Pelvic Pain: Overlooked and Underdiagnosed Gynecologic Conditions

Ewa Kuligowska, MD • Linda Deeds, MS, III • Kang Lu, MS, III

Chronic pelvic pain is a common, disabling problem among women. Although chronic pelvic pain can be produced by many conditions, some gynecologic causes are frequently overlooked and underdiagnosed, resulting in inappropriate referral and inadequate treatment. The gynecologic conditions most often unrecognized are endometriosis, adenomyosis, pelvic congestion, and less common congenital and acquired abnormalities. Transvaginal ultrasonography (US) is helpful for assessing endometriotic cysts but has a limited role in the diagnosis of adhesions or peritoneal implants. The classic magnetic resonance (MR) imaging features diagnostic of endometrioma are a cystic mass with high signal intensity on T1-weighted images and loss of signal intensity on T2-weighted images. When transvaginal US findings are suggestive of adenomyosis, MR imaging is used as the definitive imaging modality for diagnosis. High-resolution transvaginal US and MR imaging can help establish the diagnosis of adenomyosis with a high degree of accuracy, since the imaging appearance closely correlates with the histopathologic characteristics. Pelvic varices can be identified by using transvaginal US with color Doppler and Doppler spectral analysis. Three-dimensional T1 gradient-echo sequences performed after the intravenous administration of gadolinium are the most effective MR imaging sequence for demonstrating pelvic varices. Blood flow in pelvic varices appears with high signal intensity. Recent advances in radiologic imaging and therapeutic procedures make it possible to diagnose accurately the conditions producing chronic pelvic pain in most women and to guide effective treatment.

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Introduction
Patients with chronic pelvic pain can present both diagnostic and therapeutic challenges for the clinician. Chronic pelvic pain is a common and disabling condition that is defined as nonmenstrual pain of at least 6 months duration (1,2). The sources of pelvic pain are multifactorial, and their causes are difficult to determine.

The prevalence of chronic pelvic pain is 15% in women between the ages of 18 and 50 years (2). Chronic pelvic pain accounts for 10%–40% of all gynecologic outpatient visits (2). In the United States, 35% of diagnostic laparoscopies and 15% of all hysterectomies are performed because of chronic pelvic pain (1). Interestingly, black women have a lower risk of developing this condition (0.73; confidence interval, 0.55–0.99) (1). Women over 35 years of age also have lower odds of developing this problem (0.72; confidence interval, 0.60–0.85) (1).

The economic impact of chronic pelvic pain is substantial: 15% of women with chronic pelvic pain miss an average of 14.8 hours of work per month in the United States, which accounts for $14 billion of lost productivity per year (1,3). The total cost of potentially unnecessary medical, surgical, and psychiatric care or hospitalization amounts to $128 million per year. It is estimated that the total cost of care for women with chronic pelvic pain constitutes $39 billion per year (1,3).

Many conditions produce chronic pelvic pain in women. These conditions range from problems in the gastrointestinal tract to gynecologic diseases and urologic abnormalities. Some of these conditions are easily diagnosed, but other causes of chronic pelvic pain are extremely difficult to recognize. These conditions have often been overlooked and underdiagnosed in the past. Some of the gynecologic conditions most often unrecognized are endometriosis, adenomyosis, pelvic congestion, and less common congenital and acquired abnormalities.

The purpose of this article is to describe the transvaginal ultrasonographic (US) and magnetic resonance (MR) imaging appearances of some gynecologic conditions that can cause chronic pelvic pain. Radiologists familiar with the clinical, pathologic, and radiologic characteristics of the underlying causes of chronic pelvic pain will be able to make an accurate diagnosis in most cases and facilitate referral for appropriate therapy.

Endometriosis
Endometriosis is defined as functional endometrial tissue outside the boundaries of the uterine musculature that is implanted on the surface of other organs and that responds to hormonal stimuli. Endometriosis has been found everywhere in the body. The most frequent sites are the ovary, uterine ligament, pouch of Douglas, uterus, and fallopian tube; less common sites are the vagina, cervix, and bladder.

