CASE REPORTS

Real-time three-dimensional echocardiographic assessment of inferior vena caval thrombosis

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Inferior vena cava thrombosis (IVCT) represents a subset of deep venous thrombosis. Because of the variety of its clinical presentations, the exact incidence is elusive. We present two cases of IVCT that was incidentally discovered during a routine two-dimensional echocardiography. Real-time three-dimensional echocardiography (RT3DE) assessment of IVCT added more valuable information that may help in its management. To the best of our knowledge, this is the first case report using RT3DE in the assessment of IVCT.

KEYWORDS
Inferior vena cava; Vena caval thrombosis; Real-time three-dimensional echocardiography

Introduction

Inferior vena cava thrombosis (IVCT) represents a subset of deep venous thrombosis with an elusive frequency because of variable clinical presentations. The patients may be asymptomatic or may present with bilateral leg oedema, Budd-Chiari syndrome, or pulmonary embolism. Many non-invasive radiological modalities have been applied to establish the diagnosis of IVCT including echocardiography, duplex, computed tomography (CT) scan and magnetic resonance imaging (MRI). No single modality is superior and suits all situations since each has its own limitations.

We, hereby describe the value of real-time three-dimensional echocardiography (RT3DE) in the evaluation of IVCT.

Case 1

A 27-year-old male patient with sickle cell disease presented with progressive dyspnoea (NYHA class II), and generalized bone-ache for 1 week. On examination he was pale with mild jaundice. His pulse was 123 bpm and blood pressure of 100/70 mmHg. The jugular venous pressure was mildly elevated and he had normal heart sounds. Chest examination revealed reduced air entry to both lower zones with scattered basal crepitations. Laboratory results showed typical haematological changes of sickle cell disease with a haemoglobin of 9.7 g/dL. Blood film showed poikilocytosis, anisocytosis, and target cells and reticulocytes of 6.7%. D-dimer was normal: 137 mg/L.

A 12-lead ECG showed sinus tachycardia. Chest X ray was normal. Two-dimensional echocardiography (2DE) demonstrated mildly dilated cardiac chambers with hyperdynamic ventricular systolic function of both left and right sides and no evidence of pulmonary hypertension. On subcostal view, the inferior vena cava (IVC) was shown to be filled with a thrombus attached to its wall that led to impaired flow as evidenced by turbulent colour Doppler flow. The maximum diameter of the thrombus was variable with respiration (21–30 mm) (Figure 1A and B). RT3DE was performed in the same setting. With the use of crop function, longitudinal cross-section of the IVC demonstrated a large thrombus (47 mm in length, 3.0 ml in volume) adherent to its wall with a reduction of the lumen by 46%. A small part of the thrombus was freely mobile. Enface view of the IVC was obtained, starting from its cardiac junction and along its course, showed reduction of its lumen by 52% (Figure 1C and D). RT3DE with colour flow confirmed the impaired flow in the IVC. The patient was commenced on anticoagulation with a target INR of 2.5. A follow-up echo 4 months later, complete resolution of the thrombus with restoration of normal IVC flow pattern.

Case 2

A 60-year-old hypertensive female patient known to have calcified and inactive hydatid liver disease, presented with fever, cough, progressive dyspnoea and orthopaenia for 1 week. On examination she was orthopaenic, her pulse was 123 bpm, and blood pressure of 120/80 mmHg. Cardiac examination showed normal heart sounds. Chest examination revealed reduced air entry to both lower zones with scattered coarse crepitations. Chest X-ray demonstrated...
homogenous infiltration of the left lower lobe. Routine labs showed leucocytosis (white cell count: 30 000 with eosinophil predominance: 18%). D-dimer was 485 \( \mu \)g/L.

