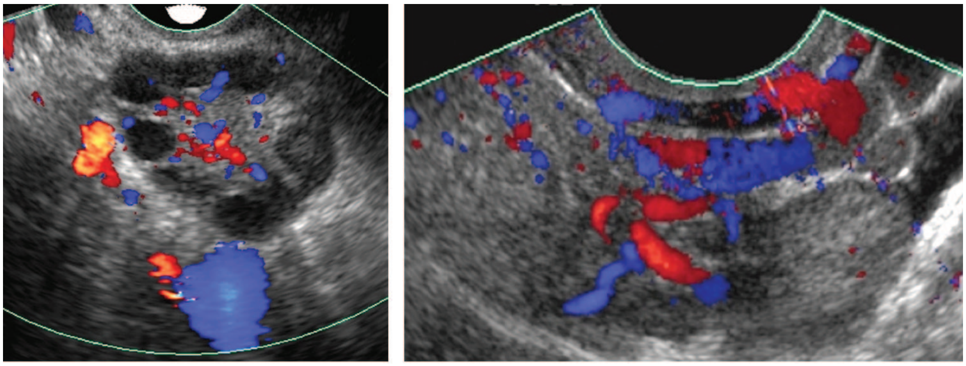
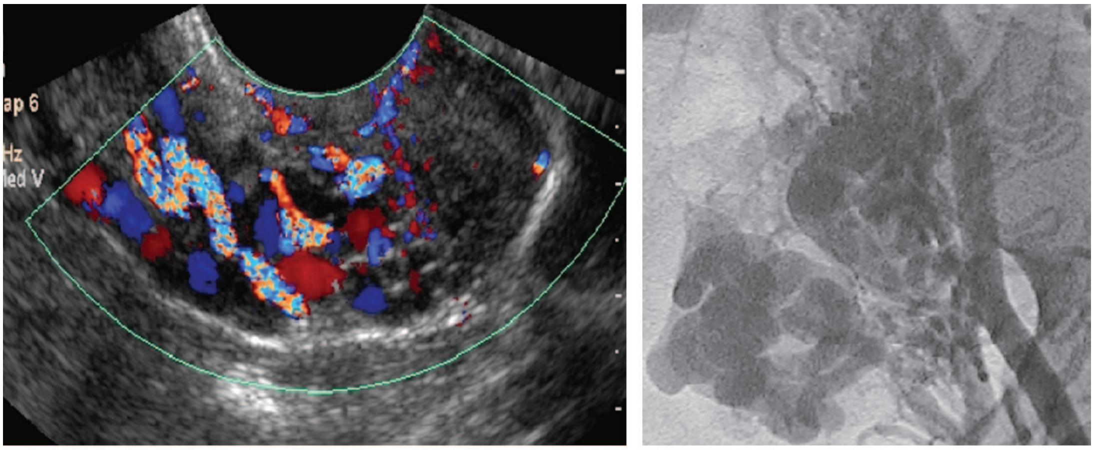


a. b.

Figure 19. Polycystic ovary disease associated with pelvic congestion syndrome. Coronal **(a)** and sagittal **(b)** transvaginal color Doppler US images demonstrate hypoechogenic masses in the ovaries that are distinct from the vasculature.



a. b.

Figure 20. Pelvic congestion syndrome. Color Doppler US image **(a)** and corresponding venogram **(b)** show severely dilated pelvic veins.

