Diagn Interv Radiol 2007; 13:152–155

Ultrasonographic diagnosis of iliac vein compression (May-Thurner) syndrome

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ABSTRACT

Iliac vein compression syndrome (IVCS), also known as May-Thurner syndrome, is the result of compression of the left common iliac vein between the right common iliac artery and overlying vertebrae. The most common clinical presentation is left lower extremity deep vein thrombosis. Rarely, a patient with IVCS can present with obstruction of venous outflow, without deep vein thrombosis. Iliac vein compression, with or without thrombosis, should be treated if symptomatic. We present a patient with IVCS that was initially diagnosed with transabdominal ultrasonography (US), and then confirmed with computed tomography and venography with pressure measurements. We believe this is the first report of an IVCS patient diagnosed with US.

Key words: • *iliac vein* • *venography* • *ultrasonography*

Iliac vein compression syndrome (IVCS), also known as May-Thurner syndrome, is the result of compression of the left common iliac vein between the right common iliac artery and overlying vertebrae. A detailed anatomic description of the syndrome was first made by May and Thurner in 1957 (1). External compression of the vein causes intraluminal changes that could cause deep vein thrombosis (DVT) or venous hypertension without thrombosis in the left lower extremity. The syndrome most commonly presents as DVT; however, patients also can present with left-sided leg pain, swelling, and venous insufficiency without a thrombosis, but these occur less frequently. Because of its complications (e.g. iliofemoral DVT or venous insufficiency), IVCS must be recognized as early as possible and treated before it causes irreversible changes in the patient. Also of note, the syndrome has been seen more frequently after catheter-directed endovascular treatment of DVT (2–4).

Venography using transvenous pressure measurements is the diagnostic modality of choice for IVCS; however, intravascular ultrasonography (US), computed tomography (CT), and magnetic resonance imaging (MRI) have been shown to demonstrate the compression successfully.

We present a patient with IVCS that was first diagnosed with transabdominal US, and then confirmed with CT and venography with pressure measurements. We believe this is the first report of an IVCS patient diagnosed with US.

Case report

A 14-year-old girl presented to our institution with recent onset left lower extremity swelling and heaviness. The swelling first appeared 6 months earlier and progressed slowly. The swelling exacerbated after standing erect for a long time or after walking more than 500 meters, but dissipated with overnight rest. Occasionally, she had mild pain in her calf while standing. The patient was referred for color Doppler US of the lower leg, which revealed widely patent lower extremity veins with no reflux on standing.

Because of the patient's gender and because her complaint was left-sided, we thought it important to examine the common iliac vein in detail and search for iliac vein compression (because we have a good amount of experience in endovascular treatment of the disorder). While evaluating the anatomy of the common iliac vein, no pressure was exerted on the abdomen with the transducer. The common and external iliac veins were patent and without thrombosis. The common iliac vein beneath the right common iliac artery appeared mildly compressed by the overlying artery on B-mode US (Fig. 1a), but the flow pattern of the external and common iliac veins distal to the arterial compression point was monotonous and monophasic, without any respiratory variation (Fig. 1b). Color Doppler US revealed color turbulence just at the crossing

