‘IVC contrast level: a sign of cardiovascular dysfunction’

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Abstract

Contrast blood level in intrahepatic inferior vena cava (IVC) on arterial contrast-enhanced CT images is referred to as IVC layering or IVC contrast level sign. This sign is important to recognize as it has dismal prognosis and requires immediate attention. The causes described in literature include cardiogenic shock, cardiac arrest and cardiac tamponade. We hereby present three cases depicting IVC contrast level sign.

INTRODUCTION

Presence of a contrast blood level on arterial contrast-enhanced CT (CECT) images is referred to as IVC layering [1]. This sign is important to recognize as it indicates grave prognosis and requires immediate resuscitation. It occurs due to circulatory failure and has been seen in cardiogenic shock, cardiac arrest and cardiac tamponade [1–3].

CASE REPORT

Case 1

A 24-year-old male presented to emergency department in circulatory shock after suffering blunt trauma abdomen. Ultrasound revealed hemoperitoneum for which CECT was requested. Blood pressure of the patient was 70/40 mm Hg with tachycardia (100 bpm). There was presence of contrast fluid level in IVC on arterial CECT images (Fig. 1) with reflux of contrast into accessory right inferior hepatic vein and segments VI and VII of liver. The patient was subsequently managed with IV fluids and vasopressors. His condition improved and was discharged in stable condition after 6 days.

Case 2

A 16-year-old male presented with shortness of breath and was clinically suspected to have pulmonary thromboembolism. He was a known case of chronic constrictive pericarditis. CECT chest (Fig. 2) revealed pericardial calcification with dilated right atrium and ventricle. No evidence of any pulmonary thromboembolism was seen. IVC contrast level sign was seen with dilated IVC and reflux of contrast into hepatic veins suggestive of right ventricular (RV) dysfunction. An echocardiography was performed, which confirmed RV dysfunction. He was started on digoxin and diuretics. His condition improved and was discharged after 4 days in stable condition.

Case 3

A 10-year-old male presented to emergency department with history of polytrauma from a road side accident. The patient was...
Figure 1: A 24-year-old male with circulatory shock after blunt abdominal trauma. Axial CECT images show contrast fluid level in IVC (Fig. 1) with reflux of contrast into accessory right inferior hepatic vein and segments VI and VII of liver (star).

Figure 2: A 16-year-old male with chronic calcific pericarditis. Axial CECT images show horizontal IVC layering (black arrow) with reflux of contrast into hepatic veins. Chest sections display pericardial calcification (white arrow).

Figure 3: A 10-year-old male with polytrauma and impending cardiogenic arrest. Axial CECT images show horizontal IVC layering (black thin arrow) with reflux of contrast into hepatic veins (thick black arrow).

pulseless on presentation. Ultrasound revealed gross hemoperitoneum. After resuscitative measures a CECT abdomen (Fig. 3) was performed, which revealed IVC layering with reflux of contrast into the hepatic veins. Complete nonopacification of aorta was seen suggestive of impending cardiogenic shock. The patient died immediately after the scan.

Figure 4: Axial CECT in a patient shows vertical IVC layering due to contrast entering into IVC from renal veins (black arrows).

DISCUSSION
We have demonstrated different cases with IVC contrast level sign in patients with circulatory shock, RV dysfunction and impending cardiogenic shock. CT depicted the presence of blood contrast level in IVC in all cases with reflux of contrast into hepatic veins and liver parenchyma.

The physiological basis of IVC layering or pooling has been described previously. In normal physiological state specific gravity has no effect on contrast agent dynamics. However, in cases of cardiac failure there is decreased arterial and venous blood flow due to failure of forward flow of blood. Contrast agents are heavier than blood and hence accumulate in dependent parts of venous system leading to dependent venous pooling. It depends on density, specific gravity and injected volume of the contrast agent [4].

This condition has been described previously after cardiogenic shock, diastolic dysfunction, myocardial infarction and cardiac tamponade [5]. The managing physicians should be notified quickly to institute quick definitive therapy when these CT findings are present because they indicate cardiac failure [1].

Vertical IVC contrast level sign (Fig. 4) can mimic IVC layering. It usually occurs due to normal retrograde filling of renal veins and here the layering will be vertical as opposed to horizontal in IVC layering sign.

CONFLICT OF INTEREST
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ETHICAL APPROVAL
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CONSENT
Written consent obtained.
GUARANTOR

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