Symptoms

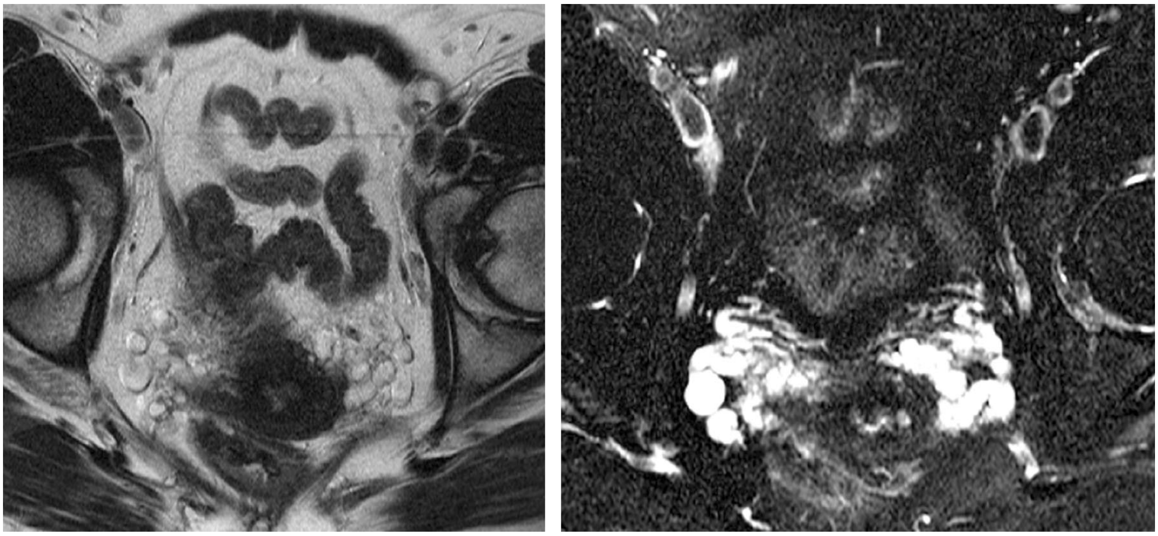
Patients with pelvic congestion syndrome report a deep, prolonged dull ache, often associated with movement, posture, and activities that increase abdominal pressure. The pain may be unilateral or bilateral and often is asymmetric; it is chronic, has no obvious source, and may be associated with dyspareunia (71% of cases), dysmenorrhea (66%), and postcoital ache (65%). Rectal discomfort and increased urinary frequency may also be reported. Physical findings suggestive of the diagnosis include varicose veins (in the vulva, buttocks, and legs) and ovarian point tenderness upon palpation (41,45).

Imaging Appearance

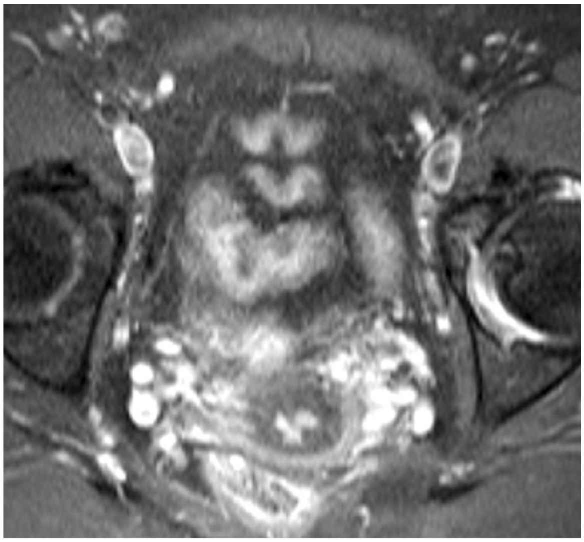
Imaging is critical in the evaluation of pelvic varicose veins. Several imaging modalities can be used to diagnose pelvic congestion syndrome accurately. Direct visualization of tortuous and dilated ovarian veins with venography is considered to be the standard reference for accurate diagnosis of pelvic congestion (Fig 20).

There are several methods for opacifying these dilated vessels. They include selective catheterization of ovarian veins, transuterine injection of contrast material, and direct injection of contrast material into vulval varices. These techniques are rarely used now, however, because they are invasive and expose the patient, especially those of child-bearing age, to ionizing radiation (42–44,46). The newer noninvasive modalities, such as US, CT, and MR imaging, have nearly replaced venography for diagnostic investigation of pelvic varicose veins (44).

Transvaginal US.—The initial modality used for patients with pelvic pain is US. Pelvic varices



a. b.



c.

