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# A Rare Cause for Acute Cor Pulmonale

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## Key Words

Right atrial mass · Hepatocellular carcinoma · Pulmonary thromboembolism · Hepatitis B surface antigen · Acute cor pulmonale · Alpha-fetoprotein

## Abstract

A number of diseases may cause right atrial mass. Primary cardiac tumors range from 0.002 to 0.25%. Intracardiac manifestation and pulmonary embolism of hepatocellular carcinoma (HCC) is a very rare finding and uncommon even at autopsy. Here we describe the case of a 32-year-old Asian man who was referred for shortness of breath lasting for a month, along with unproductive cough. He was a manual laborer with a history of diabetes, alcoholism, and smoking. Clinically he was diagnosed as having pulmonary embolism. Echocardiogram showed a mass in the right atrium. Magnetic resonance imaging showed that he had a large mass in the right atrium extending down into the inferior vena cava. Further evaluation showed that he had chronic liver disease with portal hypertension and was hepatitis B surface antigen-positive, indicating hepatitis B infection. He underwent excision of the mass, and the pathological report showed metastasis of HCC with multiple vascular emboli in the lungs. As this is the second reported case of this kind in the literature, we highlight the need of screening at least 6-monthly all patients with chronic liver disease, hepatitis B and C virus infection for the early detection of HCC.

## Case Report

The patient was a 32-year-old Asian man and a manual laborer who presented with insidious onset of breathlessness on exertion and low-grade intermittent fever of one month's duration. Fever was occurring daily, mainly towards the evening without rigor or chills. He used to take tablets (paracetamol 500 mg) prescribed by his local general practitioner which gave him temporary relief. He had diabetes detected 7 years back for which he was regularly taking tablets (glibenclamide 5 mg) twice a day. He was habituated to alcohol, consuming about 200 ml of country-made liquor per day, and had been smoking approximately 20 cigarettes per day for more than 7 years. He had productive cough with scanty, whitish sputum and had been under treatment at various hospitals for the past 3 months. He reported a weight loss of about 10 kg in the month before admission. He had experienced no cardio-specific symptoms in the past and had no significant family history of heart disease.

On examination at the emergency service, the patient was found to have features of acute cor pulmonale. He was conscious but dyspneic, with tachycardia with a rate of 140/min and tachypnea with a rate of 26/min. The jugular venous pressure pulse was elevated 10 cm from the sternal angle. He exhibited grade 2 clubbing, but no icterus or lymphadenopathy. The liver was enlarged 12 cm from the right costal margin and the spleen tip was palpable. S1 was normal, but S2 was loud with loud P2 and right ventricular S3. The patient did not exhibit heart murmurs. Examination of his respiratory system revealed bilateral basal crepitations and wheezing. Electrocardiogram and chest X-ray were normal. The patient was moved to the ward, and further routine investigations were performed, including an emergency echocardiogram showing a large mass occupying the patient's right atrium, with no attachment to the interatrial septum. Transesophageal echocardiogram showed a 6 × 5 cm mass in the right atrium with extension into the inferior vena cava (IVC), with no attachment to the interatrial septum or tricuspid valve, suggestive of a cardiac tumor ([fig. 1](#)). Abdominal ultrasound showed mild hepatomegaly with coarse echo texture of the liver; the portal vein was 14 mm in diameter, suggestive of chronic liver disease with portal hypertension; prominent hepatic veins, IVC, and right atrium were observed. Doppler venous study of the lower limb was normal, but esophagogastroduodenoscopy showed grade III esophageal varices. Routine blood investigations and urinalysis were normal. Liver function tests showed a serum bilirubin level of 1.3 mg/dl (direct: 0.6 mg/dl); the serum glutamic oxaloacetic transaminase/glutamic-pyruvic transaminase ratio was 238/90 IU. Alkaline phosphatase was 197 IU (0–140). Total protein was 8.9 g/dl and albumin was 3.9 g/dl; prothrombin time was 13.2 s, with an international normalized ratio of 1.2. Serum alpha-fetoprotein level was 677.51 ng/dl (0–7.2), and serum carcinoembryonic antigen level was 6.44 ng/dl (0–3.4). Hepatitis B surface antigen was positive, anti-hepatitis B core antibody was negative, and hepatitis C virus was negative. Weil's antibody, Widal, Brucella agglutination titer, and human immunodeficiency virus 1 and 11 were negative. Magnetic resonance imaging findings of the thorax showed a large mass filling the right atrium ([fig. 2a](#)). Magnetic resonance imaging of the thorax and abdomen showed a mass in the right atrium extending into the IVC and middle and left hepatic veins, with small irregular filling defects in the right superior pulmonary vein, suggestive of an embolus and cirrhotic changes in the liver ([fig. 2b](#)). Emergency excision of the right atrial mass was performed, and the specimen was sent for histopathologic analysis. Findings from the resected mass showed a neoplasm with a trabecular and perivascular pattern, with few hepatocytes and individual cells containing a moderate amount of eosinophilic cytoplasm, vesicular nuclei, and prominent nucleoli ([fig. 3](#)). Another section from the right atrium showed malignant cells in the right atrium and vascular emboli, confirming right atrial and pulmonary metastasis from the hepatocellular carcinoma (HCC) ([fig. 4](#)). In the immediate postoperative period, he developed sudden worsening of cardiac failure and succumbed.