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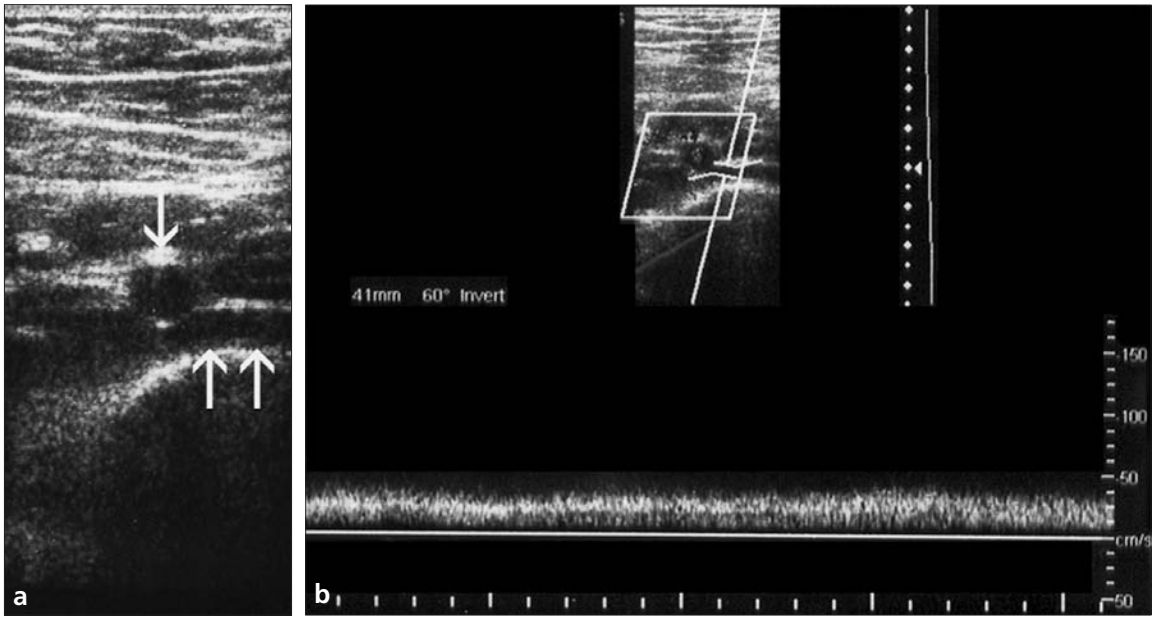
Received 11 June 2006; revision requested 8 September 2006; revision received 17 September 2006; accepted 25 September 2006.



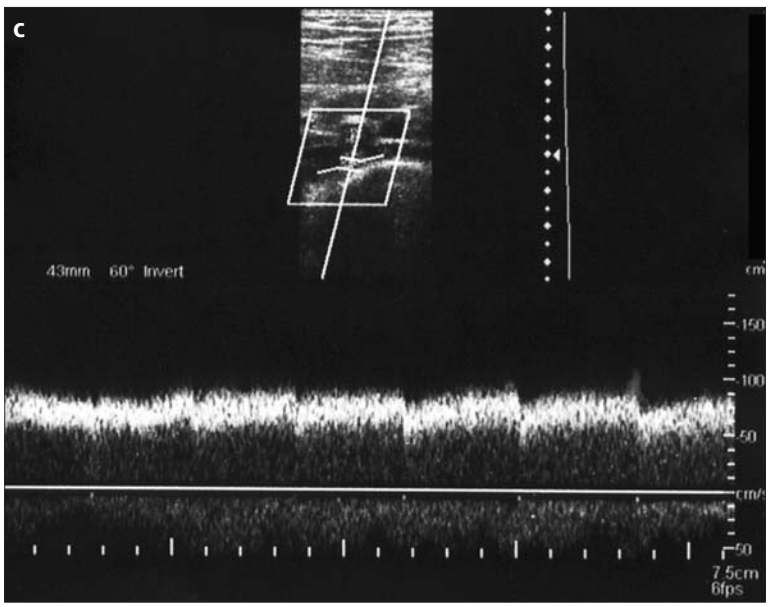


Figure 1. a–c. On the US image **(a)**, the right common iliac artery *(arrow)* lies over and compresses the left common iliac vein *(double arrows)*. Duplex Doppler US **(b)** just distal to the compression point shows monophasic venous flow without respiratory variation. The velocity of blood flow is between 35 and 40 cm/s. The velocity increases up to 100 cm/s abruptly at the point that the right common iliac artery compresses the left common iliac vein **(c)**.

