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REVIEW ARTICLE

Adnexal Masses in Pregnancy

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ABSTRACT

With the increased use of ultrasound in the first trimester, up to 4.5% of all pregnancies are diagnosed with an adnexal mass. The management of asymptomatic adnexal masses in pregnancy continues to be controversial. Potential complications include torsion and malignancy. This review will highlight the utility of ultrasound in generating a differential diagnosis for an adnexal mass based on their ultrasound characteristics. It will also review management options for the asymptomatic patient including expectant management and laparoscopic removal.

Keyword: Adnexal mass, Expectant management, Laparoscopy, Pregnancy.

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INTRODUCTION

With the implementation of routine ultrasonography in pregnancy, the incidental finding of an adnexal mass during pregnancy has become more common.[1] The majority of these masses are found to be benign and resolve spontaneously, but some will be found to be malignant. In addition, some benign masses can result in complications that can have adverse effects on the health of the mother or the fetus. Management of these masses is important for practicing clinicians, but guidelines for diagnosis and treatment can be controversial.

INCIDENCE

The reported incidence of adnexal masses in pregnancy varies based on their characteristics including size and persistence.[2,3] Most studies document rates of adnexal masses in pregnancy to be low. Nazer et al[4] performed a population-based review of almost 8 million births and reported an overall incidence of adnexal masses to be 0.25%.[4] Glanc et al[5] reported a 5.3% incidence of simple ovarian cysts defined as greater than or equal to 3 cm in the first trimester in a study of over 10,000 pregnancies. In this cohort, most had resolved by the 2nd trimester; only 1.5% had persistent cysts beyond 14 weeks gestation. Bernhard et al[6] documented an incidence of 2.3% in a cohort of over 18,000 obstetric ultrasounds. The majority of these (75%) were simple cysts smaller than 5 cm. Typically, these cysts were presumed to be corpus luteum or other functional cysts and were shown to resolve spontaneously. The other 25% of masses in this group were large and complex. Even among patients with large masses, there was over 90% spontaneous resolution rate with observation alone. No adverse outcomes, such as surgery, ovarian torsion, or malignancy were reported in this cohort. Goh et al[7] reviewed over 24,000 pregnancies and found a 4.9% incidence of adnexal masses in pregnancy. Persistent masses larger than or equal to 5 cm were observed in only 0.7% of these patients. Given the widespread use of obstetric ultrasound, many asymptomatic masses are incidentally detected on ultrasound (seven). Other masses are found when patients present with a palpable mass or other symptoms, which may be nonspecific (e.g. pelvic pain, back pain, urinary, or bowel symptoms) (three). Still other women may have a mass found as a result of an unexplained elevation of serum analytes detected on maternal aneuploidy screening (seven).

DIFFERENTIAL DIAGNOSIS

Although it seems that the majority of adnexal masses in pregnancy resolve with observation alone, some may persist and can be associated with adverse outcomes. Ultrasound characteristics of persistent masses can be vital in generating a differential diagnosis (Table 1).[8,9] The majority of simple cysts are physiologic or functional cysts or may be unilocular serous or mucinous cystadenomas.[10] Complex features seen on ultrasound can be associated with corpus luteum, teratomas, endometriomas, or theca lutein cysts. Solid masses may represent fibromas or leiomyomas. The most common types of persistent adnexal masses found during pregnancy are dermoids followed by cystadenomas.[7,10]

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Table 1: Differential diagnoses of adnexal masses in pregnancy

Benign			
Simple	*Complex*	*Solid*	*Malignant*
Functional cyst Hydrosalpinges Physiologic cyst Ovarian hyperstimulation Paratubal/ tubal cyst	Dermoid Endometrioma Hemorrhagic cyst Corpus luteum Cystadenoma Theca lutein cyst Cystic teratomas	Leiomyomas Fibromas	Primary/ metastatic tumors (epithelial, germ cell, sex cord stromal) Sarcoma

DIAGNOSTIC MODALITIES

Ultrasound

Ultrasound (transvaginal or transabdominal) is often the best first-line imaging modality used to evaluate adnexal masses in pregnancy.[8] The majority of studies evaluating the use of ultrasonography during pregnancy show high diagnostic accuracy based on common sonographic features (Table 2).[3,5,11–14] In addition, sonographic findings suggestive of malignancy seem to be consistent in the pregnant and nonpregnant patient. These features include masses with septations, solid parts, nodules, papillary components, or an average size of greater than 5 cm in diameter.[13]

