepatic IVC and hepatic venous outflow tract. Previous studies have emphasized the value of integrating echocardiography, CMR, CT, and selected positron emission tomography imaging for differentiating cardiac tumors from thrombi and assessing local invasiveness.^[2-5]

A major diagnostic challenge in this case was determining the primary origin of the malignancy. Cardiac metastases are more common than primary cardiac tumors and most frequently originate from lung, breast, renal malignancies, melanoma, or mesothelioma.^[6] However, extensive systemic evaluation failed to identify a definite extracardiac primary lesion. Histopathological and immunohistochemical findings suggested a possible hepatic origin, supported by positive Hepatocyte and Glypican-3 staining, markers commonly associated with hepatocellular differentiation and hepatocellular carcinoma.^[7] Nevertheless, triple-phase contrast-enhanced liver CT failed to demonstrate a hepatic mass. Although oc-

cult hepatocellular carcinoma could not be excluded, this case highlights an important diagnostic limitation: even advanced imaging modalities may fail to detect clinically silent or radiologically occult primary tumors. Additional evaluation with positron emission tomography, which may improve detection of occult malignancies, was declined for financial reasons.^[8,9] Additionally, despite surgical excision of the mass and initial postoperative stabilization, the patient's prognosis remained poor, and she died seven months after surgery. This unfavorable outcome likely reflects the aggressive biology of an occult malignancy, with possible systemic disease burden that was not detectable by conventional imaging at the time of diagnosis. Therefore, this case emphasizes that surgical intervention may relieve mechanical obstruction and improve short-term hemodynamic status; however, it may not overcome the adverse prognosis associated with occult metastatic malignancy.^[10]

Another notable feature was thrombocytopenia, which was likely multifactorial. Splenomegaly secondary to hepatic venous outflow obstruction may have contributed through hypersplenism and increased splenic sequestration of platelets.



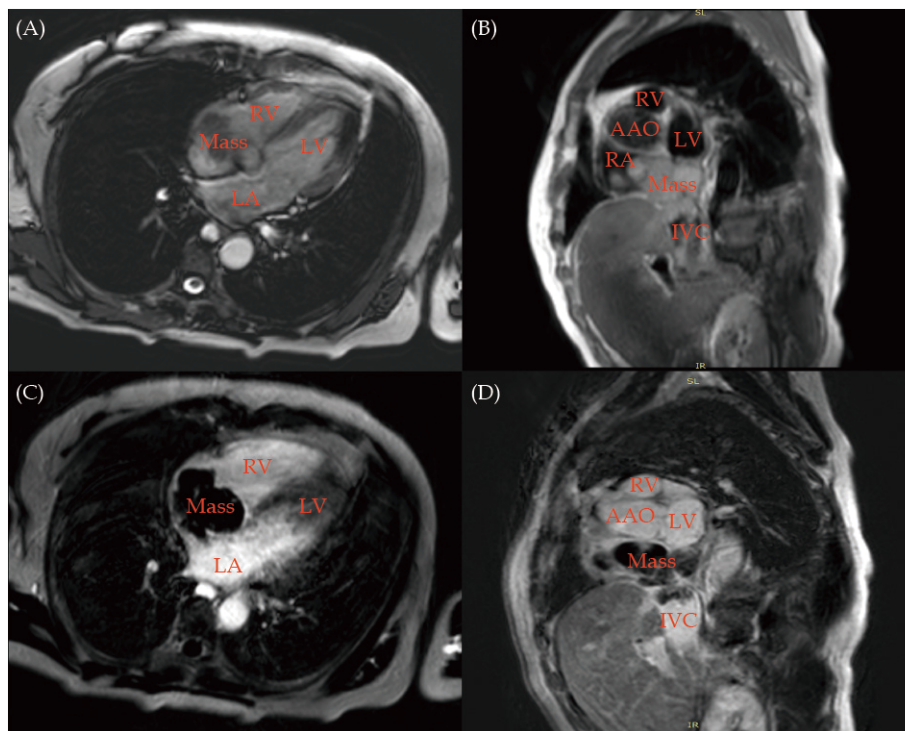


Figure 3 Cardiac magnetic resonance findings. (A): On the cine four-chamber view, a lobulated hypointense mass was observed in the RA; (B): on short-axis T2-weighted fat-suppressed imaging, the mass demonstrated hyperintensity with internal septations and extension into the IVC; and (C & D): on late gadolinium enhancement images in the four-chamber and short-axis views, the mass showed mild enhancement, with slight enhancement of the internal septations and extension into the IVC. AAO: ascending aorta; IVC: inferior vena cava; LA: left atrium; LV: left ventricle; RA: right atrium; RV: right ventricle.