A 12-lead ECG showed sinus tachycardia. The 2DE was requested to exclude the possibility of pulmonary embolism. It demonstrated normal dimensions of all cardiac chambers and normal left ventricular systolic function. Right ventricular size and systolic function were normal with normal pulmonary artery pressure. Subcostal view showed large fresh freely mobile IVCT attached to its wall and protruding into the right atrium. Colour Doppler showed impaired flow with reduced IVC luminal diameter by 40%. The maximum diameter of the thrombus was 30 mm. RT3DE with the longitudinal section of the IVC demonstrated a large freely mobile thrombus (32 mm in length, 2.5 mL in volume) attached to the IVC wall and protruding into the right atrial cavity. Enface view of the IVC showed reduction of its lumen by 57%, which was confirmed by RT3DE colour flow (Figure 2A and B). Anticoagulation was started after the 2DE findings of IVCT. Abdominal CT confirmed the presence of IVCT that appeared as a filling defect reducing its lumen by 50%. The maximum diameter of IVCT was 30 mm (Figures 2C, D and 3).

Discussion

Venous thromboembolism is a major cause of cardiovascular death.\(^2\) IVCT represents a subset of deep venous thrombosis that has a challenging incidence rate because of variable clinical presentations. Diagnosing IVCT is crucial because of its sequel and controversy concerning its management. No specific laboratory test can be considered diagnostic. D-dimer test has a high sensitivity and a high negative predictive value for pulmonary embolism in patients with a low to moderate clinical probability of the disease while its specificity decreased in patients with associated comorbidity and older age.\(^3\)

Imaging modalities including echocardiography, contrast venography, duplex scanning, CT angiography, and magnetic resonance imaging have been applied to achieve an accurate diagnosis. However, no single test can be considered a golden standard. Ultrasonography has high sensitivity and specificity for diagnosing venous thrombosis of the proximal lower extremity. However, for the high-risk asymptomatic group (such as postoperative patients), specificity is maintained, but sensitivity may be substantially diminished. CT angiography has a high negative predictive value. However, one or more additional diagnostic tests are concomitantly needed.\(^4\)

Echocardiography is the most non-invasive comprehensive diagnostic tool that has been used for evaluation of intracardiac masses or thrombi. However, little is known about its value in the assessment of IVCT. A single report described IVCT as an incidental finding during 2DE.\(^5\) Transoesophageal echocardiography was assumed to be the best technique for the detection of intracardiac thrombi. Its high diagnostic sensitivity is based on the proximity of the oesophagus to the heart allowing high-resolution and detailed visualization of the posterior cardiac structures. Besides, it has the ability to identify thromboemboli in extrapulmonary locations including both the IVC and superior vena cava. Rosenberger et al.\(^6\) reported the reliability and excellent value of intraoperative transoesophageal echocardiography during pulmonary embolectomy to discover the extrapulmonary
thromboemboli. Among 13 patients with extrapulmonary thromboemboli, IVCT was discovered in 6 patients.

In our patients, 2DE was requested to evaluate the left ventricular systolic function and to search for underlying cardiac abnormalities explaining the progressive dyspnoea. The size of the IVCT was identified with the 2DE without further details.

RT3DE has been applied for evaluation of intracardiac masses. In the current two cases, RT3DE was used to evaluate IVCT and compared its qualitative and quantitative data with the 2DE findings. Applying RT3DE in our patients added a substantial valuable information including the assessment of actual size, consistency, and mobility of the thrombus. In addition, the percentage of IVC lumen reduction along the thrombus length could be calculated. RT3DE was able to show thrombus attachment to the IVC wall and its extension either to the hepatic vein, in the first case, or to the right atrium in the second patient. We believe that RT3DE can play a role in the diagnosis of IVCT, guiding the physician for the selection of treatment strategy, and might be of help in the follow-up of these patients.

Figure 2  (A) Short-axis view of inferior vena cava (IVC) in the second case by real-time three-dimensional echocardiography (RT3DE) showed the large thrombus inside (arrows). (B) Longitudinal view of IVC by RT3DE showed the large thrombus attached to its wall and protruding to the right atrium. (C) Abdominal computed tomography showed the filling defect inside IVC and the calcified hydatid cyst (D).

Figure 3  Abdominal computed tomography in the second case showing the IVC thrombus in a longitudinal view as filling defect inside (arrows).

Supplementary data
Supplementary data are available at European Journal of Echocardiography online.

Conflict of interest: none declared.

References