Table 2: Sonographic findings of benign adnexal masses in pregnancy

Type of mass	*Sonographic feature*
Corpus luteum	Ring of fire with Doppler
Follicular cyst	Simple cyst <10 cm; sometimes debris present
Hemorrhagic cyst	"Fishnet" (fine interdigitating lines); no flow with Doppler
Dermoid cyst	Rokintansky nodule (hyperechoic nodule with acoustic shadowing in a background of low-level echoes) "Tip of the Iceberg" phenomenon—highly echogenic cyst with contents of sebum and hair causes posterior attenuation of sound "Dermoid mesh" (multiple interdigitating lines and dots which are seen when hair is floating in sebum)
Serous cystadenoma	Large simple cyst >5 cm Thin septations or papillary formations
Mucinous cystadenoma	>5 cm in diameter Multiple septations Heterogeneous appearance
Endometrioma	Round thick regular wall Diffuse homogenous low-level internal echoes (chocolate cyst) Calcifications with acoustic shadowing
Leiomyomas	Not attached to the ovary Round regular wall Central necrosis (if outgrowing blood supply)
Paraovarian cyst	1 to 2 cm simple cysts Not attached to the ovary

Zanetta et al[15] prospectively followed 82 cysts in 79 pregnant women. Expectant management was used except in symptomatic patients or suspected malignancy (which was defined as solid parts, irregular capsule or border, ascites, and irregular vascularization). This group showed that ultrasound allows for the differential diagnosis of benign complex masses and even borderline-like tumors. Similarly, other studies have shown that the more complex a mass is on ultrasound (septations and solid components), the higher is the risk of malignancy.[13,16] Whitecar et al[3] showed that 89 of 91 masses diagnosed as a simple cyst on ultrasound were found to be benign when examined pathologically. Bromley and Benacerraf[17] demonstrated the accuracy of ultrasonography alone in the diagnosis of dermoids, endometriomas, and simple cysts in a cohort of 125 pregnant patients with ultrasonographic diagnosis matching surgical pathology 95, 80, and 71% of the time respectively.

Doppler flow evaluations have been used to improve the sensitivity of ultrasound in diagnosing malignancy in nonpregnant patients. Unfortunately, there is a significant overlap in the blood flow patterns between malignant and benign lesions in pregnancy.[18] Thus, Dopplers do not aid in diagnosis of malignancy of adnexal masses in pregnancy.

Magnetic Resonance Imaging

In cases wherein ultrasonography is suboptimal or nonspecific (due to patient habitus or positioning of mass in relation to other pelvic structures), magnetic resonance imaging (MRI) can be safely used to better characterize adnexal pathology.[19] Unlike computed tomography (CT), which exposes the mother and fetus to 2 to 4 rads per examination, MRI is considered to be well-tolerated in pregnancy and can be useful in evaluating up to 20% of sonographically indeterminate adnexal lesions.[20] Masses of uncertain origin or with complex features can be evaluated with MRI, which has been shown to be accurate for identifying the origin of a mass and characterizing its tissue content. Magnetic resonance imaging may also be useful in staging, to evaluate the extent of invasive malignant disease, and in diagnosing bowel processes, such as appendicitis or inflammatory bowel disease.

Tumor Markers

The interpretation of tumor markers can be challenging during pregnancy. CA-125, a commonly used epithelial ovarian cancer tumor marker, can be elevated in pregnancy during the first trimester and postpartum in normal pregnancy.[21] However, a dramatically elevated CA-125 (1000–10,000) in the second trimester or beyond should alert the clinician to the possibility

of a malignancy. Serum markers used for aneuploidy screening may also be elevated in the setting of an ovarian malignancy in pregnancy. Alpha feto-protein elevations (greater than nine multiples of the median) can be seen with germ cell tumors.[22] Other tumor markers, such as beta human chorionic gonadotropin and lactate dehydrogenase are of limited value in pregnancy because their levels can be altered by pregnancy alone. As a general rule, tumor markers should not be routinely drawn in pregnancy, as their utility may be limited. However, in the setting that tumor markers have already been drawn or an abnormality is incidentally detected in routine aneuploidy screening, results should be interpreted in the context of the physiologic changes of pregnancy.

COMPLICATIONS OF ADNEXAL MASSES

The most worrisome complications associated with persistent masses in pregnancy include malignancy or adnexal torsion.

