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Case Report

Radiology Section

Multifocal Hepatocellular Carcinoma Extending into the Right Atrium: A Report of Two Cases

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ABSTRACT

Hepatocellular Carcinoma (HCC) is one of the most aggressive malignant tumours, frequently inducing macrovascular invasion. Tumoural Thrombus (TT) production in mature HCC stages is prevalent and typically affects the hepatic or portal veins. Hereby, the authors present a case report of two cases, firstly, 68-year-old male who presented to the Emergency Department with bilateral pedal oedema and a lack of appetite; secondly, 62-year-old female who reported with weakness and giddiness for two months, abdominal distention for one month, black-coloured stools for one month, and a two-month history of weight loss. Abdominal Computed Tomography (CT) scans for both patients revealed multiple ill-defined solid lesions with necrotic foci in the liver in the former case, and multiple heterogeneously enhancing lesions with a few calcific foci and haemorrhages in the liver in the latter patient, consistent with HCC and tumoural thrombus extending from the hepatic vein into the Right Atrium (RA) via the Inferior Vena Cava (IVC). HCC with TT spreading into the RA is a serious and challenging condition with a poor prognosis. Early detection and aggressive treatment are critical, but they are typically insufficient to prevent rapid disease progression and high mortality.

Keywords: Alpha-fetoprotein, Inferior vena cava, Necrotic foci, Tumoural thrombosis

CASE REPORT

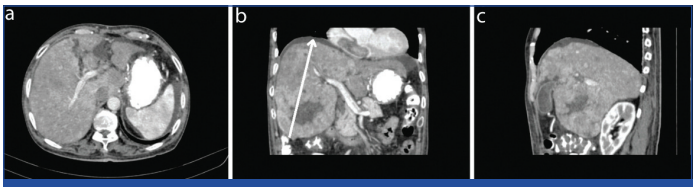
Case 1

A 68-year-old male presented to the emergency department with chief complaints of bilateral lower limb swelling, which had been gradually progressive, non tender, and accompanied by a loss of appetite for one month. He denied experiencing chest pain, fever, respiratory discomfort, or weight loss. On general examination, his pulse rate was 80 beats per minute, blood pressure was 130/80 mmHg, respiratory rate was 22 breaths per minute, and he was afebrile. The abdomen was soft and tender on physical examination, and there was no abdominal distension. The patient underwent a laboratory work-up after being admitted to the Gastroenterology ward.

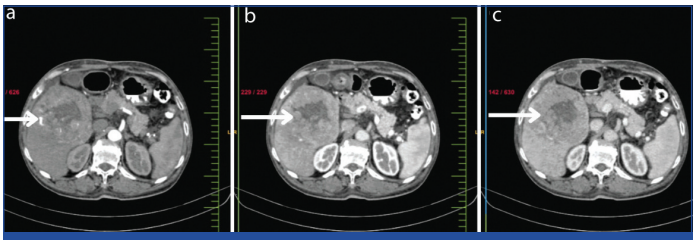
Laboratory investigations revealed a raised leucocyte count and reduced platelet levels. The alpha-fetoprotein level was elevated at 500 ng/mL. Liver Function Tests (LFT) indicated a raised Serum Glutamic Oxaloacetic Transaminase Test (SGOT) level (78 U/L) and total bilirubin count (1.3 mg/dL). The virology report indicated that the patient was positive for Hepatitis B Surface Antigen (HBsAg). (Normal ranges: SGOT Level: 8-45 U/L, Alpha-fetoprotein (AFP): 0-40 ng/mL, Total Bilirubin: <1.2 mg/dL).

The patient underwent a Contrast-enhanced Computed Tomography (CECT) abdomen, which revealed a nodular surface of the liver, along with caudate lobe hypertrophy and hepatomegaly [Table/Fig-1a-c]. Multiple ill-defined solid lesions with necrotic foci were noted in the right and left lobes of the liver, reaching up to the renal capsule, with prominent vasculature from the hepatic artery and the right inferior phrenic artery [Table/Fig-2a-c]. One of the lesions in segment VIII of the liver showed extension into the hepatic and suprahepatic IVC [Table/Fig-3], with further extension into the atrium [Table/Fig-4a-c]. There was non visualisation of the left and middle hepatic veins, as shown in [Table/Fig-5]. Additionally, there was evidence of splenomegaly and ascites. The radiological findings were consistent with multifocal HCC and the extension of tumour thrombus into the right atrium.

