Adnexal Pathology in Pregnancy

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Maria Andrikopoulou, Anthony M. Vintzileos, Andrea Tinelli, and Farr R. Nezhat

6.1 Introduction

The increasing use of antenatal ultrasound and screening during the first trimester of pregnancy has led to an increased incidence of adnexal pathology diagnosis. Even though adnexal pathology is most commonly associated with masses of ovarian origin (Fig. 6.1), it can also include causes of tubal and paratubal pathology (Fig. 6.2) as well as pedunculated fibroids (Fig. 6.3), which in imaging may appear to be extrauterine. The incidence of an adnexal mass in pregnancy ranges from 1 to 10 % depending on the population studied, the frequency of ultrasound use, and the gestational age at the time of the ultrasound exam [1–3]. The incidence of adnexal masses is higher in the first trimester (Fig. 6.4) because most of them are of benign cystic ovarian origin and approximately two thirds will resolve spontaneously later in pregnancy [3]. The risk of malignancy of an adnexal mass is very low. A population-based study of more than 4 million obstetrical patients has reported that the incidence of ovarian cancer is as low as 0.93 % [4]. Another report of 130 cases of adnexal masses, which were managed surgically, has estimated a higher risk of malignancy or borderline malignancy at 6.1 % [5]. Other risks associated with adnexal masses during pregnancy that contribute to maternal morbidity include torsion, rupture, bleeding, infection, and labor obstruction (Fig. 6.5) [3]. It should be noted that the overwhelming majority of patients are asymptomatic at the time that an adnexal mass is discovered by ultrasound (Fig. 6.6). However, in some cases, it presents with abdominal pain secondary to rupture, torsion, infection, or bleeding [6–9].

Most first-trimester cystic adnexal masses will resolve spontaneously during the second trimester. However, controversy exists regarding the diagnosis and management of a persistent adnexal mass since the risks and benefits of certain diagnostic and surgical options should be carefully balanced.

M. Andrikopoulou, MD, PhD (✉) • A.M. Vintzileos, MD
Department of Obstetrics and Gynecology,
Winthrop-University Hospital, Mineola, NY, USA
e-mail: maria_andrik@hotmail.com

A. Tinelli, MD, PhD
Department of Obstetrics and Gynecology, Vito Fazzi Hospital, Lecce, Italy

Laboratory of Human Physiology, The International Translational Medicine and Biomodelling Research Group, Department of Informatics and Applied Mathematics, Moscow Institute of Physics and Technology (State University), Dolgoprudny, Moscow Region, Russia

Institute of Physics and Technology (State University), Moscow, Russia

Division of Experimental Endoscopic Surgery, Imaging, Technology and Minimally Invasive Therapy, Department of Obstetrics & Gynecology, Vito Fazzi Hospital, Lecce, Italy

F.R. Nezhat, MD
Department of Obstetrics and Gynecology,
Winthrop-University Hospital, Mineola, NY, USA

Department of Obstetrics and Gynecology,
New York-Presbyterian/Weill Cornell, New York, NY, USA

Fig. 6.1 Ultrasonographic image showing a right ovarian cyst at 6 weeks and 5 days of pregnancy

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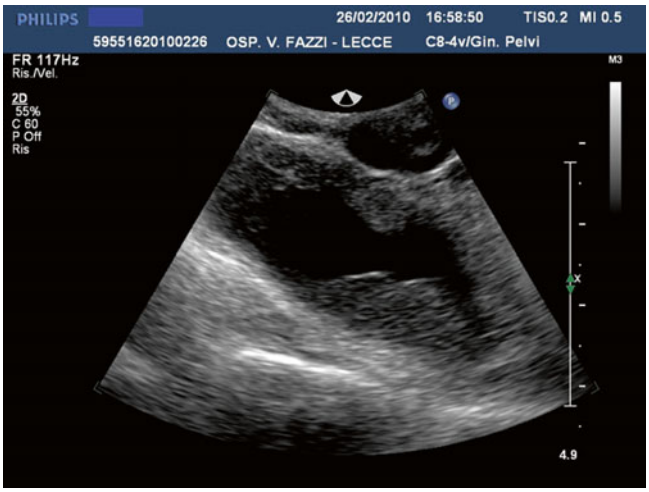

Fig. 6.2 Ultrasonographic image showing a left sactosalpingitis in early pregnancy

Fig. 6.5 A left ovarian mucinous cystadenoma removed during cesarean section, causing labor obstruction

Fig. 6.3 Ultrasonographic image showing a pedunculated anterior fibroid of 4 cm in diameter (*in the with ring*), at 30 weeks of pregnancy

Fig. 6.6 A right serous adnexal cyst discovered occasionally during a first-trimester scanning

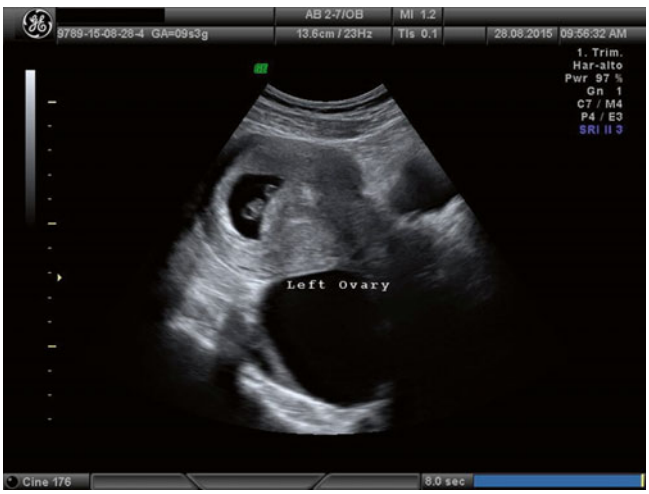

Fig. 6.4 Ultrasonographic image showing a left ovarian cyst at 9 weeks of pregnancy