Rates of malignancy are low, but a malignant mass in pregnancy can significantly affect maternal and fetal outcomes. Nazer et al[4] reported a rate of malignancy of 0.49% among patients who had diagnosed adnexal masses with an overall malignancy rate of 0.12 per 10,000 deliveries. Smith et al[23] performed a population-based review of over 3 million deliveries and found that ovarian cancer was the 5th most common malignancy diagnosed during pregnancy (0.04 cases per 1000 pregnancies) after breast, thyroid, cervical and Hodgkin's disease. Leiserowitz et al[11] analyzed California hospital discharge records from 1991 to 1999 and found a 0.93% incidence of ovarian malignancy in pregnancy (or approximately 1 cancer per 56,000 deliveries). A total of 1.25% of these masses were borderline tumors. Therefore, the cumulative incidence of clinically relevant ovarian neoplasms in pregnancy was 1 in 23,800 deliveries. The specific maternal mortality rate in this cohort was 4.7%. When the Leiserowitz cohort was examined pathologically, 51% were epithelial and 39% were germ cell tumors, primarily dysgerminomas and malignant teratomas. The lower stage and higher proportion of germ cell tumors are consistent with the generally younger age of pregnant women.

The management of malignant pathology in pregnancy should be multidisciplinary comprising of obstetricians, neonatologists, medical and gynecologic oncologists, and psychologists.[24] After surgery, chemotherapy regimens are generally prescribed, but these drugs have risks of fetal toxicity that are mainly related to the gestational age. During organogenesis (between weeks 4 and 12 of gestation), there is a high susceptibility to teratogens and fetal malformation.[25] During the second and third trimesters, chemotherapy can be associated with growth restriction and prematurity, though the risk of malformations is low.[26] Other maternal risks related to malignant adnexal masses include increased risk for cesarean section[4,23,26], increased rate of hysterectomy at the time of delivery,[2,4] and increased risk of venous thromboembolic events[4]. Fetal risks include an increased risk of premature delivery that may be due to the nature of the disease, the medical or surgical interventions during pregnancy including chemotherapy or radiation, or an elective preterm delivery.[4,26]

Torsion is also a potential complication of adnexal masses during pregnancy. Torsion accounts for 3% of all surgical emergencies of acute gynecologic complaints.[27] The incidence of ovarian torsion in pregnancy is felt to be a rare event, with a reported incidence of 1 to 10 per 10,000 spontaneous pregnancies.[28] In a multicenter cohort, Goh et al[7] found that of 12 of 118 patients admitted with an adnexal mass and pain, 10 were found to have ovarian torsion (8.5% incidence). This was similar to an earlier study by Schmeler et al[29] that found a 6.8% incidence of ovarian torsion in pregnancy of masses measuring greater than 5 cm. Hasson et al[28] showed that the presentation of adnexal torsion is similar in pregnant and nonpregnant women, and the majority presented with a chief complaint of acute abdominal or pelvic pain that lasted for several hours. Interestingly, 43% of pregnant women with ovarian torsion had peritoneal irritation signs compared with only 19% of nonpregnant patients. In both pregnant and nonpregnant patients, there was high false-negative normal Doppler blood flow in patients later found to have surgically confirmed torsion. Pregnancies conceived through assisted reproductive techniques are at an increased risk of ovarian torsion, likely because of the increased risk of ovarian hyperstimulation.[30] Smorgick et al[30] reviewed 38 cases of surgically proven torsion in pregnancy and found that 49% were conceived either through ovulation induction or *in vitro* fertilization. The size of an adnexal mass may play a role in the risk of torsion. Koo et al[27] reported that masses 6 to 10 cm in size had a significantly higher risk of torsion than masses less than 6 cm or larger than 10 cm. Yen et al[31] prospectively followed 174 pregnant patients with adnexal masses and found that masses measuring between 6 and 8 cm in size had a 22% incidence of ovarian torsion.

Ovarian torsion occurs most commonly in the first trimester.[27,31] Koo et al[27] reported an incidence of 68% in the first trimester, 20% in the second, and 22% in the third. Yen et al[31] found that 60% of ovarian torsions occurred between the 10th and 17th week of gestation, and only 6% occurred after 20 weeks.

