The Ultrasound Workup of Adnexal Masses

Marion Brody, MD[a],*, Beverly Coleman, MD[b]

Adnexal masses, both painful and asymptomatic, are commonly encountered entities in clinical practice. Most adnexal masses are benign; however, if the examining physician determines that a palpable mass is concerning, an ultrasound is often requested to further help guide management. Ultrasound is generally the initial imaging evaluation, because it is readily available, inexpensive, and has a high negative predictive value. Depending on the clinical scenario, serum tumor marker levels may also be obtained.

Although adnexal masses may be categorized in several ways, the authors believe pattern recognition to be superior and have thus classified adnexal masses in this article as cystic, complex, or solid (**Box 1**). Commonly encountered simple masses include physiologic cysts, paratubal/para-ovarian cysts, and benign cystic neoplasms. Complex masses include hemorrhagic follicular and corpus luteum cysts, peritoneal inclusion cysts, pyosalpinges or hydrosalpinges, endometriomas, teratomas, and other benign and malignant ovarian neoplasms. Solid masses include entities such as pedunculated fibroids, torsed ovaries, benign and malignant primary ovarian neoplasms, and metastases.

Ultrasound is a critical tool in precisely identifying the cause of adnexal masses, assessing the likelihood of malignancy, and helping to guide clinical and surgical management. Based on the sonographic characteristics, clinical history, and menstrual status of the patient, the sonologist may further characterize the mass as benign, indeterminant, or malignant. Sonographically benign lesions such as simple or hemorrhagic functional cysts are often managed expectantly and do not require follow-up. On the other hand, indeterminant lesions, those that cannot be categorized as benign or malignant after thorough ultrasound evaluation, may require additional imaging, such as follow-up ultrasound or magnetic resonance imaging (MRI). This classification also includes low-risk malignancies, and therefore some of these masses can be surgically removed. Diagnosis of a probable malignant neoplasm prompts the ordering physician to refer the patient for gynecologic subspecialty care and usually more complex surgery, rather than laparoscopy.

ANATOMY AND PHYSIOLOGY

The adnexa are composed of structures lateral to the uterus: the paired ovaries, fallopian tubes, broad and round ligaments, and uterine and ovarian vessels. To correctly identify adnexal pathology, the sonologist must first be able to recognize what constitutes normal adnexal morphology.

Ovaries

The ovaries are the only truly intraperitoneal structures of the adnexa and appear ovoid or almond in shape. They are supplied by both the ovarian arteries and adnexal branches of the uterine

[a] Abdominal Imaging, Department of Radiology, Hospital of the University of Pennsylvania, 3400 Spruce Street, Philadelphia, PA 19104, USA
[b] Department of Radiology, Hospital of the University of Pennsylvania, 3400 Spruce Street, Philadelphia, PA 19104, USA
* Corresponding author.
E-mail address: goodbro93@yahoo.com

<div style="border: 2px solid red">

Box 1
Common sonographic appearance of adnexal masses

Cystic

    Functional cysts

    Corpus luteum (15%)

    Cystadenomas

    Paraovarian/paratubal cysts

Complex

    Hemorrhagic functional cysts

    Hemorrhagic corpus luteum

    Endometriomas

    Peritoneal inclusion cysts

    Hydrosalpinges or pyosalpinges

    Mature cystic teratomas

    Epithelial neoplasms

Solid

    Sex cord–stromal tumors (fibromas, thecomas)

    Malignant germ cell tumors

    Metastatic disease (breast, colon, stomach, appendiceal primaries)

    Brenner tumor

</div>

artery. They are covered by mesosalpinx, a fold of peritoneum that also surrounds the fallopian tubes.

Despite their numerous suspensory ligaments, the ovaries may vary considerably in position. In nulliparous women, the ovaries lie in the ovarian fossae, shallow depressions lateral to the uterus. The fossae are bordered by the external iliac vessels laterally and anteriorly and by the ureter and internal iliac vessels posteriorly. If the uterus is tilted to the right or the left, a normal anatomic variant, the ispilateral ovary may be displaced laterally. If the uterus is retroverted, the ovaries may lie on top of the uterine fundus. After pregnancy, the ovaries may remain in the superolateral position in which they were oriented to accommodate a gravid uterus. After hysterectomy, the ovaries may be found more lateral and caudad.

Ovarian size is usually discussed in terms of volume, which may be calculated by multiplying 0.5 to the product of 3 orthogonal measurements. The ovaries gradually enlarge as a girl approaches menarche. The accepted normal ovarian size in premenopausal women differs in the literature. However, reasonable maximum volumes may be considered to be 10 mL (9.8 $\pm$ 5.8) for premenopausal women and 6 mL (5.8 $\pm$ 3.6) for postmenopausal women.[1] In premenopausal women, a physiologic size discrepancy between the right and left ovary is common and typically of no clinical significance. Postmenopausal ovaries rarely show a significant size discrepancy, and therefore, ovaries that measure more than twice the volume of their contralateral counterpart are considered abnormal.

Histologically, the ovary is made up of an outer cortex, which contains follicles, and an inner medulla, which contains sex cord cells. The ovary also contains lymphatics, blood vessels, and nerves. As cortical and medullary ovarian cells are hormone sensitive, the appearance of the ovary fluctuates with each stage of the menstrual cycle. In the follicular phase (the first 14 days of a 28-day cycle), 5 to 12 thin-walled follicles of varying sizes are seen in the cortex. At ovulation, during midcycle, a dominant follicle averaging 22 mm in size releases its ovum. In the secretory phase (days 14–28), the ruptured follicle begins secreting progesterone, develops a thicker wall, and transforms into a corpus luteum. If conception does not occur, the corpus luteum gradually involutes and becomes sonographically imperceptible.

Fallopian Tubes

The fallopian tubes are paired, cylindrical, muscular structures that extend from the uterine cornu to the medial aspects of the ovaries. In contrast to the ovaries, the appearance of the fallopian tubes is generally static. They measure 8 to 12 cm in length and are supplied by tubal branches of the ovarian and uterine arteries. Anatomically, the tubes are divided into 4 segments, from proximal to distal: intramural segment, isthmus, ampulla, and infundibulum. The lateral aspects of the infundibuli contain fimbriae that open into the pelvic cavity. The tubal mucosa, or endosalpinx, is arranged in a distinctive plicae pattern, which becomes thicker toward the fimbriae. Although the mucosa is hormonally sensitive, these morphologic changes are not recognizable sonographically.

CLINICAL AND MORPHOLOGIC ANALYSIS OF ADNEXAL MASSES

A reasonable first step in evaluating an adnexal mass is to view it in the context of a patient's symptoms, age, menstrual status, and serum tumor marker levels.

Circumstances that tend to cause acute adnexal pain are acute hemorrhage into a functional or corpus luteum cyst, acute hemorrhage into an endometrioma, inflammation from pelvic infection,