6.2 Causes of Adnexal Pathology in Pregnancy

The most common causes of adnexal pathology in pregnancy are functional or hemorrhagic cysts (Fig. 6.7), which usually resolve later in pregnancy (Fig. 6.8). However, the differential diagnosis should also include benign ovarian masses such as dermoids (Fig. 6.9), serous and mucinous cystadenomas, endometriomas, fibroids, and adenofibromas (Fig. 6.10) [5, 10]. Adnexal masses specific to pregnancy include luteomas, hyperreactio luteinalis, and theca lutein cysts, especially in the presence of a molar pregnancy or hyperstimulation (Fig. 6.11) secondary to infertility treatment [11]. Tubal pathology includes heterotopic pregnancy (Fig. 6.12a, b), tubo-ovarian abscess, hydrosalpinx, and paratubal cysts. Uterine fibroids can also appear as adnexal masses in

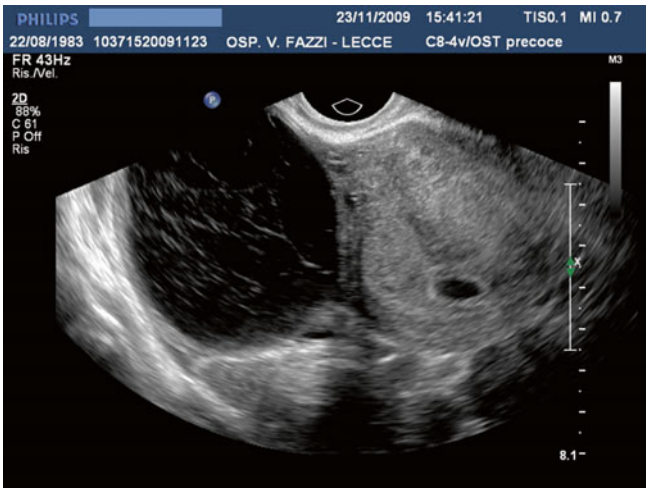

Fig. 6.7 A left hemorrhagic cyst detected in the first trimester of pregnancy

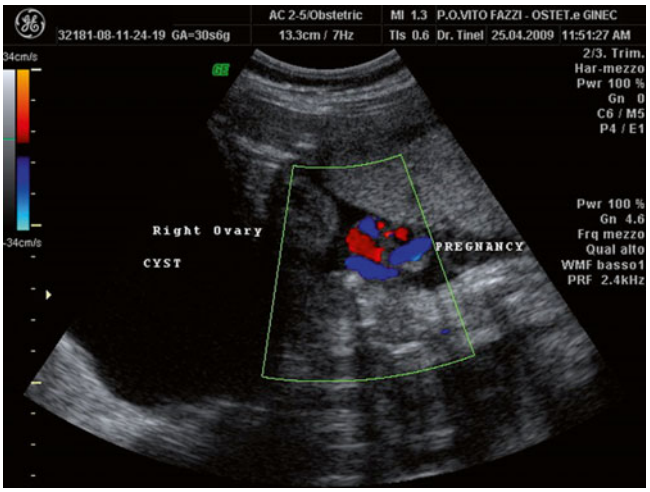

Fig. 6.8 Right functional cyst reducing in diameter at 30 weeks of pregnancy (disappeared at the term of pregnancy)

imaging. Even though the incidence of malignancy is low, epithelial tumors, germ cell tumors, and sex stromal tumors should be included in the differential diagnosis. A study of Leiserowitz et al., which examined pathologically cases of ovarian cancer in pregnancy in a large cohort of obstetrical population, showed that the majority of cases were epithelial, both malignant and borderline (51 %) [4]. Germ cell tumors were the second most common malignancy, with predominance of dysgerminomas and malignant teratomas.

6.2.1 Ovarian Pathology

6.2.1.1 Simple and Hemorrhagic Cysts

Simple and corpus luteum hemorrhagic cysts account for the majority of adnexal masses in pregnancy, and usually they regress spontaneously in the second trimester [12].

