Management of a pelvic mass

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Abstract
The presence of a pelvic mass is a common clinical problem. A combination of findings from the clinical history, physical examination, results of various investigations and imaging methods can help to determine the character and origin of the mass, including the risk of malignancy and guide management strategies. This problem-based review presents three case histories that illustrate the key principles in the management of a pelvic mass. The cases describe commonly encountered clinical scenarios with an evidence-based approach to subsequent management.

Keywords hormone replacement therapy; ovarian malignancy; pregnancy; surgery; tuboovarian abscess

Introduction
An adnexal mass is a common clinical problem and may be found in females of all ages. It may be symptomatic and detected as part of evaluation for those symptoms, either by physical exam or radiographic imaging or discovered incidentally during imaging performed for another condition. The differential diagnosis of an adnexal mass is broad (Table 1). Most adnexal masses arise from the ovary. The most serious concern when an adnexal mass is discovered is the possibility of malignancy.

Case 1
A 35-year-old woman was referred to the emergency gynecology service complaining of lower abdominal pain. Ten days previously, she underwent a hysterosalpingogram (HSG) as part of infertility investigations. Her past medical history was unremarkable. There was no previous history of sexually transmitted diseases or pelvic inflammatory disease.

On admission, the patient was afebrile and a urine pregnancy test was negative. Examination revealed mild tenderness and a palpable mass in the lower abdomen but no signs of peritonism. An ultrasound scan revealed a 12 cm complex pelvic mass of uncertain origin. Biochemical investigations showed a raised C-reactive protein level (>320) and raised serum CA125 (2100 U/ml). The patient was commenced on broad-spectrum antibiotics for suspected pelvic infection.

An MRI scan 2 weeks later showed no significant change in the size of the mass (Figure 1). The findings were suggestive of a tuboovarian abscess. The serum CA125 level had reduced markedly to 700 U/ml. A diagnostic laparoscopy was performed which revealed a left-sided tuboovarian abscess that was drained. Postoperative recovery was uncomplicated.

Discussion
Tuboovarian abscesses (TOA) can complicate pelvic inflammatory disease (PID) in up to 15% of women; the rates are reported to be higher in women hospitalized for acute PID. TOA may also follow pelvic surgery or result from bowel perforation and intraperitoneal spread of infection. In postmenopausal women, the diagnosis of TOA should trigger investigations to exclude malignancy or other pelvic pathology.

The most common organisms isolated from TOA are streptococcal species, Escherichia coli and other Gram-negative enteric organisms. The most frequent anaerobes are Bacteroides and Peptostreptococcus. There are currently no clear risk factors for tuboovarian abscess among patients who develop PID. The spread of pathogens to the upper genital tract in our case was a consequence of hysterosalpingography. The rate of infection of the upper genital tract following HSG is approximately 1% and is more common in women with previous history of PID.

Abdominal and/or pelvic pain are the most common features of TOA, but fever and leukocytosis are also common being found...
in 60–80% of patients. The imaging method of choice is ultrasonography with sensitivity and specificity 82% and 91% respectively. The classical ultrasound features of a TOA are one or more masses that are relatively homogeneous, cystic, thin-walled and well demarcated. An air fluid level and septations may be seen.

Laboratory investigations should include full blood count, C-reactive protein, tests for renal and liver function. Although, peripheral blood leukocytosis and elevated C-reactive protein levels have limited value in the diagnosis of TOA, the results can be used as an indicator of the disease severity and to monitor the response to treatment. Baseline renal and liver function tests are required to exclude dysfunction of the organ systems which may occur as a result of sepsis. In the presence of fever, urine and blood cultures should be performed. Gram stain and microscopic examination of the vaginal discharge in combination with nucleic acid amplification tests for chlamydia and gonococcus may provide useful information necessary to guide the antibiotic regime used.

The serum glycoprotein CA125 concentration (normal <35 U/ml) is elevated in 80% of women with ovarian cancer. However, the elevated serum levels are also observed in a variety of benign conditions, which affect the specificity of this test. The presence of pleural/peritoneal fluid or disease involvement of a serosal surface (whatever the cause) may increase CA125 levels. CA125 levels are elevated in approximately 1% of healthy women, and fluctuate during the menstrual cycle (Table 2). In our case the presence of TOA resulted in markedly elevated serum CA125 levels due to peritoneal irritation from the ongoing inflammatory process. The significant decrease in CA125 observed following treatment with antibiotics was in keeping with a resolving intraperitoneal inflammatory process rather than malignancy. The change in CA125 level over time can be used as an indicator of the cause of initial elevated value. The CA125 level will fall with inflammatory causes once treatment has been instituted, whereas malignant causes usually result in exponential rises. In such cases, when initial diagnosis is not confirmed and malignancy cannot be excluded serum CA125 levels should be repeated after completion of antibiotic therapy.