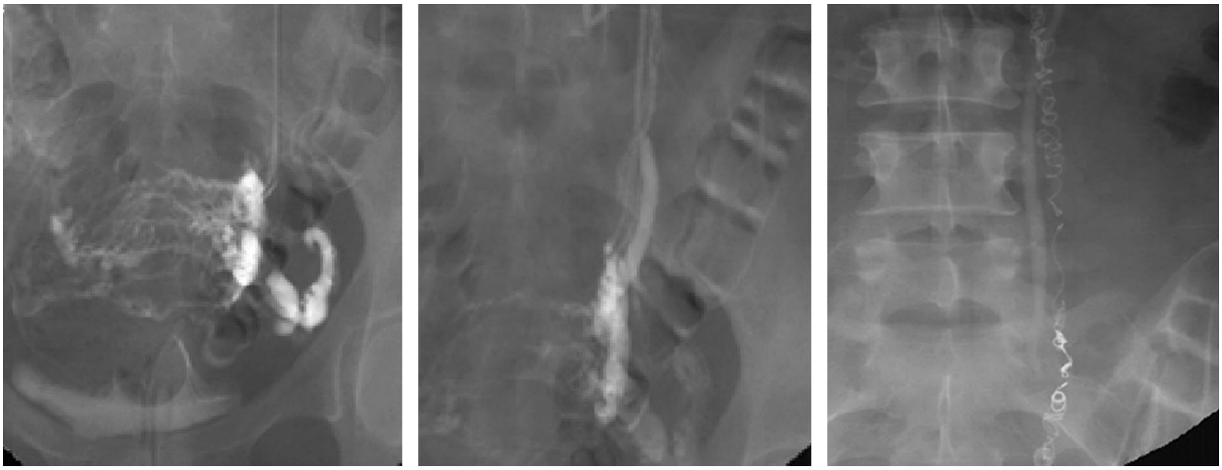
Figure 21. Pelvic congestion syndrome. Coronal T2-weighted turbo spin-echo (6000/120) image **(a),** coronal T2-weighted turbo spin-echo fat-suppressed (6000/120) image **(b),** and coronal T1-weighted (450/10) image obtained with fat-suppression and gadolinium **(c)** demonstrate severely congested pelvic veins.

can be identified by using transvaginal US with color Doppler and Doppler spectral analysis. The diagnosis of ovarian and pelvic varices is established by the identification of multiple dilated tubular structures around the uterus and ovary with venous blood Doppler signal. There are three diagnostic criteria for establishing the diagnosis of pelvic congestion: *(a)* a tortuous pelvic vein with a diameter greater than 4 mm, *(b)* slow blood flow (about 3 cm/sec), and *(c)* a dilated arcuate vein in the myometrium that communicates between bilateral pelvic varicose veins (42).

The ovaries of women with pelvic congestion syndrome tend to have cystic components, ranging from a few cysts to polycystic ovary syndrome produced by estrogen overstimulation.

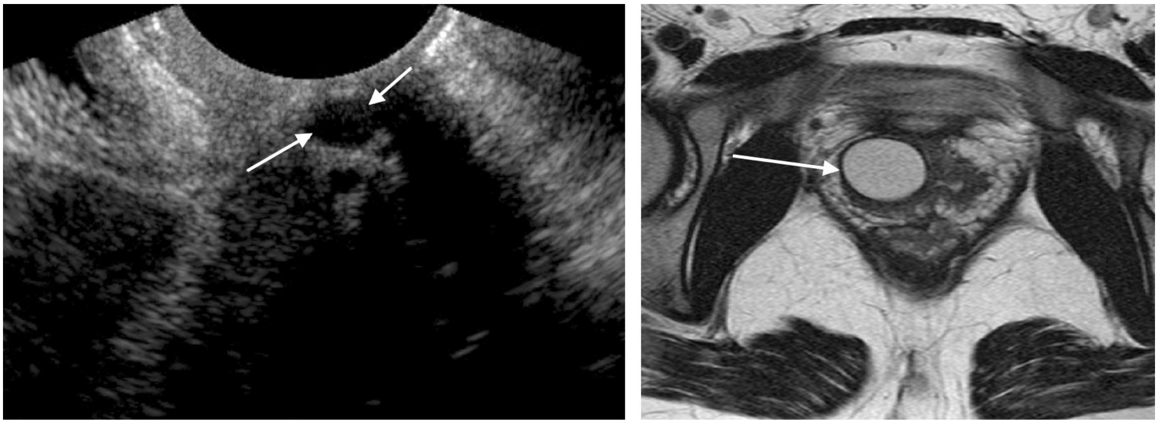
MR Imaging.—MR imaging, as well as CT, are noninvasive methods used to diagnose pelvic varices. Pelvic varices are imaged as dilated, tortuous, enhanced tubular structures around the uterus and ovary, with possible extension into the broad ligament and pelvic sidewall. They can also involve the paravaginal venous plexus (43).

On T1-weighted MR images, pelvic varices have no signal intensity because of flow-void artifact; on gradient-echo MR images, the varices have high signal intensity. On T2-weighted MR images, they usually appear as an area of low signal intensity; however, hyperintensity or mixed signal intensity may also be noted, possibly because of the relatively slow flow through the vessels (44) (Fig 21). Three-dimensional T1 gradient-echo sequences performed after the intravenous administration of gadolinium are the most effective sequence for demonstrating pelvic varices. Blood flow in pelvic varices appears with high signal intensity.



a. b. c.