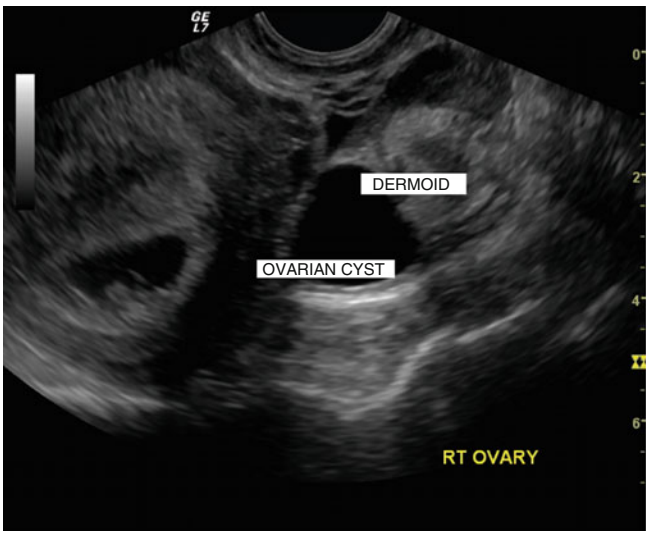

Fig. 6.9 A right ovarian cyst in pregnancy, with a dermoid mass inside

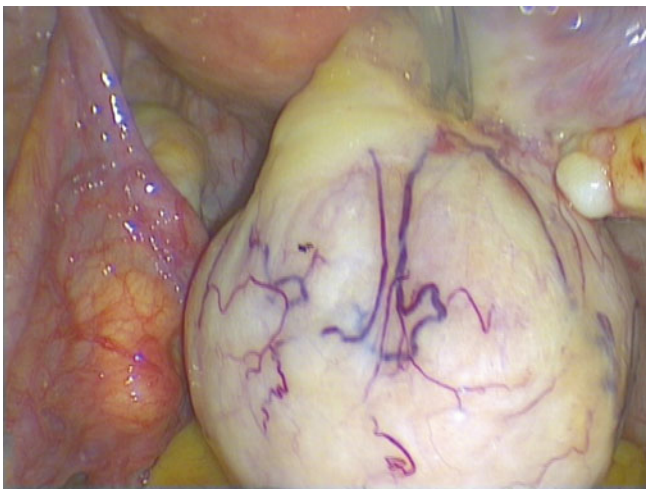

Fig. 6.10 A laparoscopic image of a right-twisted ovarian adenofibroma at 9 weeks of pregnancy

Fig. 6.11 An ovarian hyperstimulation at 9 weeks of pregnancy

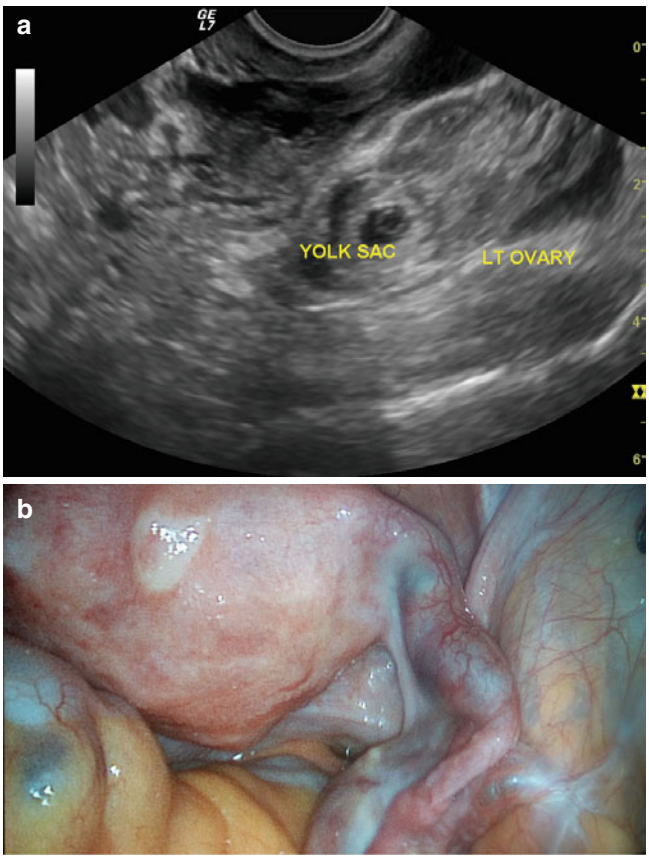

Fig. 6.12 (**a**) An ultrasonographic image showing a left heterotopic tubal pregnancy and (**b**) a laparoscopic image of a right tubal pregnancy

A simple ovarian cyst usually presents as a simple anechoic adnexal mass, whereas a hemorrhagic corpus luteum cyst presents as a complex mass with diffusely thick wall and peripheral vascularity. The best predictors for the persistence of these masses are complex appearance on sonography and the size of the mass [13]. Masses with diameter larger than 5 cm have higher likelihood to persist during pregnancy.

6.2.1.2 Endometriomas

An endometrioma is a rare entity in pregnancy (Fig. 6.13) [14, 15]. It usually presents as a unilocular cyst with diffuse homogeneous ground-glass echoes. Complications during pregnancy, such as rupture, have been reported in the literature [16]. However, it is not clear whether endometriomas in general are associated with adverse obstetrical outcomes. Some studies have suggested that the presence of endometriomas during pregnancy is associated with complications such as preterm birth, antepartum hemorrhage, and preeclampsia [17, 18], whereas other investigations have failed to show increased risk for obstetrical complications [19].