Early surgical intervention for management of TOA is supported by a substantial body of experts due to significant mortality and morbidity associated with potential complications of the condition such as rupture and sepsis syndrome that may occur unexpectedly. Because most women with TOA are of reproductive age, the primary aim of management is to be as conservative as possible, especially if the patient is stable. Introduction of effective new broad-spectrum antibiotics in clinical practice has had a significant impact on the success of medical treatment of TOA.

The choice of antibiotic therapy used should be guided by evidence of the local epidemiology of aetiological microorganisms for pelvic inflammatory disease and antibiotic sensitivity patterns. Intravenous triple antibiotic therapy including a broad-spectrum beta-lactam, such as ceftriaxone or cefuroxime in combination with metronidazole or clindamycin for anaerobic coverage and gentamycin is suggested. Triple antibiotic regimen is shown to be more effective for the treatment of TOA when compared to regimens including combination of a beta-lactam antibiotic and doxycycline or clindamycin and gentamycin. Inpatient management for all cases of TOA is recommended. General measures include administration of intravenous fluids and correction of any underlying conditions such as anaemia, hypoxia and hyperglycaemia. Careful monitoring for the development of signs of sepsis is required. This involves regular monitoring of vitals signs and clinical examination, including mental status.

Clinical improvement including resolution of the pain, fever and falling levels of white blood cell count and C-reactive protein
can be used to monitor the response to antibiotic therapy. For patients that respond to medical management, antibiotic therapy should be continued for at least 2 weeks. Regular monitoring is required during this period. It is important to remember that resolution of the abscess may take several months.

Medical treatment alone is effective in 34–87.5% of patients with TOA. If no response is seen within 48–72 h the patient should be evaluated for surgical intervention. Laparoscopy or laparotomy and drainage of the abscess should be considered if the patient does not respond to medical therapy.

An alternative approach to surgical intervention is the ultrasound-guided transvaginal or percutaneous drainage of the abscess. A large retrospective study reported a success rate of up to 93% with the combination of intravenous antibiotics and ultrasound-guided transvaginal drainage for management of tuboovarian abscess. The authors found that the procedure was generally well tolerated and minimally invasive, thus avoiding the potential risks associated with general anaesthesia and surgery.

Prior to discharge from the hospital, patients should be advised to avoid becoming pregnant during the treatment period; they should be encouraged to use barrier contraception in addition to the hormonal methods. Collaboration with the genitourinary medicine team will be necessary for follow up and effective contact tracing. Careful counselling is also required with respect to the long-term complications of TOA, such as chronic pelvic pain, infertility and ectopic pregnancy.

**Case 2**

A 28-year-old woman presented at 10-weeks of gestation in her first pregnancy with sudden onset of left-sided abdominal pain, nausea and vomiting. The patient was apyrexial at initial presentation. Abdominal examination revealed mild tenderness in the left lower quadrant but there was no evidence of guarding or rebound tenderness. A full blood count showed a mildly elevated white cell count. Other laboratory investigations were unremarkable. The patient was admitted to the ward and given intravenous fluids, analgesics and antiemetics. An ultrasound scan demonstrated a viable intrauterine pregnancy (Figure 2a) and an 8 × 7 × 8 cm mass arising from the left adnexa (Figure 2b). A decision to perform diagnostic laparoscopy was made due to the clinical suspicion of ovarian cyst torsion. Intraoperatively the clinical diagnosis was confirmed and a left oophorectomy was performed laparoscopically. Histology demonstrated a torted and infarcted mature teratoma (dermoid cyst). The postoperative period was uncomplicated. The remainder of the pregnancy was uneventful and the patient had a spontaneous vaginal delivery of a healthy baby at term.

**Discussion**

The increase in use of antenatal ultrasound has led to higher detection rate of asymptomatic ovarian cysts in pregnancy. The incidence of ovarian cysts in pregnancy varies depending on the method used for the diagnosis (clinical examination or ultrasonography). A large population-based study reported a 0.2% incidence of ovarian cysts in pregnancy. In other publications, ovarian masses have been reported to complicate up to 2% of pregnancies.