Pathophysiology
Several theories have been proposed to explain the presence of endometrial tissue outside the uterus (6,7). The implantation theory proposes the “shedding” of the endometrial glands during retrograde menstruation through the fallopian tubes to the peritoneum. The direct theory speculates that endometrial tissue is transported during
surgeries, such as cesarean sections (Fig 3). Dissemination theories describe the possible spread of endometrial cells by passage through lymphatic and blood vessels. The coelomic metaplasia theory postulates a conversion of peritoneal epithelium into endometrial epithelium by unknown mechanisms. Genetics may also play a strong role in the development of endometriosis.

Clinical Characteristics
Endometriosis occurs in women during the reproductive years (primarily 25–29 years of age) and is present in 7%–10% of the general population of women (8). In infertile women, the rate of endometriosis is much higher, between 20% and 50% of this population (9). In women with an affected first-degree relative, there is a 10-fold increase in prevalence (6,10).

Endometriosis can be associated with many debilitating symptoms, in addition to infertility. Symptoms of endometriosis occur in 50%–80% of patients and include dysmenorrhea, dyspareunia, abnormal menstrual bleeding, and infertility (9). Various co-morbid clinical symptoms can be present, depending on the location of the ectopic endometrial tissue (4,6). The amount of pelvic pain is not correlated with the extent of the disease (6,9).

Imaging Appearance
The value of imaging in the diagnosis of endometriosis is limited. Small implants and adhesions are usually not detectable with transvaginal US. Some small implants and adhesions are also difficult to detect with MR imaging. Laparoscopy is often performed to better diagnose and treat these small lesions (7) (Fig 4). Endometrioma is the only form of endometriosis readily diagnosed with transvaginal US. MR imaging is more effective for identifying endometrial implants in other organs.
Transvaginal US.—Transvaginal US is used for the initial evaluation of endometriosis. US is particularly helpful in the assessment of endometriotic cysts but has a limited role in the diagnosis of adhesions or peritoneal implants. The typical sonographic appearance of ovarian endometriomas consists of cystic masses that have diffuse low-level homogeneous echoes (Fig 5). The contents of the cyst, however, may vary in appearance because of the age of the hemorrhage. Endometriomas can be multilocular, with thin or thick septations and thick irregular walls (Figs 6, 7). Within the mass, fine interdigitating septations are often seen that give a fine reticular appearance (11). Color Doppler US shows no blood flow in the fine septations, whereas blood flow can often be detected in thick septations because of revascularization of chronic hematoma (12). Retracting blood clots (avascular) may appear as triangular or curvilinear soft-tissue components or with reticular patterns because of fibrin strands that often are attached to the wall (Fig 7). Blood products in endometriomas can occasionally be separated into layers, which appear sonographically as fluid-fluid or fluid-debris levels (13,14) (Fig 8). The sonographic appearances of endometriomas are nonspecific, and other conditions causing cystic masses in the ovary, including malignancies, cannot be excluded on the basis of the initial US examination (15–17). A follow-up transvaginal US study in 6 weeks can be helpful in differentiating endometrioma (which will change in size and appearance because of the changing age of the hemorrhage) from other causes.

The overall sensitivity and specificity of transvaginal US for the diagnosis of endometrioma is 83% and 89%, respectively (15).

MR Imaging.—In cases in which US findings are equivocal, an MR imaging examination may allow for a more definite characterization of endo-

**Figure 4.** Laparoscopic view demonstrates an endometrioma.

**Figure 5.** Transvaginal US image shows a cystic mass with diffuse low-level homogeneous echoes, findings typical of endometrioma.

**Figures 6, 7.** (6) Transvaginal US image shows an endometrioma with thin septations. (7) Transvaginal US image shows an ovarian endometrioma with low-level echogenicity, thick septations, and a soft-tissue component caused by clot formation (arrow).
metrioma. MR imaging is often valuable in the diagnosis of superficial peritoneal implants and extraperitoneal lesions, particularly those in the rectovaginal space and uterosacral ligaments. The classic MR imaging features diagnostic of endometrioma are a cystic mass with high signal intensity on T1-weighted images and loss of signal intensity on T2-weighted images. This phenomenon is referred to as “shading” and occasionally occurs in a graded pattern, with higher to lower signal intensities as result of high protein content and iron concentration from recurrent hemorrhage. Overall, the sensitivity and specificity of MR imaging for the diagnosis of endometrioma is 90%–92% and 91%–98%, respectively (19–21).