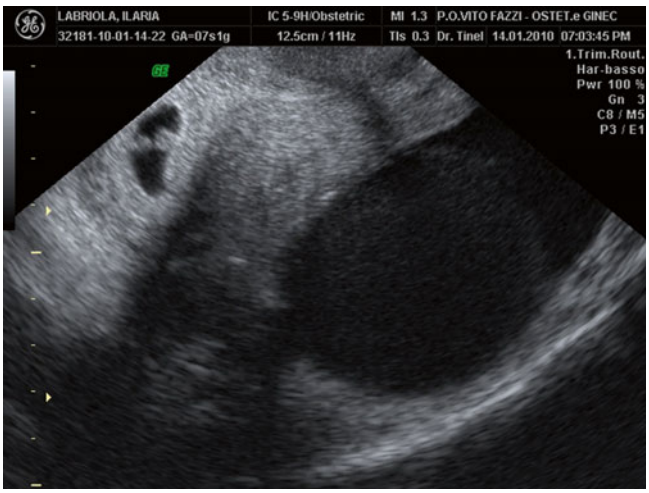

Fig. 6.13 A small right ovarian endometrioma in a pregnant at 7 weeks

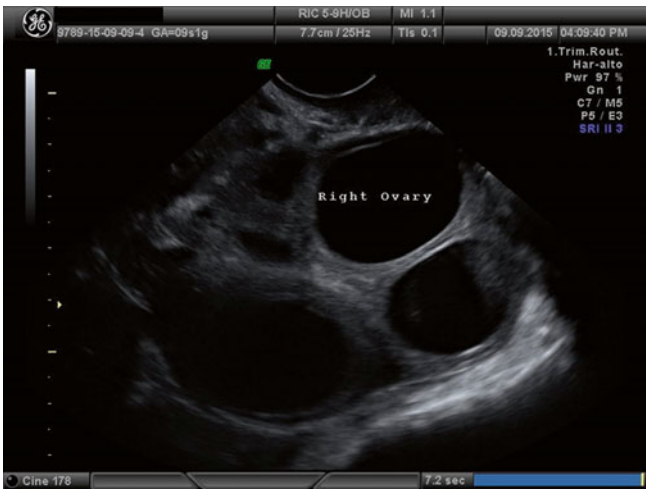

Fig. 6.14 A right enlarged ovary hyperstimulated, with multiple peripherally located cysts

6.2.1.3 Ovarian Hyperstimulation

Ovarian hyperstimulation during in vitro fertilization-embryo transfer is a risk factor for developing adnexal torsion in pregnancy. The syndrome presents with enlarged ovaries with multiple peripherally located cysts (Fig. 6.14) and in the majority of the cases is self-limited. However, there have been reports in the literature of adnexal complications during pregnancy such as hemorrhage and torsion [11, 20, 21].

6.2.1.4 Leiomyomas

Uterine fibroids are very common findings in women of reproductive age. In pregnancy, solid adnexal masses very commonly present as subserous (Fig. 6.15), intramural (Fig. 6.16), pedunculated fibroids or fibroids located in broad ligament. Approximately one third will increase in size, whereas a small percentage will undergo red/carneous

Fig. 6.15 An anterior subserous uterine body fibroid at 20 weeks of pregnancy

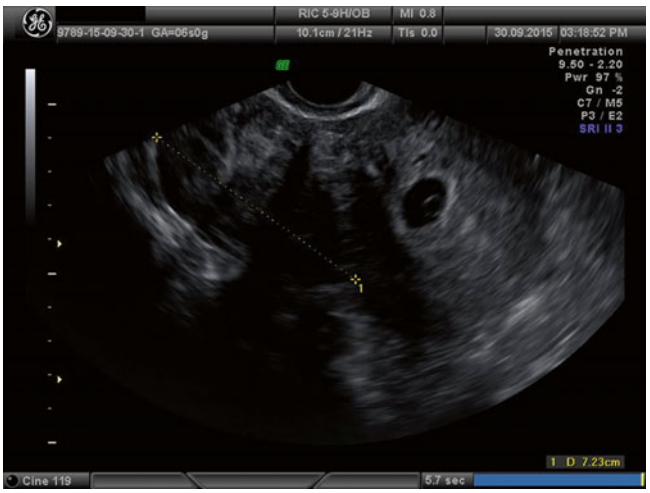

Fig. 6.16 A left transmural uterine fibroid of 7 cm of diameter at 6 weeks of pregnancy

degeneration secondary to hemorrhagic infarction with subsequent acute abdominal pain [22].

6.2.1.5 Luteoma

Luteomas constitute rare adnexal masses specific to pregnancy which usually regress in the postpartum period and can be hormonally active. Luteomas most commonly present in the second half of pregnancy as bilateral solid or mixed ovarian masses associated with elevated testosterone levels [23, 24]. They can also be found in normal pregnancy. They are usually asymptomatic, but they may present with signs and symptoms of virilization of the mother or infant or with complications such as torsion. Due to the commonly seen solid nature of this entity, the differentiation from an ovarian neoplasm can be challenging.

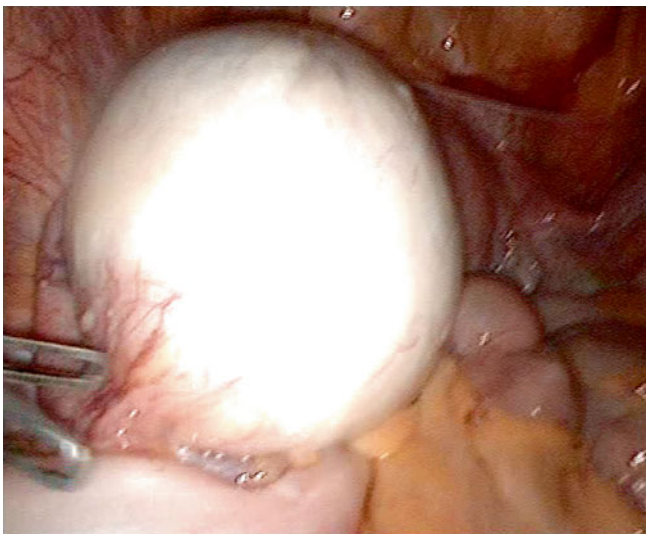

Fig. 6.17 A laparoscopic image of torsed left solid and cystic ovarian dermoid at 9 weeks of pregnancy

