

# Asymptomatic Metastasis of Hepatocellular Carcinoma into the Right Ventricular Cavity Presenting with Electrocardiographic Changes

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We report a 45-year-old woman with metastasis of hepatocellular carcinoma into the right ventricular cavity. She was asymptomatic when the metastasis was found and the clinical clue was an ECG with low voltage in limb leads and diffuse T-wave inversion. Echocardiography and magnetic resonance imaging were performed for the abnormal ECG finding and a right ventricular tumor was identified. Although she was asymptomatic initially, she had progressive dyspnea three months later and received tumor resection and total cavo-pulmonary connection under cardiopulmonary bypass to relieve right outflow tract obstruction. The pathological examination of the resected tumor revealed metastatic hepatocellular carcinoma. Oral thalidomide was given. Four months later, she died from multiple organ failure.

**Key Words:** Hepatocellular carcinoma • Metastasis • Right ventricle • ECG

## INTRODUCTION

Hepatocellular carcinoma (HCC) with intracavitary metastasis to the heart is not uncommon. The incidence of HCC with right atrial metastasis is less than 6% at autopsy.<sup>1</sup> Reports in antemortem diagnosis of HCC with right ventricular metastasis without inferior vena cava and right atrial metastasis are rarer. The diagnosis of metastasis of HCC into cardiac cavity might be overlooked because the symptoms are neither apparent nor specific.<sup>1</sup> When a patient with HCC complains of dyspnea, chest tightness, lower leg edema, unexplained arrhythmia or

signs of embolism, intra-cardiac metastasis should be suspected. We report a patient with metastasis of HCC into the right ventricle (RV) cavity. She did not have cardiac symptoms initially and presented with low voltage in limb leads and diffuse T-wave inversion on electrocardiogram (ECG).

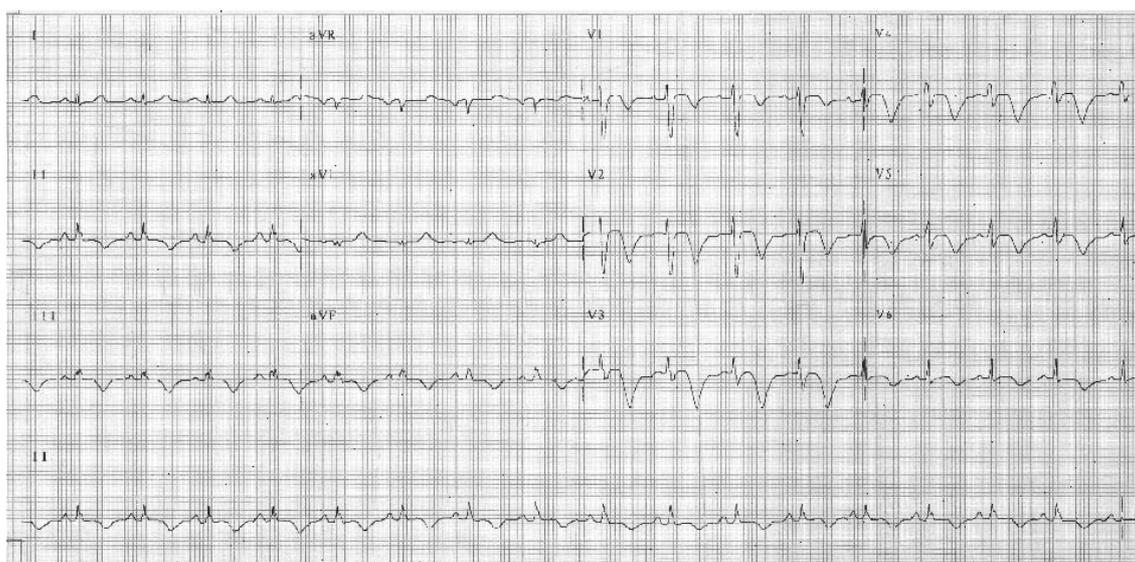
## CASE REPORT

A 45-year-old woman who was a carrier of hepatitis B had a diagnosis of HCC. She received a right hepatic lobectomy and transarterial chemoembolization (TAE) half a year after the operation. She had outpatient follow-up thereafter and had an uneventful life. However, elevated alpha-fetoprotein level (544.18 ng/mL) was noted half a year after the TAE and triphasic computed tomography (CT) scan of the abdomen revealed a 1.3-cm hepatic tumor. She was admitted for another session of TAE. The ECG on admission revealed low voltage in limb leads and diffuse T-wave inversion in II, III, aVF and precordial leads (Figure 1). She denied exertional dyspnea, chest tightness or syncope. No jugular vein engorgement

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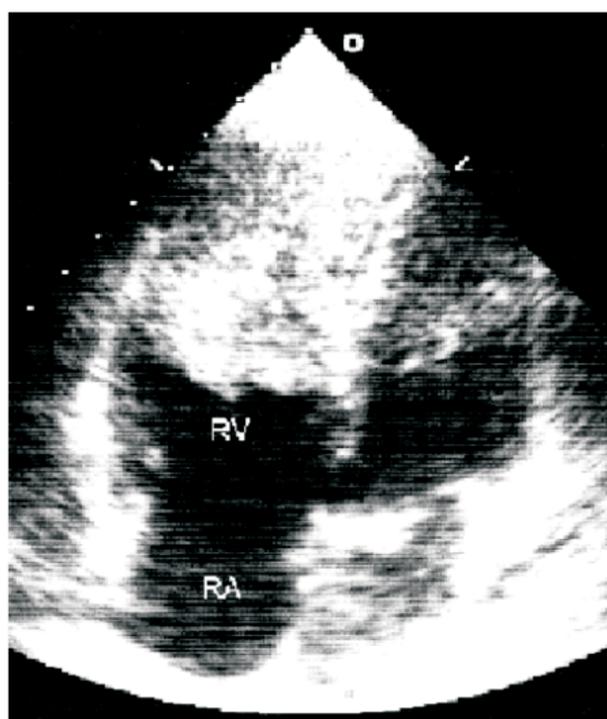
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**Figure 1.** Twelve-lead ECG in a 45-year-old woman with hepatocellular carcinoma. The ECG revealed low voltage in limb leads and diffuse T-wave inversion in II, III, aVF and precordial leads.

