Sonography of Adnexal Masses

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• Ultrasound • Ovarian neoplasm • Endometriosis • Fibroma

Transabdominal and transvaginal sonography are the community standard for the performance of pelvic sonography. Since their introduction, transvaginal probes have become the principal tools for evaluating the female pelvis.[1] Transabdominal imaging provides a global anatomic survey, whereas transvaginal imaging provides improved texture determination and characterization of the internal architecture of the ovary, vascular anatomy, and adnexal area. The location, size, consistency, and origin of adnexal masses may be defined with a combination of transvaginal and transabdominal scanning.[2,3] Transrectal ultrasound is performed whenever there is a contraindication to transvaginal scan, such as in the evaluation of the pediatric pelvis or in women who have never been sexually active. Transperineal scans also have a role to play in determining the origin and extent of some tumors. This article presents grayscale, color, and power Doppler features of common and uncommon benign and malignant adnexal masses.

SONOGRAPHIC EVALUATION OF THE ADNEXAL MASS

The benefit of ultrasound lies in its ability to characterize the mass and give significant insight as to its probable nature. Correlation of sonographic images with pathologic findings has led to a substantial understanding of adnexal abnormalities. The development of scoring systems to characterize and define ovarian lesions, first based on morphologic characteristics and later including color Doppler flow data, brought us closer to a relatively reliable distinction between benign and malignant lesions, or at least to a negative predictive value in the range of 97% to 99%. The use of grayscale ultrasound morphology to characterize a pelvic mass is based on "pattern recognition." Subjective evaluation of ovarian masses based on pattern recognition can achieve sensitivity of 88% to 100% and specificity of 62% to 96%. Such subjective evaluation is found to be superior to scoring systems. Pattern recognition is superior to all other ultrasound methods (eg, simple classification systems, scoring systems, and mathematical models for calculating the risk of malignancy) for discrimination between benign and malignant extrauterine pelvic masses.[4,5]

Benign Adnexal Lesions

The majority of ovarian masses are simple cysts (**Fig. 1**), most of which are benign. In this context, it is important to remember that the diagnosis of a "simple cyst" is based purely on ultrasound findings.

Functional ovarian cysts

Functional ovarian cysts result when a mature follicle does not rupture and the follicle continues to grow. Functional cysts include follicular cysts, serous inclusion cysts, corpus luteum, corpus albicans cysts, hemorrhagic cysts, and theca lutein cysts.[2,3,6] Most of these are simple cysts. Sonographically they appear unilocular, round, and anechoic with an imperceptible wall and posterior

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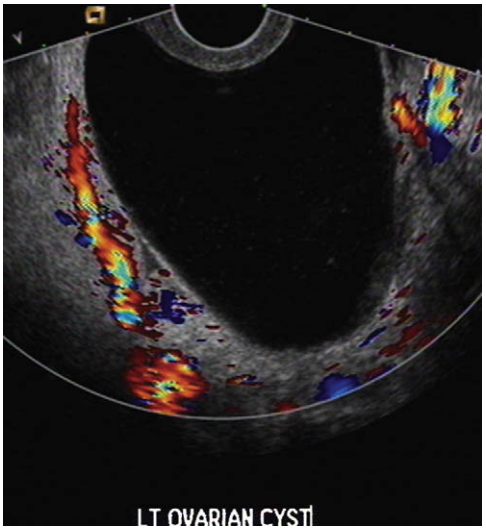

Fig. 1. Simple ovarian cyst. Transvaginal color flow Doppler image demonstrates a large simple ovarian cyst.

through transmission.[4] Functional cysts can become quite large but are usually less than 10 cm in size. These may produce discomfort or delayed menses but can be observed to regress within two menstrual cycles, although some persist for several months.

Corpus luteum cysts occur in the secretory phase of the menstrual cycle. Corpus luteal cyst in pregnancy reaches its maximum size by 7 weeks, and resolution occurs by 16 weeks. The corpus luteum can have a wide range of appearances on ultrasound (US) in the first trimester of pregnancy. The most common appearance is that of a round, thin-walled hypoechoic structure that demonstrates diffuse, homogeneous, low-level echoes. Other reported grayscale appearances (in order of decreasing frequency) include a cyst with a thick wall and anechoic center, a cyst that contains scattered internal echoes (**Fig. 2**A), and a thin-walled simple cyst that is similar in appearance to a follicular cyst.[7] On color flow Doppler sonography, it shows a typical "ring of fire" (**Fig. 2**B), and spectral Doppler examination reveals prominent diastolic flow.[8] The "ring of fire" appearance is secondary to increased vascularity in the periphery and is a nonspecific sign, because this may be seen in a mature Graafian follicle as well. Corpus luteal cyst of pregnancy is very vascular because of its hormonal status and may present with hemorrhage (known as a hemorrhagic corpus luteum), but the physiologic features are the same regardless of size.[2,3,9]

Any functional cyst may hemorrhage within and present as a hemorrhagic cyst (HC). The internal echo pattern varies with the stage of hemorrhage and the amount of fluid within the cyst. Evidence of posterior through transmission is typically present because of the cystic composition.[10,11]

The average diameter of an HC is 3.0 to 3.5 cm (range: 2.5–8.5 cm). The cyst wall is thin (2–3 mm), well defined, and regular.[12] US appearance of HC may have diffuse echogenic material within, diffuse echoes with visible fibrin strands, retracting thrombus, or a fluid–fluid level. Jain[13] described the occurrence of fibrin strands within an HC as a "fishnet" appearance (**Fig. 3**A). The presence

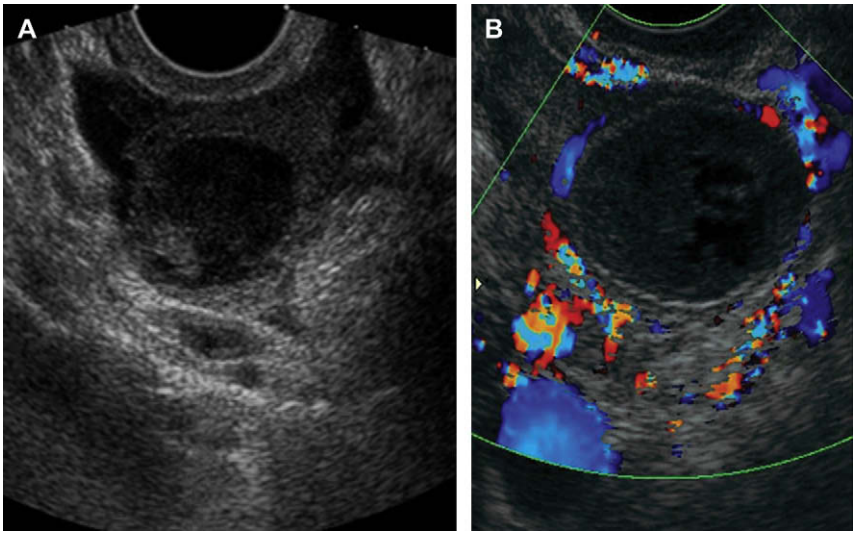

Fig. 2. Corpus luteum cyst. (*A*) Transvaginal grayscale image of the left ovary demonstrates a cyst with debris within, suggestive of hemorrhage in a corpus luteum cyst. (*Courtesy of* A. Khurana, MD, India). (*B*) Corresponding color flow Doppler image demonstrates peripheral vascularity—called the "ring of fire."