Other adverse effects from an adnexal mass have been reported in pregnancy. Increased risk of cesarean

section, as discussed above in malignancy, may also be true for benign masses as well. Goh et al[7] reported that 25% of patients who had an adnexal mass underwent a cesarean section for labor dystocia. There are also reports of hemoperitoneum resulting from ovarian rupture from enlarged adnexal masses.[32]

MANAGEMENT

Although the majority of adnexal masses have been shown to spontaneously resolve, management options of persistent masses can be controversial and involve either surgery or expectant management.

When there is concern for malignancy or if a patient is symptomatic, surgical intervention is warranted when surgical intervention is undertaken, the optimal time for this is in the early second trimester. Traditionally, if the mass was solid or had mixed solid and cystic features and ascites, a midline laparotomy was performed to remove the mass, obtain a diagnosis, examine the contralateral ovary, obtain peritoneal washings, and complete a staging procedure if malignancy was confirmed.[22] Until the 1990s, pregnancy had been considered a contraindication to use laparoscopy. The laparoscopic approach in pregnancy for maternal ovarian torsion offers several advantages over an open laparotomy, including decreased postoperative pain, lower narcotic use, and lower wound infection rates.[33] Koo et al[34] analyzed 88 patients who underwent laparoscopic surgery for adnexal masses in pregnancy (mean gestational age 11.6 weeks) and found that obstetrical complications, such as low birthweight, preterm birth, tocolysis, low Apgar scores, and fetal anomalies were not common. In addition, they reported no cases of perinatal loss. Some concerns of laparoscopic surgery in pregnancy are decreased uterine blood flow, carbon dioxide absorption, fetal hypotension, and fetal hypoxia.[22] In an analysis of women undergoing both first and second trimester laparoscopic procedures, mean uterine resistance index and umbilical artery pulsatility index remained constant during the procedures, indicating that laparoscopy did not modify uteroplacental perfusion.[35]

The incidence of detection of adnexal masses at the time of a cesarean delivery is 1 in 329.[36] Up to 5% of the masses were bilateral and the majority were mature cystic teratomas that were preoperatively undiagnosed. The recommendation is for cystectomy for a simple cyst and excision when the mass is large or heterogeneous in nature, in order to obtain pathologic analysis.[37] It is also recommended that paraovarian or paratubal cysts be removed so as not to confound future imaging studies.

Expectant management is another option in the treatment of adnexal masses in pregnancy. Some of the benefits of this practice include avoidance of surgery and its associated complications. The risk of expectant management is the risk of torsion that could have been avoided with a laparoscopic procedure, along with the risk of pregnancy loss with emergent surgery. Goh et al[7] reviewed 126 pregnancies complicated by persistent ovarian masses greater than or equal to 5 cm. A total of 8.3% of this cohort were diagnosed with ovarian torsion. They found that the majority of patients with adnexal masses can be conservatively managed if there are no ultrasound findings suspicious for malignancy, without a significant increase in antenatal or postpartum complications. Schmeler et al[29] reviewed 177 pregnancies with adnexal masses. One-third of this cohort had surgery for torsion or suspicion for malignancy. The remaining patients were observed and operated via cesarean section or postpartum, again without significant differences in obstetrical outcomes between the patients who had antepartum surgery and those managed expectantly. There is no consensus on the management strategies of ovarian masses with reference to the size of the mass. Recently, Koo et al[27] analyzed over 470 women with adnexal masses who underwent surgery during their pregnancies. Masses larger than 15 cm had a 12-fold higher risk of malignancy than the masses that measured less than 6 cm. For masses of 10 to 15 cm, however, the risk of malignancy was not higher than those of masses less than 6 cm. Earlier reviews have used cutoffs of 5 cm to triage patients after a diagnosis of adnexal masses is made.[38] Glanc et al[38] recommend serial ultrasounds in asymptomatic women with a mass greater than 5 cm until 16 weeks to allow for spontaneous resolution of the mass. If the mass increased in size or complexity, then further evaluation (by imaging or surgery) was recommended.

CONCLUSION

The majority of adnexal masses diagnosed during pregnancy will be benign. Ultrasonography is the most useful and accurate tool for characterization of adnexal masses. Laparoscopy in pregnancy is well-tolerated and should be the primary management option if patients are acutely symptomatic or if malignancy is suspected. For asymptomatic patients, prophylactic removal and expectant management are both reasonable options. Expectant management may best serve patients who wish to avoid the risks associated with surgery in pregnancy. However, these patients should be counseled on the risk of torsion and the possibility of the need for a more invasive procedure later in gestation. Additional prospective studies are needed to determine the best treatment plan for patients with an adnexal mass in pregnancy.

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