MANAGEMENT OF OVARIAN MASSES DURING PREGNANCY

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Abstract

The purpose of this paper is to present the therapeutic conduct regarding the diagnosis, prognosis and management (surgical or conservatory) of the ovarian masses during pregnancy. In this paper we will present the imagistic ways of diagnosis and the surgical therapeutic options (laparotomy, laparoscopy, robotic surgery) according to the characteristic of masses. We included 19 articles that researched the therapeutic conduct of ovarian masses during pregnancy. Transvaginal ultrasound is the first-line method of choice in the differential diagnosis of the ovarian masses. Evaluation of the ovarian masses during pregnancy must be done by a trained operator in order to choose the optimal therapeutic conduct. In the case of ovarian tumors with ultrasound benign ultrasound characteristics it is recommended the use of a therapeutic conservatory approach. The therapeutic conduct should be adapted individually for each patient. Decision criteria for the surgical approach (laparotomy or laparoscopy) must consider the measurements of the mass, the gestational age, ultrasound characteristics and surgical experience. The multidisciplinary approach is recommended in the management of this patients especially when there is a malignancy suspicion. The advantages of robotic surgery in these situations are represented by the high quality imaging, reduced uterine manipulation, precise dissection and a low rate of conversion to laparotomy.

Keywords: ovarian mass, pregnancy, ultrasound, laparotomy, laparoscopy, robotic surgery

Introduction

The incidence of tumors during pregnancy varies from 1 out of 81 to 1 out of 8000 pregnancies [1]. The majority of these tumors are benign. The incidence of malignancies is 1-6%, which makes ovarian cancer the fifth most frequent tumor during pregnancy [2] [3].

These cystic tumors can cause no symptoms and the diagnosis may be missed until their volume is big enough to compress adjacent organs [1]. These growths can be discovered incidentally on the first trimester ultrasound. Although 65-80% of these tumors are asymptomatic and more than 75% can regress spontaneously, most of them that persist longer than 16-20 weeks indicate a pathological process [4]. Ever since obstetric ultrasound was introduced as a routine examination, tumoral growths have been diagnosed more frequently. Before that, the tumors were diagnosed at the clinical examination of a patient who presented
with low abdominal pain or palpable mass [2]. A cystic tumor during pregnancy can complicate with torsion, rupture, hemorrhage, infection or obstructed labour [1].

Adnexal masses in premenopausal women can be classified into ovarian and non-ovarian. An important aspect to be taken into consideration is if the tumor was discovered during pregnancy. Ovarian growths can suffer morphological changes during pregnancy and an adequate diagnosis is necessary. The most common tumors during pregnancy are functional cysts which include corpus luteum cyst. These tumors are hormone dependent and regress spontaneously in a few weeks or even months in some cases [3]. Other causes of benign ovarian cysts are nonfunctional tumors – dermoid cysts, cystadenoma and endometrioma [4].

**Materials and methods**

In this review the Medline and PubMed databased were used. We searched for the terms ovarian masses, adnexal mass, ultrasound, pregnancy, laparoscopy, and laparotomy. After reviewing the bibliography of each article, it was decided to include both original research articles and review articles that approached the diagnosis, evaluation or treatment of adnexal masses during pregnancy.

**Results**

**Diagnosis**

Clinical and imaging assessment are the main methods that can guide us to a diagnosis, histopathological examination being the one that sets the final diagnosis but it is only indicated in some cases. The main objective of diagnosing these tumor formations is to differentiate between ovarian and non-ovarian one. If these masses have an ovarian origin a thorough evaluation should be performed by an experienced clinician in order to specify whether the criteria for benignity or malignancy is present [5-6].

**Ultrasound**

As noted above, most of the adnexal cystic formations during pregnancy are accidentally discovered in the routine ultrasound during the consultations. Transvaginal and abdominal ultrasound are the most common diagnostic method that allows the imaging evaluation of abdominal or pelvic pain during pregnancy. It is safe, accessible and accepted and has a high sensitivity and specificity [3] [2]. Routine ultrasound is performed during pregnancy between the eleventh and thirteen week of gestation and then between weeks the eighteenth and twentieth week [4].