and no lower leg edema were noted. The echocardiography revealed a large right ventricular intra-cavity tumor extending into the outflow tract and a small amount of pericardial effusion (Figure 2). Magnetic resonance imaging (MRI) revealed a 70 mm\*40 mm right ventricular tumor closely attached to the interventricular septum, RV lateral and anterior wall and RV apex. The narrowest diameter of RV outflow tract (RVOT) was 6 mm, and no mass lesion was noted in the right atrium (RA), inferior vena cava (IVC) and pulmonary trunk. CT scan of the head did not show metastatic brain tumor or intracranial lesions. Metastasis of HCC into the right ventricular cavity with RVOT obstruction was suspected. The patient refused operation and was discharged from our hospital. Unfortunately, she had progressive exertional dyspnea three months later and open heart operation was performed to relieve the RVOT obstruction although echocardiography performed 2 days before the operation revealed only a small increase of tumor size. A soft, fragile right ventricular tumor invading to the pulmonary artery trunk was noted during operation. Debulking of the tumor, closure of pulmonary and tricuspid valves, total cavopulmonary connection and repair of RV with pericardial and Teflon patches were done under cardiopulmonary bypass. Pathological examination revealed trabecular-arranged tumor cells with frequent tumor thrombi in venous space which encroached on the endothelial surface. The features were diagnosed as metastatic HCC. Extuba-



**Figure 2.** Transthoracic 2-dimensional echocardiography showing a right ventricular intra-cavity tumor in four-chamber view.

tion was done 2 days after operation and oral thalidomide was given. Four months later, hepatic failure was noted and MRI revealed suspected thrombus in the IVC. Supportive care was given and she died from multiple organ failure.

## DISCUSSION

Metastasis of HCC into the cardiac cavity is mostly caused by direct invasion of the IVC and extension into the RA. RV metastasis without IVC and RA metastasis is rarely reported and may be caused by hematogenous spread of cancer cells. To the best of our knowledge, antemortem diagnosis of HCC with right ventricular metastasis without involvement of IVC and RA was reported in only 6 cases in the English literature.<sup>1-6</sup> These patients presented with dyspnea, chest tightness and leg edema. Transthoracic echocardiography and the MRI were the mainstays of diagnosis in the cases to identify the extent of involvement, RVOT obstruction and pericardial effusion.

In this patient, no obvious symptoms or signs of right heart failure were noted initially. Echocardiography was arranged because the ECG revealed low voltage in limb leads and diffuse T-wave inversion. Cates et al. reported the ECG findings in 47 cancer patients with cardiac metastasis.<sup>7</sup> The main ECG changes included diffuse or segmental T-wave inversion, ST elevation, nonspecific ST-T wave changes, low lead voltage and atrial arrhythmia. However, patients with HCC were not included in their series. The main ECG findings mentioned in three previous case reports of metastatic intra-cardiac HCC were low lead voltage with T wave inversions in V<sub>1</sub> to V<sub>6</sub>,<sup>1</sup> diffuse ST elevations<sup>2</sup> and T wave inversion in V<sub>1</sub> to V<sub>3</sub>.<sup>3</sup> The precise cause of ECG changes was unknown. They may be caused by neoplastic invasion of the pericardium resulting in a subacute pericarditis or myocardial injury by direct physiological interaction or pressure overload due to obstruction.<sup>7</sup> We should raise the suspicion of cardiac metastasis if a patient with HCC has symptoms of heart failure, embolism, unexplained arrhythmia or new ECG changes.

There is no standard treatment for metastasis of HCC into the right ventricular cavity. The patients in previous 3 case reports<sup>1,4,6</sup> and ours received operation to relieve

RVOT obstruction. Miyazawa et al. reviewed 8 cases of metastasis of HCC to the RA treated with simultaneous resection of main hepatic and RA tumor under cardiopulmonary bypass.<sup>8</sup> The postoperative survival ranged from 18 days to 56 months with a mean of 20 months. Chang et al. reviewed 184 cases of HCC with invasion into the IVC or RA treated with oral thalidomide at 200 to 400 mg/day. The response rate was 5 to 10% while 30 to 45% of the patients had stable clinical status.<sup>9</sup> They suggested that thalidomide may sometimes provide palliation for patient of HCC with symptomatic IVC or RA metastasis and who are not candidate for operation.

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## 以心電圖異常為表現的無症狀的右心室內轉移肝細胞癌

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我們報告一位 45 歲女性，她有肝細胞癌合併右心室內轉移。當肝細胞癌轉移到右心室被發現時，她並沒有明顯症狀，而其臨床的表現是心電圖中四肢導的低電位及廣泛性的 T 波倒置。因為心電圖中的異常，我們安排了經胸前心臟超音波及核磁共振的檢查，因而在右心室中發現了一個 7 公分 × 4 公分大的腫瘤。病患雖然一開始沒有症狀，但在 3 個月後，她開始感到呼吸困難。她接受了開心手術以去除腫瘤所造成的右心室流出通道阻塞。病理報告顯示，右心室的腫瘤為轉移性的肝細胞癌。病人在術後接受口服 thalidomide 治療，但在手術 4 個月後，她因多重器官衰竭而死亡。

**關鍵詞：**肝細胞癌、轉移、右心室、心電圖。