6.2.1.6 Hyperreactio Luteinalis

Hyperreactio luteinalis is a rare entity usually associated with trophoblastic disease, high-order multiple pregnancy, and fertility treatment. It is caused by increased levels of β-hCG and is usually asymptomatic or presents with abdominal pain or signs and symptoms of torsion. In one fourth of the cases, it can be associated with hyperandrogenism. Large adnexal masses consisting of many thin-walled small cysts can be seen in ultrasound similar to ovarian hyperstimulation syndrome. The majority of these lesions resolve spontaneously after delivery [25].

6.2.1.7 Theca Lutein Cysts

Theca lutein cysts are associated with gestational trophoblastic disease (complete molar pregnancy) and are considered to be secondary to excessive amounts of circulating gonadotrophins. They usually present bilaterally with thin walls and a solid component and are associated with increased risk of post-molar trophoblastic disease [26].

6.2.1.8 Dermoid Cysts

Dermoid cysts constitute the most common diagnosis of surgically removed adnexal masses in pregnancy (Fig. 6.9) [27]. Sonographic findings of dermoid cysts may include a cystic or a combined cystic and solid component. Some mature teratomas (10–20 %) are cystic in nature, and they may be indistinguishable from other cystic masses. However, the most common ultrasound appearance is combined both solid and cystic (Fig. 6.17) with the following characteristics: (a) a solid spherical component, representing the hair and sebum, may occupy part of the cyst; (b) echogenic lines and dots, representing floating hair, dispersed throughout the cyst; and (c) shadowing from the echogenic portion of the tumor due to bone

calcifications or adipose tissue. Many studies in the literature have reported complications secondary to rupture, torsion, or labor dystocia of dermoid cysts in pregnancy [28, 29]. However, a study by Caspi et al. has demonstrated that ovarian dermoid cysts <6 cm are not expected to grow or to cause complications during pregnancy or labor [30].

6.2.1.9 Cystadenomas

Cystadenomas are benign tumors and constitute the most common ovarian neoplasms. There have been many reports in the literature of both serous (Fig. 6.18) and mucinous (Fig. 6.19) cystadenomas in pregnancy [31, 32]. In the cohort of Goh et al. which included patients with persistent ovarian masses during pregnancy that underwent surgical treatment, almost one third of the cases were serous and mucinous cystadenomas [27]. In the retrospective study by Gordon et al., benign cystadenomas comprised one fifth of all surgically resected ovarian neoplasms [33]. During ultrasonography they present as simple cysts or they may contain septations. Mucinous cystadenomas tend to be larger at presentation compared to serous. The presence of irregular septations and nodules increases the risk of malignancy.

Fig. 6.18 An ovarian left serous cystadenomas at 8 weeks of pregnancy

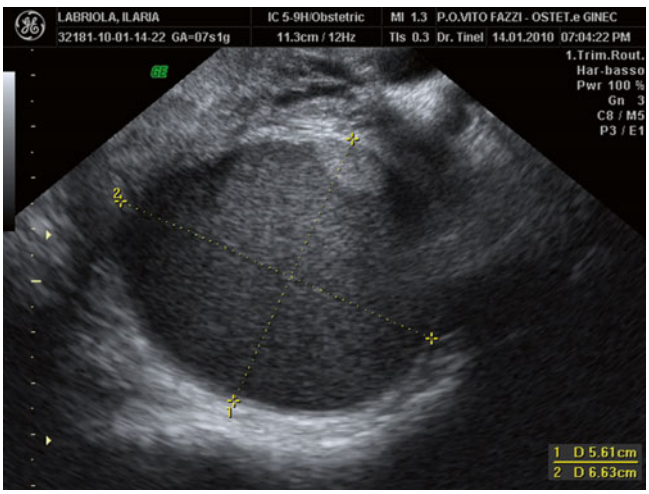

Fig. 6.19 A right ovarian mucinous cystadenomas at 7 weeks of pregnancy

6.2.1.10 Ovarian Malignancy

The incidence of ovarian malignancy during pregnancy is very low. Sonographic features suggestive of malignancy include a complex cyst with thickened walls, septations, papillary solid components, and increased blood flow detected by color Doppler. Most of the ovarian cancers diagnosed during pregnancy are epithelial and low-malignant-potential tumors. Most malignancies are diagnosed at earlier stages [34]. This can be explained by the younger age of pregnant women. For the same reason, it appears that there is an increased incidence of germ cell tumors during pregnancy.