Our diagnosis was HCC with cardiac metastasis in the right atrium and pulmonary embolism, chronic alcoholic liver disease, and cirrhosis with portal hypertension and positive hepatitis B surface antigen.

## Discussion

HCC is the most common primary malignant tumor of the liver. At least 372,000 new cases of HCC occur worldwide every year, accounting for 4.6% of all new human cancers [1]. Liver cancer is the fifth most common cancer in men and the eighth most common cancer in women. Most cases of HCC are diagnosed at an advanced stage when the tumor has already spread, most frequently to the lungs, peritoneum, adrenal glands, and bones. Cardiac metastasis is an uncommon secondary cardiac malignancy in HCC [2–4], with an incidence of 0.67–3% [4, 5]. Intracavitary cardiac extension or metastasis is associated with a dismal prognosis [6, 7]. Our case is extremely rare and is only the second report of HCC presenting as pulmonary embolization [8].

HCC is known to have a marked propensity for vascular invasion and extension. Tumor growth into the cardiac cavity is relatively rare, occurring mostly in the right atrium [4, 6]. The mechanism of cardiac involvement is related to the propensity of this tumor to invade the vena cava, thus easily reaching the cardiac cavities [8]. Mechanical

factors during blunt mobilization and rotation of the hepatic tumor also appear to be responsible for tumor spread into the venous system [6, 9]. HCC infrequently metastasizes to the right atrium via the IVC [10]. In spite of its propensity for vascular and right atrium invasion, isolated tumor spread to the right atrium with myocardial invasion is very unusual in HCC [6, 11]. Only 2 reports have described 3 cases of isolated involvement of the right atrium and myocardium with intracavitary extension; in all 3 cases, the cardiac involvement was seen after liver lobectomy [12, 13]. Metastases may reach the heart via lymphatic or hematogenous routes, or by direct or transvenous extension. Lymphatic spread tends to give rise to pericardial metastases; hematogenous spread preferentially gives rise to myocardial metastasis [5]. Endocardial tumor deposits are only rarely observed [14].