The aim of ultrasound is to help the operator determine the masses whose management can be conservative and observational and those who require surgery. It has been found that the ultrasound is accurate in determining the morphological characteristics of an ovarian tumor. The more complex a formation (the more septa and solid components) is, the higher the risk of malignancy. Doppler ultrasound can also show the malignancy probability - those with a malignant potential have lower blood flow impedance and higher blood flow velocity [7] [8] [9].

The tumors have different sonographic aspects. Functional corpus luteum cysts during pregnancy can range from a simple cyst to a complex cystic lesion [2]. Regarding endometriosis, diagnosis is more difficult because of the high level of progesterone and the decidualization process which has common aspects with neoplasia [3]. In a series of 46 cases, Bailleux et al. observed 53 cysts in the first trimester of pregnancy, which they had diagnosed as endometriosis through ultrasound. Of the 53 cases, approximately half did not prove to be endometriosis, thus demonstrating the difficulty of its ultrasound diagnosis [10]. Specific ultrasound characteristics of the most common masses that appear during pregnancy are presented in Table 1 [11].
### Type of mass

<table>
<thead>
<tr>
<th>Type of mass</th>
<th>Sonographic features</th>
</tr>
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<tbody>
<tr>
<td><strong>Functional cyst</strong></td>
<td></td>
</tr>
<tr>
<td>Corpus luteum</td>
<td>Common appearance, „Ring of fire“ with Doppler</td>
</tr>
<tr>
<td>Follicular cyst</td>
<td>Mainly simple cyst &lt;10 cm, sometimes with debris</td>
</tr>
<tr>
<td>Haemorrhagic cyst</td>
<td>Fine interdigitating lines (fishnet); solid compounds with concave lining. No flow with Doppler</td>
</tr>
<tr>
<td><strong>Dermoid cyst</strong></td>
<td>- Rokitansky nodule; a hyperechoic nodule with acoustic shadowing in a background of low-level echoes.</td>
</tr>
<tr>
<td></td>
<td>- ‘Tip of the iceberg’ phenomenon, where a highly echogenic cyst, contents of sebum and hair, causes posterior attenuation of sound.</td>
</tr>
<tr>
<td></td>
<td>- ‘Dermoid mesh’, multiple interdigitating lines and dots which are seen when hair is floting in sebum.</td>
</tr>
<tr>
<td>Serous cystadenom</td>
<td>Large simple cyst &gt; 5 cm. Thin septations or papillary formations</td>
</tr>
<tr>
<td>Mucinous cystadenoma</td>
<td>Mass &gt; 5 cm in diameter. Multiple septae. Heterogenic aspect.</td>
</tr>
<tr>
<td>Endometrioma</td>
<td>Round thick regular wall; diffuse homogenous low-level internal echoes (chocolate cyst). Calcifications with acoustic shadowing</td>
</tr>
<tr>
<td>Leiomyomas</td>
<td>Round regular wall. When outgrowing the blood supply central necrosis may be seen. Not attached to the ovary.</td>
</tr>
<tr>
<td>Paraovarian cyst</td>
<td>1-2 cm simple cysts. Not attached to the ovary</td>
</tr>
</tbody>
</table>

**Table 1** - Benign adnexal masses discovered during early pregnancy sonography with their morphologic appearance on ultrasound; adapted after Hann et al.

![Diagram](image)

**Figure 1** - General principles of management adapted after Aggarwal and Kehoe
To help examine and diagnose ovarian pathology, IOTA (International Ovarian Tumor Analysis) had developed studies and then rules and models so that it can be easy to do a diagnose using uniform language. These rules help to classify 75% of ovarian tumors [11].