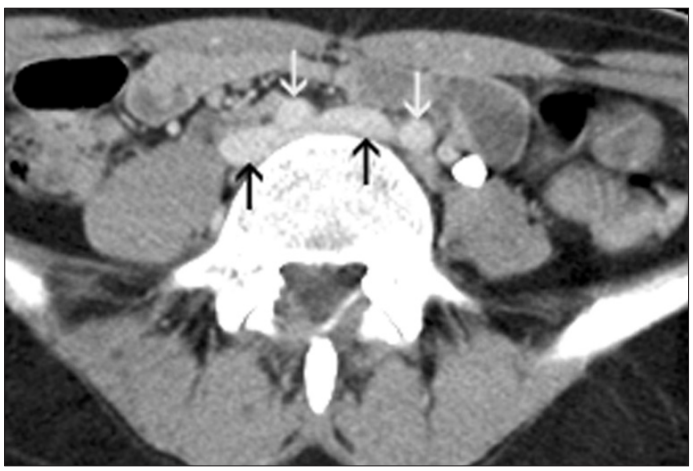


Figure 2. Axial CT image at a point just distal to aortic bifurcation. The left common iliac vein is compressed between the right common iliac artery *(white arrow on the right side of the patient)* and the underlying vertebral body *(white arrows: the right and left common iliac arteries, black arrows: the right and left common iliac veins)*.

point of the artery. Duplex scanning revealed an abrupt increase in velocity from 40 cm/min distal to the arterial crossing point to 100 cm/s at the crossing point (Fig. 1c). The contralateral iliac vein had normal phasicity with normal respiratory variation. The inferior vena cava was normal. A presumptive diagnosis of venous stenosis secondary to iliac vein compression was made. CT examination of the lower abdomen was performed to confirm the compression and the absence of thrombosis, and revealed a significant compression of the left common iliac vein at the arterial crossing point (Fig. 2). For definitive diagnosis, venography was scheduled. The procedure was explained in detail to the patient and her family and written informed consent for venography was obtained.

Venographic examination using a digital subtraction angiography unit (Multistar, Siemens, Erlangen, Germany) was performed a week after the CT examination. Puncture of the left common femoral vein was performed under US guidance and a 4-F dilator was placed in the vein. Nonionic contrast material (Ultravist 370, Schering, Berlin, Germany) was used for venog-

Figure 3. Venography performed through a 5-F vascular sheath dilator in the iliac vein shows severe stenosis at the point where the right common iliac artery crosses the left common iliac vein *(arrow)*. Although there is almost no collateral vein to show the significance of the stenosis, there was a pressure difference of 4 mmHg across the stenosis which is abnormal in the iliac vein.

raphy, which revealed severe compression of the left common iliac vein with significant stenosis (Fig. 3). The dilator was exchanged over a guide wire with a 5-F vascular sheath and a 5-F diagnostic catheter was placed proximal to the stenosis. Pullback pressure measurement revealed a mean venous pressure gradient of 5 mmHg across the compression point. The possibilities of alternative treatment methods, including bypass surgery and percutaneous transluminal angioplasty (with or without stent placement), were explained, and endovascular treatment was suggested. The patient and her family refused both endovascular and surgical treatment.

Discussion

The presented case had US findings characteristic of an isolated iliac vein stenosis. She was an adolescent with a lean body, and examination of the entire iliac vein was quite easy. B-mode US failed to demonstrate a severe stenosis of the left common iliac vein at the point that the right common iliac artery crossed it, but color and duplex Doppler US examinations revealed monophasic flow without respiratory variation distal to the compression and a significant increase in flow velocity at the point of arterial compression in the common iliac vein. These US findings are signs of an isolated iliac vein stenosis. Thus, color and duplex US not only demonstrated flow abnormalities due to compression, but also the significance of the stenosis, which was confirmed with venography and pressure measurement. A pressure gradient >2 mmHg is abnormal across a stenosis in iliac veins (5).