**Treatment**

Treatment for symptomatic endometriosis can be medical or surgical and depends on the size of the endometrioma. Medical treatment frequently involves use of nonsteroidal, anti-inflammatory drugs to treat the symptoms of endometriosis when the diagnosis has not been definitely established. Oral contraceptives, which effect an anovulatory state, are often used as treatment.

Laparoscopy can also be used to diagnose and treat endometriosis. Although it is an invasive surgical procedure, laparoscopy is the most sensitive way to diagnose the disease. Treatment may
be performed during this procedure and may include ablation of implants, lyses of adhesions, or removal of endometrioma implants. Definitive treatment is hysterectomy and oophorectomy. In young women, a conservative treatment is preferred to preserve fertility (4,6).

Adenomyosis
Adenomyosis is an often-overlooked condition that is responsible for uterine enlargement and pelvic pain associated with dysmenorrhea and menorrhagia. These symptoms are not specific and can occur with other common gynecologic disorders. The diagnosis of adenomyosis was, until recently, rarely recognized before surgery (22).

Adenomyosis is a condition characterized by the migration of glands from the basal layer of the endometrium to within the myometrium; the focus of basal endometrial glands is surrounded by smooth muscle hyperplasia. The ectopic glands are located at least 2–3 mm below the endometrial-myometrial junction and produce asymmetry of the uterus with a globular configuration (22) (Fig 10). Adenomyosis is frequently misdiagnosed clinically and radiologically as leiomyomas, which results in inappropriate treatment and persistent symptoms.

Uterine adenomyosis is a common disease. Its reported prevalence varies widely, depending on the analytic technique used by the pathologist. Adenomyosis is found in 5%–70% of posthysterectomy pathologic specimens (23). The disease most commonly (70%–80% of cases) affects parous women aged 40–50 years (24). Seventy percent of women with adenomyosis have symptoms (24).

There are two distinct types of adenomyosis: diffuse and focal (25). In the diffuse form, the ectopic endometrial glands and stroma are distributed diffusely throughout the myometrium, in contrast to the focal form, in which ectopic endometrial glands produce circumscribed nodular aggregates known as adenomyomas.

Pathophysiology
The pathogenesis of adenomyosis is poorly understood and is likely multifactorial. Proposed mechanisms include the lack of a basement membrane or the presence of a basement membrane defect at the endometrial-myometrial interface, which allows endometrial tissue to grow into the myometrium. Another theory postulates that endometrial migration may occur via lymphatic or vascular channels. The risk factors remain unclear, but the possibilities include hereditary factors or uterine trauma from childbirth or abortion. Chronic endometritis and hyperestrogenemia can also predispose a patient to adenomyosis (26,27).

Symptoms
Patients with adenomyosis present with dysmenorrhea, menorrhagia, pelvic tenderness, or infertility. Adenomyosis also predisposes a woman to develop an intramural ectopic pregnancy. Symptoms are rarely seen in nulliparous or postmenopausal women (27).

Imaging Appearance
All patients with chronic pelvic pain are first examined with transvaginal US to identify whether fibroids, focal adenomyosis, or diffuse adenomyosis are present and to rule out other causes (28,29). When transvaginal US findings are suggestive of adenomyosis, MR imaging is used as the definitive imaging modality for diagnosis. High-resolution transvaginal US and MR imaging can help establish the diagnosis of adenomyosis with a high degree of accuracy, since the imaging appearance closely correlates with the histopathologic characteristics of this entity (30). The first goal of transvaginal US and MR imaging is to establish the correct diagnosis for potential treatment. There are multiple conservative treatments possible for uterine fibroids, in contrast to debilitating extensive adenomyosis, for which hysterec-