**MRI**

It is safe to use Magnetic Resonance Imaging (MRI) during pregnancy, chiefly in the second and third trimester. However, the fetal safety for gadolinium-based MRI has not been yet settled and should be avoided [2]. MRI has a sensitivity of 100% and a specificity of 94% in the diagnosis of tumors. It is helpful especially when the ultrasound is inconclusive to guide us in the diagnosis and treatment process [4, 13]. MRI is particularly helpful in creating 3D images but also in differentiating the morphological characteristics of different tissues (leiomyomas, paraovarian cysts) [2]. Computer tomography (CT) is also accepted in pregnancy but exposed mother and fetus to radiation (2-4 rads) on a single exam [9].

**Management**

There is no common consent regarding surgical or conservative management of benign adnexal masses during pregnancy [4]. The major aspects to be taken into consideration when a mass is discovered during pregnancy are: the nature of the tumor, the probability of malignancy, the chance to regress spontaneously and possible complications. [1]. Generally, an ovarian cystectomy or a salpingo-oophorectomy is executed for the benign pathology. In theory there is a risk for miscarriage when the oophorectomy is performed before 9-11 weeks. If surgery occurs at 16-20 weeks, it may ensure spontaneous resolution of the masses, a better uterine visualization and reduced risk of preterm labour [14].

The dimension of the mass should also be considered in the tumor management. An ovarian cyst below 6 centimeters at the beginning of pregnancy is usually due to corpus luteum formation. Cysts greater than 10 centimeters should be removed due to the risk of malignancy, while those under 5 centimeters can be observed without resection. The management of the masses with a diameter of 5-10 centimeters remains controversial, leaving the other characteristics of the mass - gestational age, ultrasound characteristics and surgical experience to decide the options [15-16].

Aggarwal and Kehoe elaborate some principles of managing an adnexal mass that appear during pregnancy. During the first trimester, conservatory approach is justified when asymptomatic masses are discovered accidentally through ultrasound. The surgical treatment should take place only for the symptomatic tumors. If there are clinical or ultrasound features suggesting malignancy, surgery should be undertaken. The MRI is indicated if the malignant process cannot be excluded with certainty. If there is followed a surgical plan, then it should be performed in during 18-22 weeks. If the ultrasound shows no features of malignancy, it should be repeated at 18-20 weeks when is the time of congenital anomaly scan. A mass without features pertaining to malignancy is detected in the third trimester should not be interfered with until the time of cesarean section or 6 weeks postpartum. This principals are represented in the Figure 1 [17].

**Conservative management**

Given that 71% of benign ovarian tumors will reduce their volume or regress spontaneously, conservative management must be considered [18].

A guideline from The Royal College of Obstetricians and Gynaecologists (RCOG) established that simple, unilateral, unilocular, ovarian cysts with less than 5 cm in diameter have a low risk of malignancy. A normal serum level of CA125 and the before mentioned features indicate that a conservative management can be done [19].

Schmeler et al. support this idea in one of their review. The study included 59 pregnant patients who received either surgical or observational management for an ovarian tumor of 5 centimeters or more. Surgery was performed antepartum for 17 patients (15 laparotomies and 2 laparoscopies) while 42 patients were observed through their pregnancy and underwent intrapartum (at the time of C section) or postpartum surgery. Five malignancies (four malignant, one borderline) were noticed in the first group. Adverse fetal outcomes were not detected in either group of patients. Thus, he concluded that observational management is a reasonable alternative to
antepartum surgery in patients with benign adnexal masses [20].

**Surgical management**

Indications of a surgical intervention depend on gestational age, tumor dimensions, ultrasound characteristics and surgical experience. The incidence of ovarian masses for which a surgical procedure is warranted during pregnancy ranges from one to 600 to one in 1500 pregnancies, and the rate of malignant disease in patients treated surgically is 1-3% [3].

If an adnexal mass with suspicion for malignancy is discovered at the physical examination or imaging during pregnancy, surgery is indicated. Nonetheless, the benefits of a surgical approach must be weighed against the risks to the pregnancy [21]. Surgery is considered as potentially risky for both the mother and the fetus, including maternal complications, fetal death and premature birth [22]. Generally, surgeons operating on pregnant patients must be familiar with the specific pathophysiologic aspects of pregnancy, like elevated hemostatic capacity, reduced anticoagulation activity, major alternations in the fibrinolytic system and the change in surgical incision site to conform to the size of the pregnant uterus to maximize exposure and displacement of other pelvic and extra-pelvic organs [23].