DVT is more common in the left than the right lower extremity, and IVCS is considered to be a risk factor for patients with left-sided iliofemoral DVT. The overall prevalence of symptomatic IVCS is unknown and ranges from 18% to 49% among patients with left-sided lower extremity DVT (6, 7). It occurs predominantly in young to middle-aged women (between 20–40 years). May and Thurner found obstructive lesions in the common iliac vein in 22% of 430 cadavers and described 3 different histological types of bands or spurs: lateral spur, central spur, and partial obliteration, which looked like a web of multiple fenestrations (1). They suggested that chronic trauma to the inner side of the vein wall due to adjacent arterial pulsation leads to an accumulation of collagen and elastin, and the formation of spurs. These spurs are then considered to be a probable risk factor for the development of left-sided DVT. The female predominance of left-sided iliac vein compression has not yet been explained. The presumed role of pregnancy in iliac vein compression is that the gravid uterus causes the 2 layers of the vein to oppose each other, causing the formation of venous spurs by the rubbing of the 2 opposite walls.

Today, noninvasive imaging methods are widely used to diagnose deep vein thrombosis. Color Doppler US is a simple and noninvasive method, but examination of the pelvic veins is technically difficult, especially in obese patients or in cases of poor visibility due to bowel gas (8). Compression of the common iliac vein by the artery has yet to be shown by transabdominal color Doppler US. Intravascular US (IVUS) has been used successfully to demonstrate iliac vein compression (9). IVUS performed in 2 different patients revealed focal hyperechoic wall thickening in one and multiple channels together with marked wall thickening in the other (10). The authors claimed that the thickening represented spurs, and this use of US had not been previously described. In another study, IVUS successfully identified the cause of iliac vein compression in all 16 patients examined and confirmed the diagnosis of IVCS (9). In one of these patients, the compression was at a level more caudal than the typical location, due to a tortuous left common iliac artery compressing the vein. In 11 of 16 patients (68%), the vein lumen was obliterated at the point that the artery crossed the vein. A thrombus was found in 4 patients, whereas linear filling defects (representing synechia and resulting in multiple channels from recanalization) were present in 7 patients. IVUS was helpful in identifying and localizing the guide wire in a chronically-occluded vein and in precisely placing the stents after diagnostic work-up. The researchers concluded that IVUS influenced the endovascular management of iliac vein compression in 8 of the 16 patients (50%).

CT and MRI have been used successfully to diagnose lower extremity DVT. CT has 100% sensitivity and 96% specificity in detecting DVT when

compared to conventional venography (11). In one study, transverse pelvic CT images showed IVCS in all 10 patients examined (12). Another study reported that multidetector CT scanning detected IVCS in 27 of 44 acute left-sided lower extremity DVT patients (13). Venography confirmed 26 of these patients, with only one false-positive result. The sensitivity and specificity of magnetic resonance venography in evaluating DVT have been reported to be as high as 100%.

Using MR venography, the incidence of IVCS was found to be 37.5% among 24 patients with left lower extremity swelling (14). In a retrospective study of 50 patients, CT demonstrated >50% compression of the left common iliac vein by the right common iliac artery in 24% of 50 asymptomatic subjects (15). Mean compression of the vein in the entire study population was 35.5%. The authors concluded that iliac vein compression by itself does not place the patient at risk for venous hypertension or the development of DVT.

Catheter-directed endovascular treatment has been widely accepted as an effective treatment for acute DVT. It has also been shown that endovascular treatment is a safe and effective means of treating IVCS. O'Sullivan et al. reported the treatment of iliac compression using stents in 35 of 39 patients (4). The primary and secondary patency rates were between 79% and 93% at one-year follow-up, respectively (3, 4). Successful endovascular treatment of IVCS with stent placement has also been reported in an adolescent patient (16).

When visualization of the common iliac veins is possible, IVCS may be diagnosed with transabdominal color and duplex Doppler US. Clinicians should be suspicious when any young patient (especially a female) presents with left-sided lower extremity symptoms secondary to increased venous pressure in the leg veins or DVT. In the absence of DVT, US examination should include a thorough search for a stenosis at the point that the right common iliac artery crosses the left common iliac vein.

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