Figure 22. Pre- and postembolization of gonadal veins for treatment of pelvic congestion syndrome. **(a, b)** Angiograms obtained before coil embolization show pelvic varices **(a)** and a dilated left renal vein **(b)**. **(c)** Angiogram obtained after selective percutaneous coil embolization reveals that treatment was adequate.



a. b.

Figure 23. Gartner cyst. Transvaginal US image **(a)**, axial T2-weighted turbo spin-echo (4900/120) image **(b)**, and axial T1-weighted spin-echo (450/10) image obtained with fat-suppression and gadolinium **(c)** demonstrate the cystic mass (arrows).

c.

Treatment

Several treatments for pelvic congestion syndrome are currently available or under investigation. Medical treatment of the underlying disorder, such as a hormonal imbalance, may be possible with medroxyprogestrone or goserelin (GnRH analog) (45). Procedural treatments of pelvic congestion syndrome include laparoscopic transperitoneal ligation of ovarian veins and percutaneous coil embolization of the gonadal vein. Interventional treatment such as venous stent placement may also be used for anatomic anomalies (46–48).

Coil embolization of the gonadal vein is a safe technique that relieves pelvic pain in many patients with pelvic congestion syndrome. Various centers have technical success rates of 96%–99%, with few immediate or long-term complications. Of the few complications that have been reported, most are mild and usually do not require hospital admission for treatment. The reported rates of symptomatic relief have varied, but they are approximately 75%, with about 60% of patients experiencing complete resolution of symptoms (46–48) (Fig 22).

Bilateral ligation of ovarian veins near their origin by means of a laparoscopic transperitoneal para-aortic approach has been explored as a treatment for pelvic congestion syndrome. In one prospective pilot study performed on 23 women in Italy, there was both complete remission of pain and absence of pelvic varicose veins for at least 12 months in all women (49).

Rare Conditions

Gartner Cysts

Gartner cysts are remnants of mesonephric (wolffian) ducts, which in women are present in the uterus, vagina, and hymen until the 3rd month of gestation and which give rise to the ureter. Remains of the Gartner duct may be detected in up to one-fourth of adult women, although Gartner cysts arise only in approximately 1%–2% of the population (50,51). Most Gartner cysts are small (<3 cm), and they are usually paravaginal and in the anterolateral position; however, they can be large and cause urethral or even ureteric obstruction. Infrequently, an ectopic ureter can also terminate in a Gartner cyst.

Diagnosis of a Gartner cyst with transvaginal US and MR imaging relies on identification of the location and cystic nature of the lesion. On T1-weighted images, Gartner cysts typically exhibit high signal intensity because of the proteinaceous nature of the cystic fluid. Gartner cysts are treated with surgical resection (52) (Fig 23).

Periurethral Cysts and Urethral Diverticula

Tubuloalveolar mucous glands known as periurethral glands drain into the urethra. Congenital dilatation of periurethral glands may form cysts, which are often asymptomatic. Symptomatic infection of these cysts or of normal periurethral glands can result in urethral diverticula. Patients often complain of pain, urinary urgency, frequency of urination, recurrent urinary tract infections, dribbling after urination, or even incontinence. Traditional imaging techniques are limited in the diagnosis of lesions that are continuous with the urethral lumen. Differentiation between a urethral diverticulum and a periurethral cyst can be challenging, but the distinction is crucial because the surgical procedures for treating the two entities are different. Both lesions require surgery. Diverticula, but not cysts, require a urethral reconstruction. Common complications of untreated urethral diverticula include recurrent infection, calculi, and carcinoma (53,54).

MR imaging is emerging as an important imaging technique in the evaluation of female urethral and periurethral regions in symptomatic patients. MR imaging is superior to transvaginal US for demonstrating abnormalities in these areas. The fine details of periurethral masses are best shown with high-resolution transvaginal MR imaging (Fig 24). Urethral diverticula appear as high-signal-intensity cystic structures surrounding the urethra on T2-weighted images. Diverticula are most often located in the midurethra and involve the posterior lateral wall. Carcinoma in preexisting diverticula can best be seen on T1-weighted images as focal enhancing soft-tissues masses within the diverticulum (55).