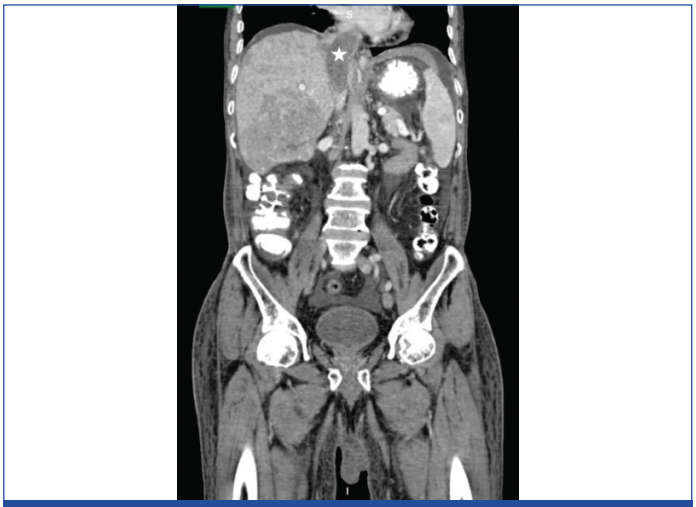
The patient later underwent an endoscopy that revealed small oesophageal varices and portal hypertensive gastropathy. The



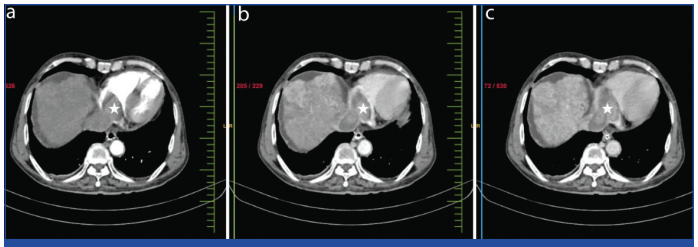
[Table/Fig-1]: Nodular liver surface is seen with caudate lobe hypertrophy and hepatomegaly s/o liver parenchymal disease.



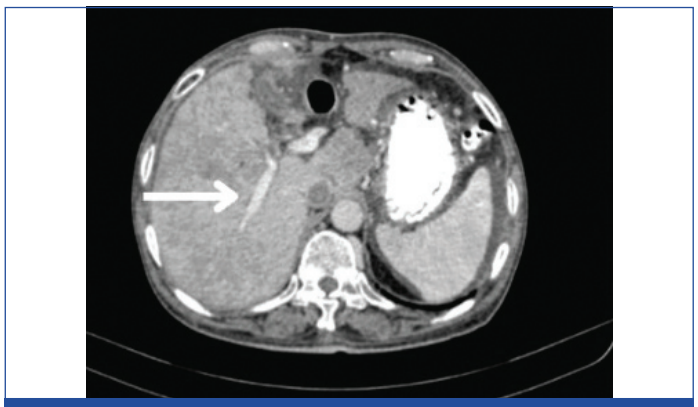
[Table/Fig-2]: CECT abdomen shows ill-defined solid lesion with necrotic foci consistent with Hepatocellular Carcinoma (HCC) (white arrow). a) arterial phase; b) portal phase; c) venous phase.



[Table/Fig-3]: CECT abdomen coronal section shows tumoural thrombus extending through suprahepatic IVC into the Right Atrium (RA) (indicated by the asterisk).



[Table/Fig-4]: CECT abdomen shows tumoural thrombus extension into the Right Atrium (RA) through a portal vein as shown by an asterisk. a) Arterial phase; b) Portal phase; c) Venous phase.



[Table/Fig-5]: Axial section of CECT abdomen shows non visualisation of middle and left hepatic veins suggesting thrombosis (arrow indicates right hepatic vein).

patient attended a consultation with the medical oncology team, who advised chemotherapy; however, the patient was resistant to undergoing treatment and was discharged at their request.