ts.^[1] Meanwhile, the presence of positive platelet-associated IgG and weakly positive IgM raised the possibility of an immune-mediated mechanism, although this could not be definitively established.^[2] Malignancy-associated immune dysregulation may also have contributed, as it has previously been implicated in secondary thrombocytopenia and other paraneoplastic hematologic abnormalities.^[3]

Overall, this case highlights the diagnostic value of multimodality imaging in differentiating RA masses from thrombi and recognizing secondary BCS. It further underscores the complementary role of histopathological evaluation when imaging findings remain inconclusive. Finally, this case emphasizes the limitations of even advanced imaging modalities in identifying rare infiltrative or occult malignancies, particularly when clinical and pathological findings strongly suggest an underlying diagnosis despite the absence of radiological confirmation.

ACKNOWLEDGMENTS

This study was supported by the Research and Innovation Fund of The First Affiliated Hospital of Harbin Medical Un-

iversity (No.2021L05). All authors had no conflicts of interest to disclose.

REFERENCES

- [1] Carrick RT, Desai K, Johnson J, *et al*. Rapidly progressive right atrial mass secondary to metastatic hepatocellular carcinoma. *JACC Case Rep* 2024; 29: 102505.
- [2] Sharma S, Narula N, Argulian E. Solving the diagnostic challenge of right atrial mass. *JACC Case Rep* 2022; 4: 236–238.
- [3] Angeli F, Bodega F, Bergamaschi L, *et al*. Multimodality imaging in the diagnostic work-up of patients with cardiac masses: *JACC: CardioOncology* state-of-the-art review. *JACC CardioOncol* 2024; 6: 847–862.
- [4] Khan AA, Ali SR, Tan TC, *et al*. The central role of multimodality cardiac imaging in the assessment and management of cardiac masses. *Eur Heart J Case Rep* 2024; 8: ytae630.
- [5] Anagnostopoulos GK, Margantinis G, Kostopoulos P, *et al*. Budd-Chiari syndrome and portal vein thrombosis due to right atrial myxoma. *Ann Thorac Surg* 2004; 78: 333–334.
- [6] Goldberg AD, Blankstein R, Padera RF. Tumors metastatic to the heart. *Circulation* 2013; 128: 1790–1794.
- [7] Guo M, Zhang H, Zheng J, *et al*. Glypican-3: a new target for diagnosis and treatment of hepatocellular carcinoma. *J Cancer* 2020; 11: 2008–2021.

- [8] Tyebally S, Chen D, Bhattacharyya S, *et al*. Cardiac tumors: *JACC CardioOncology* state-of-the-art review. *JACC CardioOncol* 2020; 2: 293–311.
- [9] Bodega F, Angeli F, Bergamaschi L, *et al*. Multimodality imaging in cardiac masses. *Eur Heart J* 2023; 44: ehad655.187.
- [10] Mani K, Deng D, Lin C, *et al*. Causes of death among people living with metastatic cancer. *NatCommun* 2024; 15: 1519.
- [11] Lim HI, Cuker A. Thrombocytopenia and liver disease: pathophysiology and periprocedural management. *Hematology Am Soc Hematol Educ Program* 2022; 2022: 296–302.
- [12] Provan D, Semple JW. Recent advances in the mechanisms and treatment of immune thrombocytopenia. *EBioMedicine* 2022; 76: 103820.
- [13] Anat GG. Current approaches for the diagnosis and management of immune thrombocytopenia. *Eur J Intern Med* 2023; 108: 18–24.

Please cite this article as: Gebremichael MH, FENG YH, REN J, PAN YJ, CUI HL, ZHANG WB, LI JQ. Right atrial metastatic tumor with an occult primary malignancy complicated by secondary Budd-Chiari syndrome. *J Geriatr Cardiol* 2026; 23(8): 542–546. DOI: 10.26599/1671-5411.2026.08.001