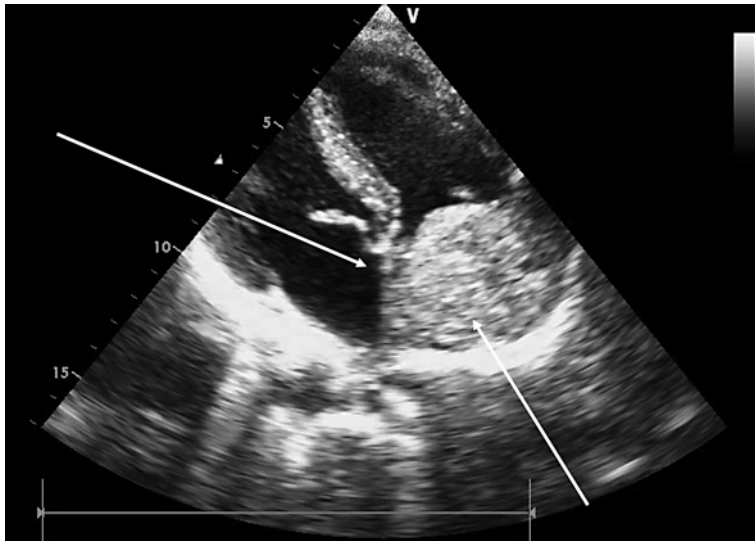
Symptoms of cardiac metastasis have been shown to be varied, with asymptomatic presentation in 19 cases (39.5%), bilateral lower leg edema in 18 cases (37.5%), and exertional dyspnea in 15 cases (31.3%) in one study [15]. The median and mean survival times from the time of diagnosis of cardiac metastasis were found to be 102 days and 161 days, respectively [15]. However, compared with a cohort of age-, gender- and stage-matched HCC patients without cardiac metastasis, the median survival time in the cardiac metastasis group was found to be similar (68 days) ( $p = 0.67$ ) [15]. The cause of death was HCC in 29, hepatic failure in 7, and multiple organ failure in 4, gastrointestinal bleeding in 3, sepsis in 2, pulmonary embolism in 1, respiratory failure in 1, and acute myocardial infarction in 1 case. HCC patients with cardiac metastases generally are in the advanced stages of HCC, and these patients therefore already have a poor prognosis from the time of diagnosis of cardiac metastases. The most common cause of death in the above study was related to HCC per se or the underlying liver disease. Only a few patients died because of cardiac metastases directly. Cases of HCC metastasis to the right ventricle are exceedingly rare and such patients generally have a dismal prognosis [15, 16]. There is only 1 previous report in the literature describing the use of cardiac surgery to remove a HCC that had metastasized to the right ventricle [17]. Even with curative resection, the prognosis of patients with cardiac metastases is poor, with a 5-year survival rate of 12–39% [5, 7, 18]. A number of studies have suggested that the incidence rates of HCC are increasing, with a shift toward a younger age group, and it seems likely that hepatitis C virus infection is partly responsible for the observed increase [19, 20]. Reports have shown that <20% of patients with liver cirrhosis who develop HCC receive regular surveillance and that gastroenterologists/hepatologists or physicians in academic institutions are more likely to perform surveillance [20].

## Conclusions

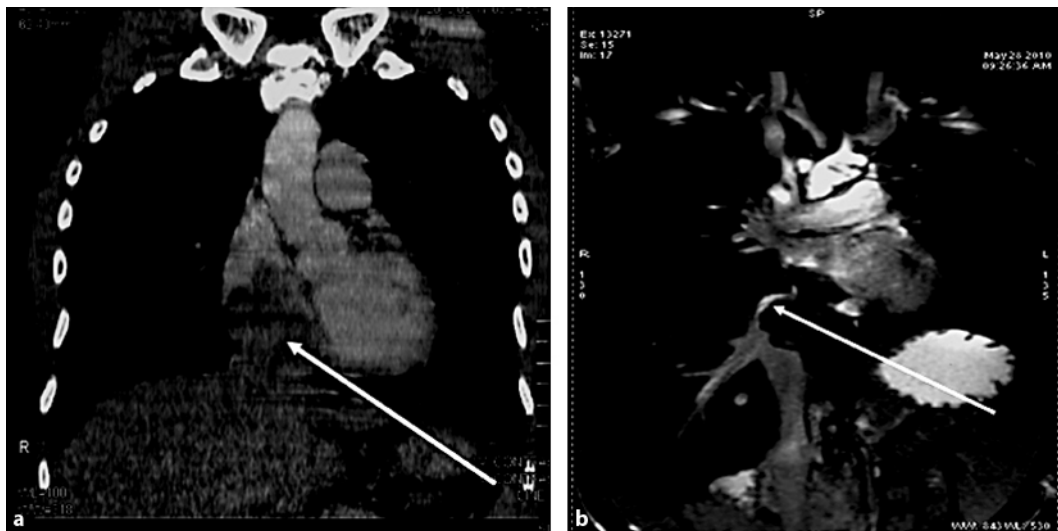
Secondary heart tumors are usually clinically silent. In view of the camouflaging features of HCC, it is preferable to perform serum alpha-fetoprotein analysis and abdominal ultrasound at least every 6 months in patients with concurrent liver cirrhosis or hepatitis B or C infection. Echocardiographic examination of the heart should be performed in these patients as soon as symptoms of heart failure, angina pectoris, and embolism or rhythm disturbances develop, or a new heart murmur becomes audible. Adequate surveillance for early detection of the disease is mandatory considering the dismal prognosis and ineffective treatments now available for such patients. Appropriate surveillance methods should be implemented at the general practitioner level.

