Enucleation Sign: A Computed Tomographic Appearance of Ruptured Hepatocellular Carcinoma

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Rupture of hepatocellular carcinoma (HCC) is a catastrophic complication, which carries high mortality. We report a case of spontaneous rupture of HCC, diagnosis of which was considered on clinical presentation and confirmed on computed tomographic (CT) scan. On CT scan, characteristic ‘enucleation sign’ was observed on arterial phase imaging, where a hypervascular peripheral mass showing central necrosis was seen protruding from liver surface with discontinuity of hepatic parenchyma associated with high attenuation ascites. (J CLIN EXP HEPATOL 2016;6:335–336)

The ‘enucleation sign’ is a finding that may be seen on contrast-enhanced computed tomographic (CT) images of the ruptured hepatocellular carcinoma (HCC). This sign is defined as separation of tumor content with intraperitoneal rupture into the perihepatic space, which is seen as low attenuating lesion from peripheral enhancing rim on arterial phase imaging.¹

EXPLANATION

The mechanism of rupture of HCC is poorly understood. Several hypotheses have been postulated and these include rapid tumor growth, venous hypertension, trauma or compression by the respiratory movements of diaphragm, coagulopathy, and thrombocytopenia.^{2–4} Rapid growth leads to tumor out-growing the vascular supply resulting in tumor necrosis with subsequent intratumoral bleeding. As HCC draws its blood supply primarily from the hepatic artery, the high intratumor pressure can lead to dissection of the tissue plane. Breach of the hepatic capsule will lead to intraperitoneal bleeding. This is currently the most accepted hypothesis. Another hypothesis postulates that due to vasculo-invasive behavior of HCC, there may be progressive or sudden occlusion of branches of hepatic veins leading to an increase in intratumoral pressure causing venous congestion within the tumor that in turn may lead to bleeding and rupture. The underlying coagulopathy

and thrombocytopenia in cirrhotic liver further increase the risk of rupture. Other factors include large tumor size, peripheral location, and the extent of extrahepatic protrusion.^{2,5} The exophytic tumor projecting beyond the original liver contour is more likely to rupture than one surrounded by normal parenchyma. The protruded tumor without surrounding normal parenchyma may easily rupture due to compression or friction to the adjacent diaphragmatic muscle, abdominal wall, and gastrointestinal tracts.⁶ Recent studies suggest that underlying vascular dysfunction may have a role.⁷ The vessels in the ruptured HCC tend to be more friable due to increased collagenase expression and increased collagen degradation.⁸ This proposed mechanism explains why some of the small tumors also rupture.

The CT findings of ruptured HCC may include hemoperitoneum, HCC with surrounding perihepatic hematoma, active extravasation of contrast material, tumor protruding from the hepatic surface with focal discontinuity due to rupture of tumor through the capsule, or the ‘enucleation sign’. The “enucleation sign” is seen as non-enhancing low attenuating lesion with peripheral rim enhancement (due to separation of tumor contents from peripheral enhancing rim) and focal discontinuity of the hepatic surface during the arterial phase (Figure 1). Low attenuating lesion is due to extensive loss of blood from the tumor, loss of homeostatic function within the HCC due to hypovolemic shock leading to compensatory arterial vasoconstriction, and ischemic changes in the tumor. Peripheral rim enhancement is due to compressed normal parenchyma and does not represent true lesion.⁵

DISCUSSION

HCC is prone to spontaneous intraperitoneal rupture and can present with potential life-threatening condition. This may occur in 3–26% of all patients with HCC, with mortality rates as high as 32–66.7%.^{9,10} A spontaneously ruptured HCC carries an extremely poor prognosis with high

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Abbreviations: CT: computed tomography; HCC: hepatocellular carcinoma
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Figure 1 Contrast-enhanced CT axial images in arterial phase show a peripheral mass, showing central necrosis (asterisk), protruding hypervascular mass from liver surface (thick arrow), and discontinuity of hepatic surface (thin arrows). Note high attenuation ascites consistent with hemoperitonium.

mortality due to hypovolemic shock and renal failure; moreover, this is usually fatal in patients with underlying liver cirrhosis due to severe coagulation defects. Owing to high mortality, prompt and accurate diagnosis is desirable, which is possible by CT scanning.

Diagnosis of tumor rupture is based on presenting symptoms, imaging studies, and presence of blood-stained ascites. The clinical features are signs of peritoneal irritation: severe abdominal pain and vascular collapse. Though no large series are reported as to the percentage of ruptured HCC demonstrating “enucleation sign” on CT scan, nevertheless it is the imaging of choice and is very specific.^{5,10,12,13}

On CT scan, a ruptured HCC manifests as “enucleation sign,” which appears as a peripheral mass, showing central necrosis, protruding contour, and discontinuity on hepatic surface. These findings if associated with a surrounding hematoma and/or extravasation of contrast material as a sign of active bleeding are highly specific for ruptured HCC.^{5,11–13}

CONFLICTS OF INTEREST

The authors have none to declare.

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