6.2.1.11 Tubal Pathology

Tubal pathology can present during pregnancy as hydrosalpinx, tubo-ovarian abscess (TOA), or heterotopic pregnancy. Hydrosalpinx commonly associated with pelvic inflammatory disease (PID) appears at sonographic imaging as an anechoic tubular or elongated fluid-filled structure, and its morphology remains unchanged during pregnancy. Tubo-ovarian abscess (Fig. 6.20) is a very uncommon entity in pregnancy and most often arises as a consequence of PID. However, TOA can be also associated with recent pelvic surgery of intra-abdominal infectious process such as appendicitis. Also, there have been case reports of TOA in pregnancy after oocyte retrievals in women with preexisting endometriomas [35]. TOAs usually present with signs and symptoms of pelvic infection and in ultrasound imaging as one or more multilocular complex cysts. Heterotopic pregnancy, even though extremely rare, should be included in the differential

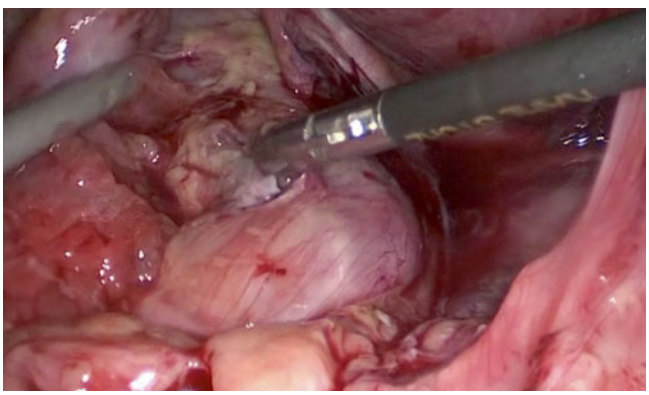

Fig. 6.20 A laparoscopic image of a tubo-ovarian abscess in pregnancy

diagnosis especially in patients with history of IVF or ovulation induction [36]. The ultrasound may reveal features of concomitant ectopic and intrauterine pregnancy.

6.3 Diagnosis

6.3.1 Ultrasound

Most of the adnexal masses in pregnancy are incidental findings during antenatal ultrasound evaluation. If a mass is clinically palpated during pregnancy, ultrasonography is the initial imaging modality of choice because of its low cost, safety, high resolution, and noninvasive nature. Features suggestive of malignancy include a solid component within a cystic mass papillary projections, excrescences, vegetation, and nodules. Septations in a cystic ovarian mass may indicate the presence of a malignant neoplasm especially if greater than 2–3 mm in thickness; other ultrasound signs suggestive of malignancy include ascites, increased thickness of the cyst wall, and a very large size of the mass [13, 37]. Conventional ultrasonography has been shown in many studies to be helpful in characterizing the nature of adnexal lesions and identifying the cases with possible malignancy [5, 10, 38, 39]. Although the accuracy of conventional ultrasound in differentiating malignant from benign neoplasms has been questioned and color Doppler has been suggested as a means to improve the accuracy of diagnosis, the high incidence of false-positive results up to 49 % provided by color Doppler makes unclear at this time if it adds any further information to the conventional sonogram [37, 40].

6.3.2 MRI

Many studies have evaluated the role of MRI in the diagnosis of adnexal masses in pregnant populations as it is generally considered a safe modality during pregnancy. MRI is a useful adjunct when sonography is inconclusive and can be used to guide management of adnexal masses especially due to its ability to evaluate tissue contrast [41]. MRI may help the physician differentiate whether the adnexal mass originates from the uterus, the ovary, or the tube and also identify specific characteristics of the morphology of the mass such as leiomyoma degeneration (Fig. 6.21), decidualization of endometrioma, and the presence of massive ovarian edema [42]. Additionally, in cases of malignancy, the MRI can define the extent of the disease and possible metastases [43].

