Ovarian lesions pose diagnostic dilemmas

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The main objective of imaging patients with symptoms suggestive of ovarian lesions is to distinguish benign findings from malignant disease. Masses can be characterized with a variety of noninvasive imaging techniques, including transabdominal and transvaginal ultrasound, CT, and MRI. Each of these modalities has its advantages and limitations.

The appearance of benign and malignant lesions on imaging can sometimes have overlapping characteristics, creating a diagnostic dilemma. This should be borne in mind, whichever modality is chosen.

Ultrasound is typically the first-line imaging tool. It is readily available, free from ionizing radiation, and able to provide important information on adnexal masses in certain cases. It can help determine whether a mass is ovarian or extraovarian, solid or cystic, simple or complex, and vascular or avascular. It can also be used to monitor lesions that are thought to be benign.

Ultrasound has a high sensitivity for the detection of malignant ovarian masses. Findings that are suggestive of a malignant ovarian mass are listed below:

- solid or cystic components;
- septations;
- evidence of surface nodularity or papillae;
- increased vascular flow;
- heterogeneous echotexture; and
- presence of abdominal ascites, hydrenephrosis, pleural effusions, and/or pelvic or abdominal lymph-adenopathy.

Physiologic cysts and benign tumors may have characteristics similar to malignant masses, however, and ultrasound's specificity for diagnosing ovarian malignancy is low.

CT is of limited value when characterizing adnexal masses. A contrast-enhanced CT scan can be used to stage the extent of disease in cases in which clinical and ultrasound findings are consistent with a diagnosis of ovarian cancer. The resulting images can be used to detect peritoneal seeding, pelvic sidewall disease, lymphadenopathy, and ascites. This information can then be used to determine the most appropriate course of treatment; for example, primary laparotomy with cytoreduction and surgical staging as opposed to image-guided peritoneal biopsy and primary chemotherapy.

MRI has a higher specificity than ultrasound for the identification of lesions as either benign or malignant. It may be used in this capacity when ovarian lesions cannot be characterized definitively from ultrasound, clinical findings, or tumor markers. Lipid, fluid, hemorrhage, smooth muscle, fibrosis, and solid tissue all have typical imaging features on MRI. This information can often be used to establish their presence in adnexal masses.

Practitioners should still take care to avoid recognized pitfalls. Certain benign ovarian lesions may have a complex appearance on MRI and possess imaging features that are suggestive of malignancy. Some lesions that have obviously benign features may also undergo malignant change.

**BENIGN LESIONS**

The most common solid benign ovarian neoplasm is the fibroma. This lesion, often found in postmenopausal women, is composed of spindle cells that produce a variable amount of collagen.
and are not hormonally active.
Fibromas are typically unilateral, solid, and homogeneous, and they tend to measure up to 3 cm across. They are hypoechoic on ultrasound and have extremely low signal intensity on T1- and T2-weighted MRI, as does muscle. Contrast enhancement is moderate. Fibrothecomas (Figure 1A) contain fibrous tissue and theca cells and are often hormonally active.

Diagnosis can be complicated in cases of Meigs' syndrome, an unusual manifestation in which the fibroma is associated with ascites and pleural effusions. The appearance of a torted fibrothecoma can also cause diagnostic problems (Figure 1B). The mass becomes markedly heterogeneous, with areas of hemorrhagic infarction and necrosis. Fewer than 1% of fibromas undergo malignant transformation to become fibrosarcomas.

Sarcoidosis of the genital tract is a rare condition. Ovarian sarcoid is rarer still. Only seven cases of ovarian involvement have been reported in the English language literature to date. Lesions tend to be unilocular cystic masses, measuring approximately 5 to 15 cm in diameter. They are bilateral in 12% of cases. Almost all dermoids contain lipid material—either sebaceous or adipose tissue—and ectodermal structures such as hair, teeth, and skin. Most of the hair arises from a prominent solid component known as a Rokitansky nodule, which, when present, projects into the cyst cavity. Any teeth or bone will generally be found in this area.

Dermoids can contain variable cystic and solid components. A few will show septa within the cystic component. Solid components do not enhance when the lesion is benign, but in cases of malignant degeneration (fewer than 2%), enhancement of these solid components will be observed (Figure 3). Endometriomas are circumscribed masses of endometrial tissue that occur outside the uterus. The mean age at diagnosis is 25 to 30 years, though endometriomas have been reported in girls as young as 11 years old. The deposits can occur anywhere in the pelvis or outside the abdomen, though they are most easily recognized on the ovary and broad ligament.

Because endometriomas contain old blood, they are also known as the “chocolate cyst.” Wall thickness varies, and highly reflective foci or flecks of calcification may be seen within the wall. Diagnostic difficulties can occur when septations create multilocular cysts. The existence of locules containing blood of different ages can produce varying signal intensities on MRI, again complicating the diagnosis. If malignancy arises within an endometriotic cyst, the solid components will enhance on MRI when contrast is administered.