Ovarian cysts without suspicious features can be managed conservatively during the pregnancy. In the majority of cases the cysts will resolve by the second or third trimester. Complications include torsion, rupture, haemorrhage and obstruction of labour. The incidence of ovarian cyst torsion can be up to 15% during the pregnancy, which is higher than in non-pregnant women. The risk of ovarian torsion is higher for cysts between 6 and 8 cm in size. The majority of cases of torsion (up to 60%) occur between 10 and 17 weeks gestation; the same study found that only 6% of cases of ovarian torsion occurred after 20 weeks of gestation. The exact pathophysiological mechanism that increases the risk of ovarian torsion in pregnancy is not clear. The use of assisted reproductive techniques, resulting in the development of ovarian cysts or enlarged ovaries is a recognized risk factor for adnexal torsion in pregnancy. Other proposed mechanisms are the presence of enlarged corpus luteum cysts in early pregnancy and the laxity of the supporting tissues of the ovary. As the pregnancy advances the risk of torsion is reduced because the ovaries are pushed out of pelvis and against the abdominal wall by the enlarging uterus.
Ovarian torsion in pregnancy presents with the same clinical symptoms as occur in non-pregnant women, with lower abdominal pain, nausea, vomiting and low-grade fever. Physical examination in pregnancy is often difficult due to changes in the position of intraabdominal organs and may not be informative. However in the first and early second trimesters of pregnancy, satisfactory clinical examination can be performed. Laboratory tests are also non-specific: a full blood count may reveal signs of leukocytosis; C-reactive protein levels may be elevated and abnormalities of electrolytes may be present due to prolonged vomiting.

Ultrasound examination can detect the presence of an adnexal mass, although has limited ability to determine if torsion has occurred. Use of Doppler blood flow imaging has a high false-negative value and a normal study cannot reliably exclude the diagnosis of ovarian cyst torsion. Magnetic resonance imaging (MRI) without gadolinium can be used in pregnancy, but has limited ability to detect ovarian cyst torsion. Computed tomography (CT) is contraindicated in pregnancy in order to avoid radiation exposure to the fetus. Furthermore, neither of these modalities has been shown to be superior to ultrasonography in the assessment of adnexal masses.

Most ovarian masses detected during pregnancy are benign. As was seen in this case, dermoid cysts (mature cystic teratoma) are the most frequent histological type found. The reported risk of malignancy of an ovarian mass in pregnancy varies from 0.93% to 3.4%; this is approximately 10 times lower than that in the non-pregnant population. This is not surprising as majority of ovarian cancer cases present in the postmenopausal years.

Ultrasonography can be used to characterize ovarian masses reliably, although histological examination is required to confirm the diagnosis. Ultrasonographic features suspicious of malignancy include the presence of bilateral lesions, solid components, septations or the presence of ascites. Evidence suggests that the risk of malignancy is increased in cases where the tumour diameter is equal to or greater than 10 cm at initial diagnosis. Also, tumours with a growth rate of equal to or greater than 3.5 cm/week have increased risk of malignancy. The specificity of tumour markers (e.g., CA125, alpha-fetoprotein, human chorionic gonadotropin) in pregnancy is low. The levels are elevated in normal pregnancy and fluctuate with gestational age. Studies have shown that maternal serum CA125 levels increase in the first trimester of pregnancy compared to non-pregnant women and decline subsequently during the second and third trimesters. The increase in the levels of CA125 in pregnancy has been attributed to production by the decidua. After the first trimester markedly elevated serum levels of CA125 or a significant increase during consecutive measurements should raise the suspicion of malignancy. It has been suggested that a more appropriate cut-off value for maternal serum CA125 levels during pregnancy may be 112 IU/ml. If an ovarian mass is suspicious of malignancy a gynaecological oncology opinion should be sought.

Non-obstetric surgery should be avoided during pregnancy. When elective surgery is indicated in pregnancy it should be performed in the early to mid-second trimester. At this stage the background risk of miscarriage is reduced and organogenesis completed. Available evidence suggests no increase in the rate of congenital malformations or unexplained stillbirth in the offspring of women who underwent surgery during pregnancy. However, the incidence of low birth weight infants and early neonatal deaths is increased. At this stage of pregnancy the operative exposure to the pelvis is not restricted significantly by the enlarged uterus. During the late second trimester and third trimester of pregnancy the uterus impairs the surgical exposure to the adnexa.