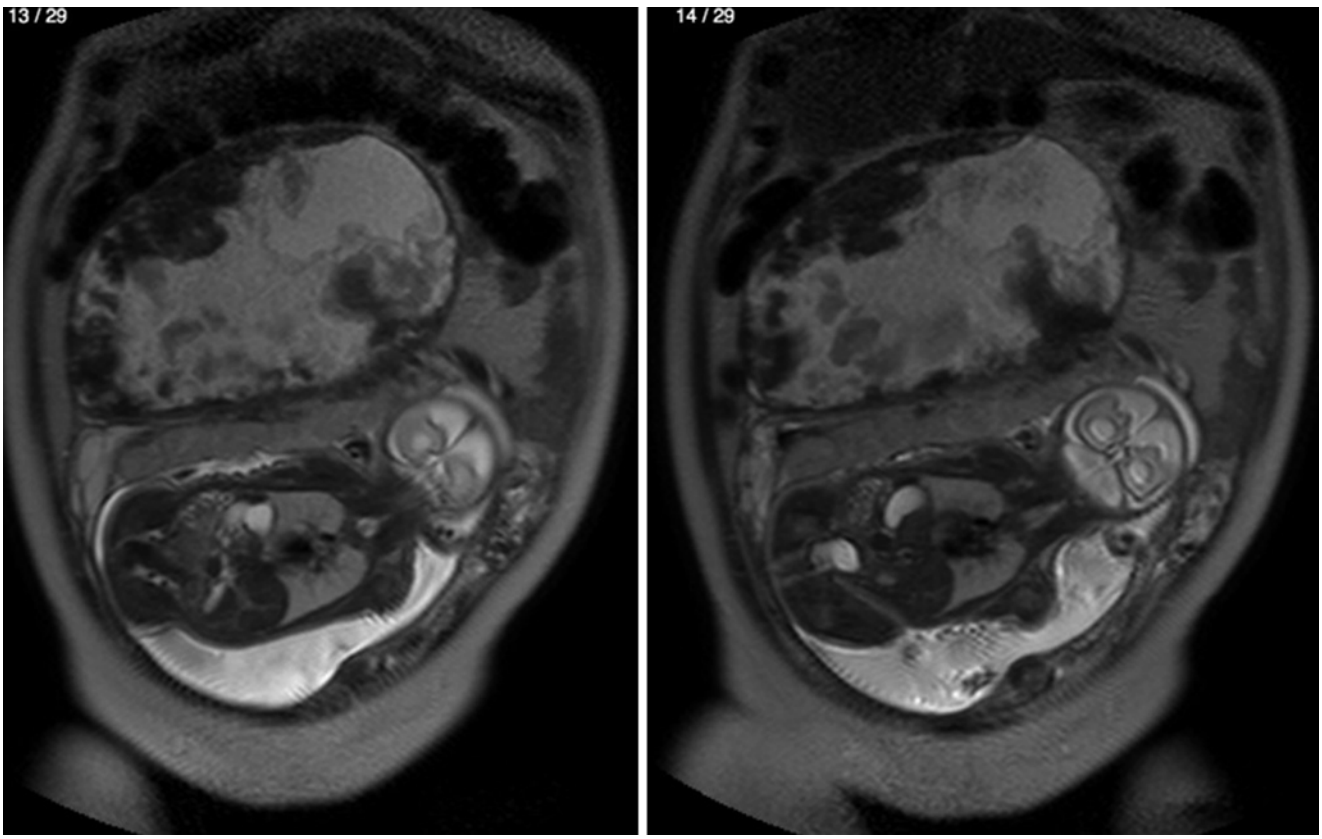

Fig. 6.21 A MRI coronal scan showing a huge subserous leiomyoma in degeneration in a pregnant at 25 weeks

6.3.3 CT Scan

CT scan of the abdomen and pelvis is another imaging modality that can be used in the evaluation of maternal adnexal masses. Even though CT scanning is considered relatively safe during pregnancy since the typical fetal radiation dose for a routine CT of the abdomen and pelvis is only 25 mGy [44], it should be kept in mind that the contrast material, if needed, can cross the placenta. CT scan is also very useful in identifying other intra-abdominal pathology in a pregnant woman such as appendicitis or diverticulitis.

6.3.4 Tumor Markers

The interpretation of tumor markers during pregnancy can be very challenging.

CA 125 is a glycoprotein which holds an important role in monitoring patients with ovarian cancer. However, its levels can be elevated in early pregnancy and during the early postpartum period, thus making its interpretation very difficult in the presence of suspicious adnexal masses [45]. AFP (a fetoprotein) which is typically used as part of antenatal screening can be elevated in endodermal sinus tumors, and elevated lactate dehydrogenase levels may be associated with dysgerminomas. However, the levels of these tumor markers can vary in pregnancy, thus limiting their use; additionally, normal levels of tumor markers cannot exclude malignancy. As a result, the decision to pursue surgical versus conservative management should be in general based on the symptomatology, physical examination, and imaging findings rather than the level of the tumor markers.

6.3.5 Management of Adnexal Mass in Pregnancy: Observation Versus Surgery

Controversy exists regarding the management of adnexal mass in pregnancy. Some studies recommend conservative management and observation, whereas other investigations favor surgical intervention [10, 46]. The majority of simple cysts that are less than 5 cm in diameter will resolve spontaneously during the course of pregnancy [13]. Thus, many observational studies support close monitoring during pregnancy in selected cases as an alternative to antepartum surgery [10, 47]. Surgical management is warranted when the patient is symptomatic and when complications such as adnexal torsion, rupture, or enlargement enough to cause possible labor obstruction occur. If an adnexal mass is suspicious of malignancy with sonographic evidence of solid component(s), nodules, thick septations, and size greater than 5 cm, surgical management should be strongly considered, ideally during the second trimester of pregnancy (Fig. 6.22) [34, 48].

Studies in the literature have shown the advantages of surgical management during the second trimester of pregnancy. The intervention at this time of pregnancy is associated with reduction of obstetrical complications such as miscarriage and preterm labor or birth with the absolute risk being very small. The theory behind this recommendation is that the developing pregnancy is dependent on the corpus luteum during the first trimester and much less in the second trimester [49].

The surgical approach for the management of adnexal mass during pregnancy can be via a laparotomy or laparoscopy. Even though until the 1990s, pregnancy had been considered a contraindication to the use of laparoscopy, many observational studies have shown that laparoscopy in the second trimester for the management of adnexal mass can be safe and technically feasible in the hands of a skilled laparoscopic surgeon [50–53]. The frequency of obstetric complications, such as low birth weight, preterm delivery, the use of tocolytics for preterm labor, low Apgar score, and fetal anomaly, is quite acceptable [53].

Laparoscopy in pregnancy can provide accurate diagnosis, faster recovery, minimal risk for thromboembolic disease, less fetal depression secondary to decreased narcotic use, fewer incisional hernias, and fewer postoperative adhesions. However, the risks related to pregnancy should always be taken into account [54, 55]. The trocar placement can lead to uterine injuries due to the enlarged uterine size; therefore, trocar placement under direct visualization, rather than insufflation with Veress needle, or open laparoscopic approach using the Hasson cannula is suggested. An additional concern is that increased intra-abdominal pressure can decrease cardiac output in pregnancy; thus, left lateral position of the mother is of utmost importance. Finally, the potential risk of hypercarbia and acidosis can be decreased by maintaining the intra-abdominal pressure less than 20 mmHg.