Tubo-ovarian abscesses are present in 14% to 18% of patients hospitalized with pelvic inflammatory disease. Initial inflammation in the endometrium may spread to the adnexa via the fallopian tubes. Imaging typically reveals a pyosalpinx, or pus-filled fallopian tube, with a serpiginous contour. If this has an enhancing thickened wall, septations, and ascites, it may be difficult to distinguish the abscess from ovarian cancer. Strong clinical correlation is essential and imaging follow-up advised. Many imaging findings of abdominal and pelvic tuberculosis, including those of ovarian tuberculosis (Figure 4), overlap with those of other pathologies. Findings can readily simulate an ovarian or gastrointestinal primary cancer. Imaging may reveal the presence of loculated ascites, omental cake, peritoneal thickening, pleural effusions, para-aortic lymphadenopathy, and a complex adnexal mass.

Acid-fast bacilli may be obtained from ascitic fluid to aid diagnosis. Sarcoidosis of the genital tract is a rare condition. Ovarian sarcoid is rarer still. Only seven cases of ovarian involvement have been reported in the English language literature to date. Radiological findings of ovarian sarcoidosis are not specific. The lesions tend to be cystic, demonstrate enhancement in the septae, and have thick walls that also enhance (Figure 5).

Pelvic lymphadenopathy may be present as well. Ovarian sarcoidosis is, however, associated with other systemic findings. Biopsy results will reveal noncaseating granulomata.

Lymphoceles (Figure 6), abnormal collections of lymphatic fluid that can occur following lymphadenectomy, follow the line of blood vessels. Lymphoceles may appear complex, presenting with thick walls or septations, and may mimic ovarian lesions.

**MALIGNANT MASSES**

Ovarian cancer is the second most common gynecological malignancy but the leading cause of death in this group of cancers. Mortality as a result of ovarian malignancy has decreased during the last two decades but only minimally, in contrast to other gynecological cancers, where more
progress has been made regarding survival rates. Primary lesions include epithelial ovarian carcinoma (70% of all ovarian malignancies), germ cell tumors, sex-cord stromal tumors, and other rarities.\(^1\) Metastatic spread to the ovaries is relatively frequent, most commonly from primary tumors in the endometrium, breast, colon, and stomach. Malignant ovarian lesions typically appear as complex solid/cystic adnexal masses on imaging. Any solid components will enhance following administration of contrast.\(^9\)

Epithelial ovarian cancer is thought to arise from the epithelium covering the ovaries, which is derived from the coelomic epithelium in fetal development. An epithelial cancer is typically a complex cyst with septations. It will be partially cystic and contain solid components that enhance on imaging with contrast. The surface may be smooth or covered in papillary projections. The five main histological subtypes of epithelial ovarian cancer are serous, endometrioid, mucinous, clear cell, and Brenner tumors. Metastatic spread typically involves the peritoneal cavity, surface of the liver, mesentery, serosa of the large and small bowel, omentum, uterus, and para-aortic and pelvic lymph nodes. It can also spread to the pleural cavity, lungs, precardiac lymph nodes, and groin lymph nodes. Malignant germ cell tumors include dysgerminoma, endodermal sinus tumor, malignant teratoma, embryonal carcinoma, and choriocarcinoma.\(^1\) The most common of these is dysgerminoma, which accounts for 3% to 5% of all ovarian cancers. Malignant germ cell tumors, which are derived from primitive germ cells in the embryonic gonad, are more common in young women but occasionally occur in infants and older women. Sex-cord stromal tumors make up fewer than 5% of all ovarian tumors. This classification covers granulosa cells (the most common malignant sex-cord stromal tumor), sertoli cells, and the specialized stroma of the genital ridge.\(^1\) All tend to secrete sex hormones.

Metastatic spread to the ovary (Figure 7) can originate from another gynecological cancer, such as endometrial or cervical cancer, or from breast, colon, or stomach cancer. Metastasis from a signet-ring stomach cancer produces bilateral enlargement of the ovaries, known as a Krukenberg tumor. In all cases, spread may occur via direct invasion, via the bloodstream or lymphatic system, and/or within the peritoneal cavity.

Imaging features characteristic of malignant ovarian disease are now well recognized. A degree of overlap remains, however, in the appearance of benign and malignant lesions. Radiologists should remain aware of unusual manifestations and pitfalls when diagnosing ovarian lesions. Cross-sectional imaging is vital in the characterization of ovarian lesions. Ultrasound and, in particular, MRI are the most sensitive and specific imaging modalities in providing diagnostic information that will aid the clinician in selecting the most appropriate clinical management plan. DR. PIERCE, DR. NARAYANAN, DR. SAHDEV, PROF. REZNEK, and DR. ROCKALL are radiologists at St. Bartholomew's and The Royal London NHS Trust in the U.K.

References


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