

Intramural inferior vena cava occlusion: The minaret sign

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Introduction

We describe an interesting imaging finding in a patient with inferior vena cava (IVC) occlusion or severe stenosis due to an intramural cause as the ‘Minaret sign’. This appearance in IVC occlusion or severe stenosis is due to caudal dilation of the IVC and the progressive merging of the IVC wall cranially at one point as observed in the IVC ultrasound (US) (Fig. 1a) and the IVC digital subtraction venogram (DSV) (Fig. 1b), resembling the appearance of a Minaret, that is, ‘the Minaret sign’.

Case

A 42-year-old male patient presented with abdominal pain, ascites, and pedal edema. The complete blood count, the liver function test, and renal function tests were normal. An US and Doppler of the abdomen revealed a short segment of occluded intrahepatic IVC at the level of hepatic venous confluence, caudal dilation of the IVC with convex outer margins, and progressive merging of the IVC wall till the point of occlusion. DSV confirmed the US and Doppler findings. No obvious cause of occlusion could be identified. Balloon angioplasty of the occlusion was performed. The patient improved significantly with complete resolution of abdominal pain, ascites, and pedal edema. Informed consent was obtained from the patient.

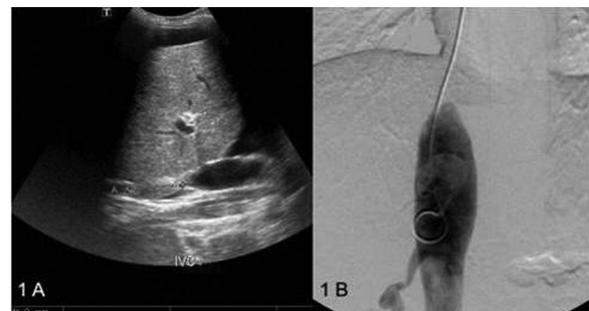
Discussion

IVC occlusion is not an uncommon condition and is often associated with debilitating symptoms that vary depending on collateral venous drainage [1]. The causes of IVC occlusion can be divided into extramural/extrinsic, intramural, and intraluminal. US, Doppler,

computed tomography venogram, magnetic resonance venogram, and DSV can be used in the imaging of IVC occlusion [2]. The imaging appearance of IVC occlusion can vary depending on the cause, such as narrowing/occlusion, caudal dilation, collaterals veins, membrane, etc.

Membranous obstruction of the intrahepatic IVC accounts for most cases of primary Budd–Chiari syndrome (BCS) in Asia. It is typically a disease of adulthood with an insidious onset and a chronic course that eventually leads to congestive cirrhosis [3]. In contrast, in most western nations, BCS results from hepatic venous thrombosis due to an underlying prothrombotic state, has an acute onset, and is often fatal. The cause of membranous obstruction of the

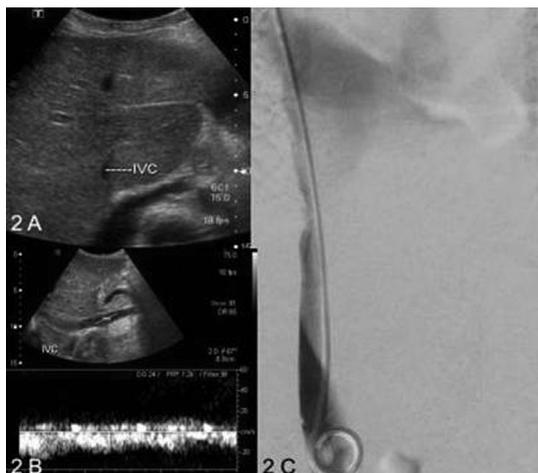
Figure 1



IVC occlusion causing caudal dilation of the IVC and progressive merging of the IVC wall cranially at one point as observed in the sagittal IVC ultrasound (a) and the IVC digital subtraction venogram (b), resembling the appearance of a Minaret. IVC, inferior vena cava.

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Figure 2



Caudate lobe hypertrophy causing side-to-side narrowing of the intrahepatic IVC. (a) The axial ultrasonography image showing the side-to-side slit-like narrowing of the hepatic IVC. (b) Sagittal Doppler with a spectral waveform showing continuous phasic flow in IVC. (c) A digital subtraction venogram showing a slit-like narrowing of the hepatic IVC with no caudal dilation. IVC, inferior vena cava.

intrahepatic IVC remains unclear in the majority of the cases; however, there is mounting evidence that it is a sequelae of IVC thrombosis [4]. England *et al.* [5] reported cases of benign external compression of the IVC associated with thrombus formation, where the extrinsic compression on the IVC had a 'slit-like' appearance. This report provides much enlightenment on uncommon causes of IVC compression and thrombus formation.

We emphasize that the 'Minaret sign' helps differentiate intramural causes from other extramural/extrinsic causes such as a hypertrophied caudate lobe (Fig. 2) in BCS,

where we expect to notice concave outer margins with a slit-like lumen as interventional options in BCS can vary depending on the cause [6].

Learning point

The 'Minaret sign' helps differentiate intramural causes from other extramural/extrinsic causes such as a hypertrophied caudate lobe in BCS, where we expect to notice concave outer margins with a slit-like lumen as interventional treatment options in BCS can vary depending on the cause.

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Conflicts of interest

There are no conflicts of interest.

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