Even though observational studies have provided overwhelming evidence for the safety of laparoscopy and the advantages in postoperative course during the second trimester of pregnancy, the decision regarding laparotomy versus laparoscopic approach should be tailored on each case individually based on the preference and experience of the surgeon.

Adnexal mass can be detected for the first time during cesarean section in 0.3–0.5 % of cases, and up to 5 % can be bilateral [56, 57]. The options include conservative management for simple small cysts and excision for larger heterogenous complex cysts so that further surgical intervention after cesarean section is avoided and malignancy is excluded [1, 43, 49, 56].

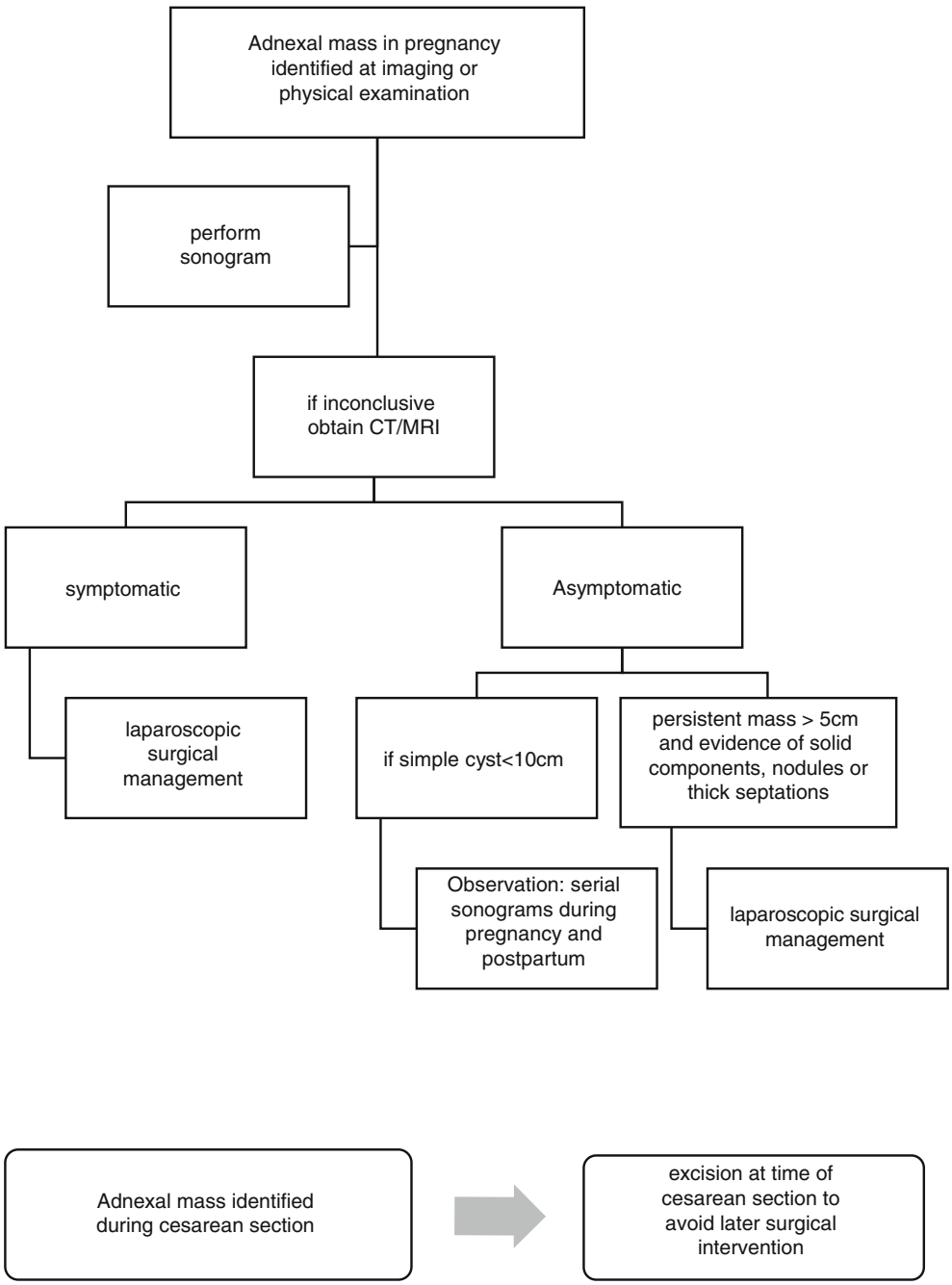

Fig. 6.22 Management of adnexal mass in pregnancy

Conclusion

The extensive use of ultrasound for antenatal screening has led to an increased frequency of incidental adnexal mass diagnosis during pregnancy. Thus, it is of utmost importance that the physician is familiar with the modes of accurate diagnosis and management of this entity. Other than ultrasound, MRI and CT scan can be employed for better characterization of the morphology of the mass and for evaluation of other intra-abdominal pathologies. In terms of management of adnexal mass in pregnancy, observation can be a viable option in cases of small masses with no signs of possible malignancy. Surgical intervention is recommended for larger persistent complex masses as the risk of complications such as torsion or rupture and malignancy are increased. Given the benefits of laparoscopy versus laparotomy, laparoscopy should be preferred as a surgical option in the hands of a skilled laparoscopic surgeon.

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