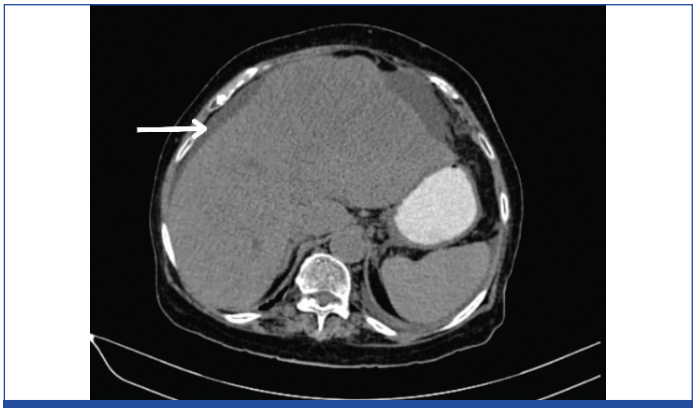
Case 2

A 62-year-old female presented to the emergency room with chief complaints of weakness and giddiness for two months, abdominal distention for one month, black-coloured stools for one month, and a two-month history of weight loss. There was no history of fever, melena, loose stools, or rectal bleeding. On general examination, the pulse rate was 78 beats per minute, blood pressure was 140/80 mm Hg, respiration rate was 24 breaths per minute, and the patient was afebrile. The patient had been diabetic and hypertensive for four years and was using unknown medications. The patient stopped using the unknown hypertensive drug one month ago.

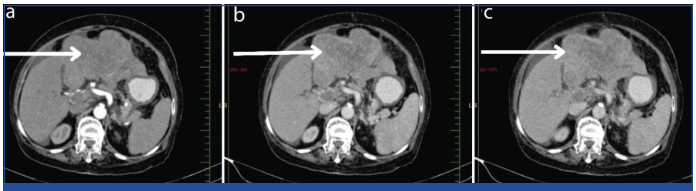
Laboratory tests revealed that the patient was anaemic {Haemoglobin (Hb)-8 g/dL} and had a modestly elevated leucocyte count (12,500/uL). LFT indicated elevated SGOT levels (63 U/L) and total bilirubin levels (1.8 mg/dL). The alpha-fetoprotein level was elevated (>500 ng/mL). The virology profile was negative for Humanimmuno Deficiency Virus (HIV), Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV).

The patient underwent a CECT of the abdomen, which revealed an enlarged liver measuring 18 cm, suggestive of hepatomegaly, and evidence of moderate free fluid in the abdomen, suggestive of ascites [Table/Fig-6]. Multiple heterogeneously enhancing lesions with a few calcific foci and areas of haemorrhage are seen in the left lobe, specifically in segments VII, VIII, IVA, and the caudate lobe, with the largest lesion measuring 10×6.6×10 cm in the left lobe [Table/Fig-7a-c]. There is an extension of the lesion in the left lobe into the hepatic and suprahepatic IVC, reaching up to the RA, suggestive of tumoural thrombus [Table/Fig-8a-c,9]. One of the lesions at the porta hepatis involves the portal vein, causing near complete tumoural thrombosis. The radiological findings are consistent with multifocal HCC with extension of tumoural thrombus into the RA and near complete tumoural thrombus of the portal vein.

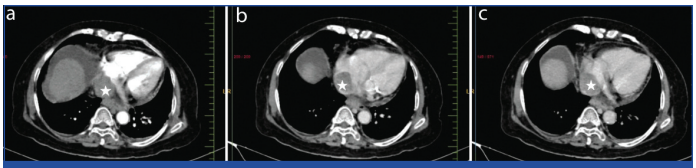
The patient underwent endoscopy, which revealed small oesophageal varices and gastric ulcers (Forest Classification Grade IIB) [1], as well as a hiatus hernia (Hills Grade III) [2]. The patient was admitted to the gastrointestinal ward, haemodynamically stabilised,



