The Usefulness of Ultrasound Imaging in Gynecologic Oncology

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KEYWORDS

• Pelvic ultrasound • Uterine sarcoma • Endometrial carcinoma • Cervical carcinoma
• Ovarian carcinoma • Fallopian tube carcinoma • Gestational trophoblastic disease

KEY POINTS

- Ultrasound examination is the primary imaging modality for evaluating pelvic symptomatology in female patients, and is often the first study to detect a gynecologic neoplasm.
- Myometrial masses are readily visualized and monitored, but there is imaging overlap in the appearance of large, degenerated benign leiomyomas and more aggressive leiomyoma variants and uterine sarcomas.
- The thickness and appearance of the endometrium is readily amenable to evaluation by transvaginal ultrasound imaging.
- Ovarian cysts are routinely encountered on pelvic ultrasound examination; many cysts can be fully characterized and managed based predominantly on their sonographic appearance.
- Gestational trophoblastic disease encompasses a spectrum of placental origin tumors with a variety of manifestations at pelvic ultrasound examination.

INTRODUCTION

Pelvic ultrasound (US) examination is the primary imaging modality for evaluating female patients with a wide range of pelvic symptomatology including abnormal vaginal bleeding, endocrine abnormalities, pelvic pain, pelvic infection, and pelvic masses. US imaging can identify the primary site of origin for a wide range of pelvic pathologies, and in many cases render a specific diagnosis that immediately directs patient management. Included in this role of pelvic US examination as a first-line gynecologic imaging modality is the ability to detect or suggest the presence of a gynecologic neoplasm. Familiarity with the varied sonographic appearance of gynecologic neoplasms and potential neoplasm mimics facilitates the timely diagnosis and management of patients. This article reviews the US appearance of gynecologic neoplasms grouped by anatomic site of origin, the US appearance of select benign pelvic pathology not to be misinterpreted as malignancy, as well as available US-based guidelines for managing potential gynecologic neoplasms.

IMAGING TECHNIQUE AND NORMAL ANATOMY

Imaging Technique

Pelvic US examination to evaluate the uterus, ovaries, and adnexa is routinely performed using a combination of transabdominal (TA) and transvaginal (TV) imaging approaches (**Table 1**). As an imaging modality in general, US examination has the

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Table 1
Components of the female pelvis ultrasound examination

Component	Purpose
Transabdominal imaging	Pelvic overview; screen for large masses and free fluid
Transvaginal imaging	Close visualization of the uterus, ovaries, and adnexa
Gray-scale imaging	Differentiate normal anatomy and pathology; assess cystic vs solid nature and complexity
Color and spectral Doppler imaging	Detect and differentiate true vascularity and solid elements in structures
Sonohysterography	Detect and localize endometrial lesions

advantages of being widely available, portable, free of ionizing radiation, not requiring the use of oral or intravenous contrast material, and being relatively inexpensive. Limitations inherent to US imaging include a relatively small field of view, reliance on operator performance and experience, dependence on the patient's body habitus and mobility, and the presence of overlying structures, such as an air-filled bowel, which may obscure anatomy and pathology. Patient information that should be available at the time of performing and interpreting pelvic US examinations includes the examination indication, any relevant laboratory test results such as serum cancer antigen 125 level or serum β-human chorionic gonadotropin (β-hCG) level, date of last menstrual period, any prior pelvic surgeries, and any hormonal replacement therapy.

Gray scale ultrasound imaging

A complete US examination of the female pelvis usually begins with TA imaging to obtain an overall view of the pelvis, and to screen for and evaluate larger pelvic masses and free fluid that might otherwise be overlooked or incompletely evaluated on smaller field of view TV imaging. TA imaging is typically performed with a 2.5- to 5.0-MHz transducer and a full bladder. A full bladder serves as an acoustic window to the pelvic organs and can help to displace potentially overlying bowel out of the pelvis. After emptying the bladder, TV imaging is then performed with a higher frequency transducer (5–8 MHz) that has a smaller field of view, but allows for closer and higher resolution visualization of the uterus, ovaries, and adnexa.[1] In cases where TV imaging cannot be performed owing to patient preference or contraindications, that is, premenarchal, a transperineal US approach may be used to further visualize the vaginal canal and cervix. Many US machines are also now equipped with 3-dimensional software that can further demonstrate the overall size and orientation of pelvic anatomy and pathology. Other US techniques under investigation for use in pelvic imaging include US elastography, contrast-enhanced US, and specialized transcervical US transducers.[2–5]

Spectral Doppler ultrasound imaging

Color and power spectral Doppler imaging techniques are routinely used during a pelvic US examination to evaluate both anatomic and pathologic vascularity. Color and power Doppler imaging are especially useful for detecting and confirming solid components and vascularity in pelvic pathology and structures. Spectral Doppler interrogation of apparent areas of power and color Doppler vascularity helps to further differentiate true vascularity from artifactual color flashes of random motion. The use of a spectral Doppler pulsatility index (peak systolic velocity – end diastolic velocity/mean velocity) or resistive index ([peak systolic velocity – end diastolic velocity]/peak systolic velocity) as a means of differentiating between benign and malignant vascularity in ovarian and adnexal pathology is not currently in widespread used owing to overlap in the index values for both benign and malignant masses.[6] Originally, detection of lower resistance, higher diastolic vascular flow in a mass was thought to be more indicative of malignant neovascularity than benign vascularity.[7,8] More helpful than a discriminatory vascularity index may be the subjective assessment and location of vascularity in a mass, with greater overall vascularity and more central vascularity being more suspect for malignancy than minimal or peripheral vascularity.[9]

Sonohysterography

Saline-infused sonohysterography (SIS) is a specialized pelvic US examination that can be performed to further evaluate the endometrium for pathology following a routine pelvic US examination. In particular, it can detect focal endometrial pathology such as polyps, focal hyperplasia, and polypoid carcinomas that might otherwise be occult with routine TV imaging or missed with random endometrial biopsies. SIS involves placement of a thin (5 or 7 Fr) catheter into the endometrial cavity, catheter retraction to the level of the