### Disclosure Statement

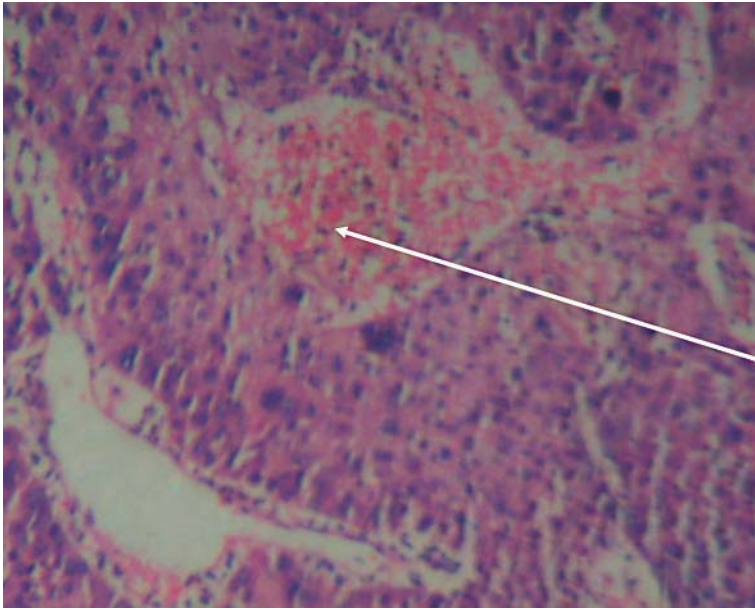
The authors declare no competing interests.



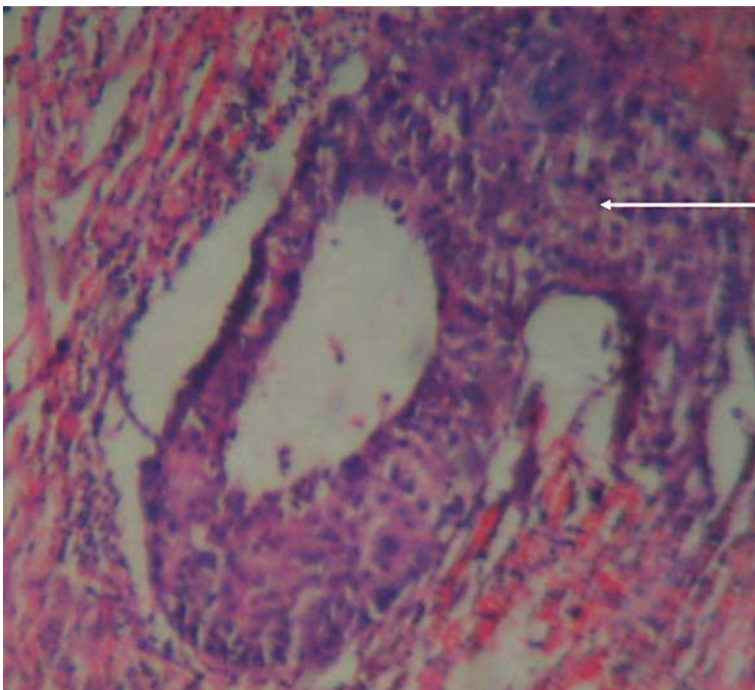
**Fig. 1.** Echocardiogram showing a 6 × 5 cm mass in the right atrium with no attachment to the interatrial septum or tricuspid valve, suggestive of a cardiac tumor (arrows).



**Fig. 2.** **a** Magnetic resonance imaging showing a right atrial mass. **b** Magnetic resonance imaging showing a mass filling the left vein and IVC extending into the atrium.



**Fig. 3.** Histology section from the right atrium showing a neoplasm with a trabecular and perivascular pattern, with few hepatocytes. Individual cells have a moderate amount of eosinophilic cytoplasm, vesicular nuclei and prominent nucleoli. Neoplastic cells in right atrium show a perivascular pattern (arrow).



**Fig. 4.** Section showing vascular emboli, confirming right atrial and pulmonary metastasis from a HCC. Malignant cells are seen in the right atrium (arrow).



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