Ultrasonography Evaluation of Pelvic Masses

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KEYWORDS

• Pelvic sonography • Uterine fibroid • Adenomyosis • Endometrial hyperplasia • Endometrial carcinoma • Cervical cancer • Ovarian cysts • Ovarian neoplasms

KEY POINTS

- Ultrasonography is the primary imaging modality for evaluation of pelvic masses.
- Both real-time imaging and three-dimensional ultrasonography are important in identifying the organ of origin, which helps narrow the differential diagnosis.
- Many pelvic masses have characteristic sonographic appearances that allow confident diagnosis.
- Clinical factors such as age, menstrual status, and symptoms are important in the management of pelvic masses.

INTRODUCTION

Ultrasonography (US) is the primary imaging modality for evaluation of pelvic masses, both for symptomatic pelvic masses and asymptomatic pelvic masses that are incidentally detected on physical examination or other imaging modalities. US has the advantage of being inexpensive, widely available, and offering superior tissue characterization compared with computed tomography (CT). The real-time imaging ability of US and three-dimensional US (3DUS) also has the advantage of being better able to identify the organ of origin of the pelvic mass compared with CT and magnetic resonance (MR). Many pelvic masses have characteristic sonographic appearances that allow confident diagnosis and management (**Box 1**). This article reviews the sonographic appearances and management of common pelvic masses encountered in a nonpregnant women, and is organized based on anatomic location: uterus, cervix, ovaries, and fallopian tubes.

NORMAL ANATOMY AND IMAGING TECHNIQUE

Pelvic US is optimally performed using both the transabdominal (TA) and transvaginal (TV) techniques. The TA examination is performed using transducers with frequencies of up to 5 MHz through the anterior abdominal wall using the distended urinary bladder as an acoustic window. The TV examination is performed with the patient's bladder empty using an endovaginal transducer with frequencies of 7.5 MHz or higher.[1] The TA examination serves as a general overview of the pelvic anatomy. The TV examination provides better anatomic detail, tissue characterization, and evaluation of vascular flow at the cost of a more limited field of view.

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Box 1
Pearls and pitfalls of US evaluation of pelvic masses

Pearls

Real-time imaging to identify correct organ of origin

Characteristic sonographic features of tissues (fat, fibrous tissue, hemorrhage) allow confident diagnosis

Presence of internal flow in complex adnexal mass is concerning for neoplasm

Management of pelvic masses depends on patient age, menstrual status, and symptoms

Pitfalls

Organ of origin can be difficult to identify in large pelvic masses

Solid component or mural nodularity can be missed in large pelvic masses

Some masses do not have classic sonographic appearance and may need MR imaging for further characterization

The normal uterus can have different orientations within the pelvis but is most commonly anteverted with the entire uterus tilted forward toward the anterior abdominal wall. The uterus is composed of the endometrium, junctional zone, and myometrium. The sonographic appearance of the endometrium varies during the monthly menstrual cycle. During the proliferative phase, the hyperechoic endometrial complex increases from 2 to 3 mm to 8 mm in thickness. A trilaminated appearance with alternating hyperechoic (3) and hypoechoic (2) layers is typically seen at midcycle. During the proliferative phase, the endometrium further thickens to 15 mm or more and becomes more homogeneous.[1] The junctional zone, which represents the innermost layer of the myometrium, is the anatomic boundary between the endometrium and the myometrium and is not always detected by US.

The ovaries vary in size during each menstrual cycle because of the varying number and sizes of follicles. The reported maximum volumes of the ovaries are 9.0 mL for nulliparous and 15.0 mL for parous women. During the estrogen phase (before ovulation), the dominant follicle progressively grows in size and attains a diameter of 20 to 25 mm by midcycle. This mature follicle ruptures and releases its egg at midcycle and becomes the corpus luteum of menses during the progesterone phase.[2] The normal fallopian tubes are not usually identified on US unless surrounded by ascites.

IMAGING FINDINGS AND DISORDERS

Uterine Masses

Uterine fibroids or leiomyomas are the most common benign uterine tumors, observed on US in up to 24% of premenopausal women.[3] Predictors of increased incidence of fibroids include African American race, nulliparity, obesity, and positive family history of fibroids.[4] The most common sonographic appearance of a fibroid is a solid hypoechoic mass with posterior acoustic shadowing and/or edge refraction (**Fig. 1**, **Table 1**).[5] Fibroids, especially if greater than 3 to 5 cm in diameter, can occasionally undergo necrosis and calcification, which may result in a more heterogeneous echotexture. Areas of calcifications can be identified as well-defined hyperechoic areas with posterior acoustic shadowing.[1] Although most fibroids are intramural and are surrounded by myometrium, fibroids can also be submucosal or subserosal in location, and may mimic an endometrial (**Fig. 2**) or adnexal mass, respectively.[5] Real-time examination is important in showing the attachment of a subserosal fibroid to the myometrium or a tissue plane separating a submucosal fibroid from the endometrial complex. In rare cases, a saline infusion sonohysterogram (SIS) or 3DUS (see **Fig. 2**) is helpful in differentiating a submucosal fibroid from an endometrial mass. The claw sign and visualization of bridging vessels crossing between the uterus and an adnexal mass are important clues to the diagnosis of an exophytic subserosal fibroid rather than a solid ovarian mass.[5]

Adenomyosis is the presence of ectopic endometrial glands and stroma within the myometrium.[6] Both diffuse and focal forms of adenomyosis can be confused with uterine fibroids.[7] Sonographic findings of adenomyosis include globular uterine enlargement, cystic anechoic spaces in the myometrium (**Fig. 3**), linear hyperechoic bands or nodules extending deep into the myometrium, diffuse

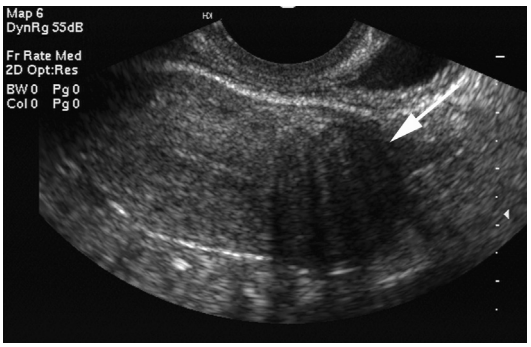

Fig. 1. Uterine fibroid. Gray-scale transverse US image shows classic hypoechoic mass with posterior acoustic shadowing (*arrow*).

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