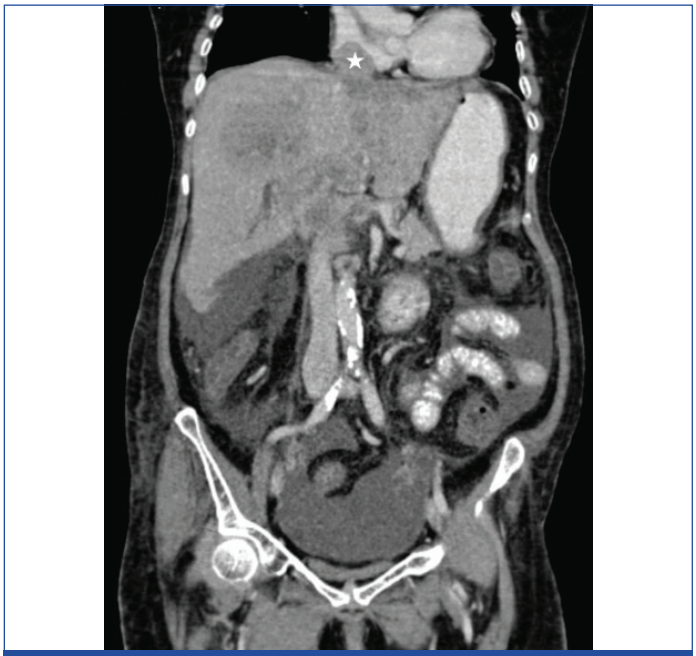
[Table/Fig-6]: NCCT abdomen shows the enlarged size of the liver suggestive of hepatomegaly. There is also evidence of free fluid suggestive of ascites (arrow).



[Table/Fig-7a-c]: CECT abdomen shows ill defined solid lesion with necrotic foci consistent with Hepatocellular Carcinoma (HCC) (white arrows). a) Arterial phase; b) Portal phase; c) Venous phase.



[Table/Fig-8a-c]: CECT abdomen shows tumoural thrombus extension into the Right Atrium (RA) through a portal vein as shown by an asterisk. a) Arterial phase; b) Portal phase; c) Venous phase.



[Table/Fig-9]: CECT abdomen coronal section showing tumoural thrombus extending through suprahepatic IVC into the Right Atrium (RA) [Indicated by the asterisk).

and discharged when further management was anticipated, opting for Discharge Against Medical Advice (DAMA).

DISCUSSION

The HCC is a frequent and aggressive malignancy, ranking sixth globally and third in terms of cancer-related mortality. Chronic infections with hepatitis B and C viruses, long-term alcohol consumption, cirrhosis, non-alcoholic fatty liver disease, and aflatoxin exposure are among the leading causes [3]. HCC develops silently and is frequently identified in advanced stages, complicating

therapy. Early identification is critical to improving prognosis and survival rates. It is the second most lethal tumour after pancreatic cancer, with a 5-year survival rate of 18% [3].

The HCC, a major cause of death in cirrhotic livers [4], often infiltrates vascular structures, particularly the portal vein and its branches. Intravascular TT can extend to the IVC or RA, with a worse prognosis. IVC or RA TT is very rare in HCC patients, with an incidence of 3% to 4% [5,6].

The HCC diagnosis is challenging and often requires imaging methods. Tumours should be less than 2 cm for optimal therapy. Haemostasis in advanced HCC frequently causes vascular invasion and tumour thrombosis. Vascular invasion is more likely in individuals with high serum AFP levels and larger tumour sizes [7]. IVC thrombosis is typically asymptomatic; however, it can result in upper gastrointestinal bleeding, abdominal pain, and ascites [8]. Intra-atrial development can lead to pulmonary thrombosis and metastasis. Advanced HCC with invasion of the IVC and RA is uncommon but has a poor prognosis and limited treatment options [9]. Vascular invasion is more prevalent in patients with serum AFP levels greater than 1000 µg/L and tumour diameters exceeding 5 cm, accounting for 82% of cases [10].

Common clinical signs of HCC with IVC/RA TT include stomach discomfort, fever, lower extremity oedema, and palpable lumps. Budd-Chiari Syndrome, abrupt right heart failure, and pulmonary embolism are additional possible diagnosis. IVC/RA TT can be detected through Doppler ultrasound, CT scan, or MRI. All individuals with TT from the retrohepatic IVC and RA can be treated surgically if the main tumour can be removed. Patients with decompensated liver cirrhosis, advanced tumour stages, or distant metastases are not surgical candidates and, therefore, are not eligible for the benefits of surgical intervention [11].

More than one-third of individuals with liver cancer have multifocal tumour nodules separated by non neoplastic parenchyma. This may be related to the concurrent development of numerous separate liver tumours or intrahepatic metastases from a single tumour. Tumours in the former category may vary in histologic grade and characteristics, while all tumours in the latter are advanced lesions. Patients with multifocal HCC due to intrahepatic metastases have a poor prognosis [12,13].

The HCC is unique in that it is often diagnosed based solely on imaging features without histologic confirmation. The disease spectrum includes multiple nodules, small nodules, and "nodules within nodules," making routine biopsy of cirrhotic nodules impossible. Additionally, a biopsy of HCC poses a risk of seeding cancer cells along the needle tract [14,15].