For a better view of the abdominopelvic cavity, if surgical staging should be done, the surgical treatment of the ovarian masses during pregnancy has been executed through laparotomy. Disadvantages include increased postoperative recovery time, and increased incisional pain and discomfort that may limit a patient's mobility, thereby increasing the risk of postoperative thromboembolism in a patient population that is already at high risk [1] [3] [4]. Management by laparoscopic intervention can be considered in the treatment of cystic tumors. This intervention should be scheduled between the weeks 16-20 of gestation, this choice being based on the fact that the masses can be constantly disappearing, but also the better visualization of the tumor compared to the enlarged uterus. The advantages of laparoscopy are significant lesser operative time, lesser perioperative morbidity, decreased length of hospital stay, and reduced postoperative pain resulting in faster postoperative recover, which has a great importance in pregnancy because of the increased thrombotic events [24-25]. Mathevet et al. reported a total of 48 pregnant women treated with laparoscopy in first (17), second (27) and third trimesters (4) and showed that risk for both mother and fetus were minimal evaluating the possible technical difficulties and accurate approach by the surgeon and his specialized team [25-26]. However, laparoscopy carries an increased risk of tumor rupture, port-size metastases and inadequate surgical staging if adnexal histology is malignant [27]. Society of American Gastrointestinal and Endoscopic Surgeons in one of their guidelines declared that the laparoscopic approach for symptomatic adnexal masses is a safe and effective treatment [28].

A new laparoscopic technique is single port laparoscopy, Tsaì et al. shows that there are certain advantages in addition to classical laparoscopy - a single postoperative scar (which brings a cosmetic advantage but also prevents stretching and distention of the laparotomy scar due to rapid growth of the uterus) and the low risk of uterine penetration [29]. Ding&Chang demonstrates the same ideas showing that this new technique in surgeries during pregnancy is useful and feasible for both mother and fetus [22].

Another intervention that has spread rapidly lately is robotic-assisted laparoscopy. Carter et al. reports 6 cases in which they applied this technique to remove symptomatic, persistent ovarian tumors with a size exceeding 10 centimeters. The robotic system advantages are that it allows 14-fold magnification, a bioptic scope with 3-dimensional image, and instruments with more than 340 degrees of motion. These specifications allow for far better visualization, almost no manipulation of the pregnant uterus, more precise dissections and fewer conversions to laparotomy. The disadvantages of this intervention are primarily the high costs and then the fact that there are no randomized controlled trials to compare the cost-effectiveness of this intervention [30].

**Conclusions**

Transvaginal or abdominal ultrasound is the most common diagnostic method that allows the
imaging evaluation of abdominal or pelvic pain during pregnancy. It is a safe, accessible and accepted and has a high sensitivity and specificity. Transvaginal ultrasound through its very frequent use has made the diagnosis of cystic tumor formations more frequent.

Transvaginal ultrasound is the first-line method of choice in the differential diagnosis of the ovarian masses. Evaluation of the ovarian masses during pregnancy must be done by a trained operator in order to choose the optimal therapeutic conduct.

In the case of ovarian tumors with ultrasound benign ultrasound characteristics it is recommended the use of a therapeutic conservatory approach. The therapeutic conduct should be adapted individually for each patient.

Decision criteria for the surgical approach (laparotomy or laparoscopy) must consider the size of the mass, the gestational age, ultrasound characteristics and surgical experience. The multidisciplinary approach is recommended in the management of this patients especially when there is a malignancy suspicion. Laparoscopy is a safe and effective treatment in pregnant patients with symptomatic ovarian masses. The advantages of robotic surgery in these situations are represented by the high quality imaging, reduced uterine manipulation, precise dissection and a low rate of conversion to laparotomy.

References