There is currently no accurate tumour marker for hepatocellular cancer. Serum AFP levels are measured as a diagnostic and screening tool. A spike in AFP serum levels in a cirrhotic patient should highlight the possibility of hepatocellular cancer. However, an increased AFP level is not always associated with HCC; for example, AFP levels may be raised during viral hepatitis flares. Furthermore, when a threshold value of 20 mg/L is applied, the detection of serum AFP levels has a sensitivity of 60% [16,17].

A multiphasic contrast material-enhanced CT or Magnetic Resonance (MR) scan can be used to identify hepatocellular cancer. The condition is distinguished by an increase in contrast medium in the liver parenchyma during the arterial phase, resulting from blood flow from aberrant hepatic arteries that have not yet opacified. During the portal venous phase, the surrounding liver parenchyma becomes comparatively hyperattenuated, whereas the lesion is seen as hypoattenuated due to a lack of portal venous supply. This phenomenon is known as the "washout effect." Occasionally, washout is only visible during a delayed phase sequence. Thus, a four-phase imaging investigation is necessary: non-contrast enhanced phase, arterial phase, portal venous phase, and delayed phase. If the lesion exhibits the diagnostic signs of HCC-namely, arterial phase hyperenhancement and portal venous or delayed phase washout-with a single modality, the diagnosis can be determined, and no additional study is necessary. If, both of these traits are not present and the imaging findings are not compatible with a benign process (for example, haemangioma), a second imaging scan should be performed with an alternate modality [18].

Classic HCC exhibits arterial phase amplification followed by washout in the portal and/or delayed phase, with a pseudocapsule surrounding the nodule. Other common imaging findings include an internal mosaic pattern, the presence of fat, vascular invasion, and interval growth of 50% or greater on serial images taken fewer than six months apart [19]. On unenhanced images, the appearance of HCC varies according to the surrounding liver parenchyma and the aetiology of chronic liver disease. HCCs often appear hypodense or isodense to the liver on unenhanced imaging; however, they might appear hyperdense when developing in a fatty liver background.

Portal Vein Tumour Thrombosis (PVTT) is a well known complication of HCC that alters standard imaging findings. Recognising these altered appearances is critical for accurate diagnosis and treatment. When HCC infiltrates a portal vein or its branches, it continues to collect blood from the hepatic artery and may discharge directly into the portal vein. This direct drainage causes arterioportal shunting and portal vein haemodynamic abnormalities. Large HCCs with PVTT exhibit less of the characteristic arterial phase hypervascularity and subsequent washout diagnostic of HCC. Instead, the PVTT can reveal arterial phase augmentation followed by washout with vein distension [20]. The portal vein may exhibit a vessel cast, indicating PVTT neovascularity. The arterioportal shunting may also result in poor enhancement of the surrounding liver parenchyma.

Tumour invasions into the IVC and RA are unusual consequences of HCC. Tumour load may result in heart failure, pulmonary embolism, or sudden cardiac death. The median survival rate for localised illness ranges from nine to 33 months after surgical excision. Previously, metastatic disease of the IVC and RA was treated palliatively, with an average survival rate of 2 to 3 months. With advances in technology and surgical techniques, aggressive treatment of metastatic HCC to the IVC and RA-including systemic chemotherapy, transarterial chemoembolisation, intra-arterial chemotherapy, radiation, or surgery-can improve overall survival time anywhere from 4.5 to 30.8 months, depending on the treatment modality [21].

CONCLUSION(S)

The HCC is a common and aggressive malignant tumour that causes advanced-stage tumoural thrombus in the portal veins and, less frequently, in the hepatic vein, with extension of the tumoural thrombus into the RA. In our discussion, we examined two cases: one in which HCC occurred in a male with an underlying hepatitis infection, and another in which HCC developed in a non cirrhotic female with no underlying HIV, Hepatitis B, or Hepatitis C infection. CECT findings were associated with elevated AFP levels. These two instances illustrate the spread of tumoural thrombus into the RA with underlying HCC in two different case situations. Non invasive imaging is critical for detecting HCC and staging primary liver tumours. These cases show the necessity of screening patients for HCC and tumoural thrombus, both with and without underlying risk factors, which will aid in early identification and improve patient outcomes.

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