Physiological maternal adaptations to pregnancy such as increased swelling of the upper airways, reduced gastric emptying, relaxation of gastroesophageal sphincter, increase in the tidal volume, reduced blood pressure due to compression of the inferior vena cava from the enlarged uterus and an increased thrombotic tendency require a modified perioperative approach in order to minimize the potential surgical and anaesthetic risks. Maternal complications of surgery in pregnancy include miscarriage, anaesthetic risks (e.g. pulmonary aspiration, difficulties with intubation), haemorrhage and venous thromboembolism. Preoperative hydration, use of medications to improve gastroesophageal tone and reduce acidity of stomach contents (e.g. metoclopramide, H2 antagonists) and thromboprophylactic measures are required to reduce the risk of complications. It is also advised that uterine manipulation should be minimal. When surgical procedures involving the removal of corpus luteum are performed before 7–9 weeks of gestation, progesterone supplementation is recommended to reduce the risk of miscarriage. After this period, placental tissue is responsible for the progesterone production and progesterone administration is not required.

In this case, emergency surgery was indicated as the clinical presentation with sudden onset of lower abdominal pain with associated nausea and vomiting was highly suspicious of ovarian torsion. Although the above symptoms are non-specific and differential diagnosis can include conditions such as appendicitis, gastroenteritis or pelvic inflammatory disease, the detection of the ovarian mass on ultrasound further supported the suspected diagnosis. Delaying surgery in this situation could have resulted in infarction of the ovarian mass, haemorrhage or peritonitis. This may lead to increased maternal morbidity and higher miscarriage rate.

Laparotomy has been the mainstay of surgical treatment for ovarian masses in pregnancy. A midline skin incision is recommended to facilitate the exposure due to presence of the gravid uterus. The decision to perform cystectomy or oophorectomy is based on numerous factors including the size of the cyst, the degree of suspicion of malignancy, vascular compromise and the appearance of the contra-lateral ovary. Salpingo-oophorectomy is the procedure most commonly performed in such cases, although de-torsion of the ovary, cystectomy and adnexal fixation could be considered in carefully selected cases.

Laparoscopic surgery appears to be safe in pregnancy. However, concerns regarding laparoscopic surgery in pregnancy include uterine trauma during the insertion of Verres needle or trocars, decrease in the uterine blood flow due to raised intraabdominal pressure, or absorption of the carbon dioxide from the fetus. Laparoscopic procedures performed using an open entry technique and port site placement under direct vision can potentially reduce the risk of injury to the gravid uterus and are recommended.

Case 3
A 40-year-old woman was referred to the gynaecological clinic by her general practitioner with a recent history of abdominal swelling. She had no urinary or bowel symptoms. She was otherwise fit and healthy. Family history included her mother being diagnosed with breast cancer at the age of 35.
Ultrasonography revealed bilateral complex ovarian masses measuring 7 × 6 × 6 cm and 10 × 11 × 12 cm. There was also a moderate amount of ascites present. No other pelvic or upper abdominal pathology was noted. Serum CA125 level was 600 U/ml. Serum CEA and CA19-9 levels were within the normal range.

Discussion
The clinical presentation is highly suspicious of ovarian malignancy. Although, the majority of ovarian cancers present in postmenopausal women, approximately 5–18% of ovarian masses in premenopausal women are malignant. Recent studies have shown that women with ovarian cancer are often symptomatic, with 70% of women able to recall having symptoms for 3 months or longer prior to the diagnosis. Symptoms commonly associated with ovarian cancer include abdominal distension, bloating, abdominal pain, indigestion, fatigue, loss of appetite and urinary symptoms. These symptoms are often vague and non-specific and have poor predictive value for ovarian cancer, except abdominal distension which has a predictive value of 2.5%.

In this case, sonographic features suggestive of malignancy included the bilateral nature of the ovarian lesions, the complex features of the cysts and the presence of ascites. Serum CA125 in premenopausal women has limited specificity for predicting ovarian cancer as the levels can be moderately elevated in a variety of benign conditions commonly seen in this age group such as endometriosis, pelvic inflammatory disease, adenomyosis and inflammatory bowel disease. However, in this patient the levels are markedly elevated. The calculated risk of malignancy index (RMI) for this patient is 1800 (see Table 3). The risk malignancy index is used to triage women with respect to the most appropriate place for them to be managed. This reflects the organizational changes for the management of gynaecological cancers in the United Kingdom. Evidence suggests that women with ovarian malignancies have better prognosis when managed by trained gynaecological oncologist.

Further case history
A CT scan showed bilateral complex pelvic masses and a moderate amount of ascites (Figure 3). There was no pelvic or para-aortic lymphadenopathy. The patient was referred to a gynaecological oncology centre where, after review at the multidisciplinary team meeting, she underwent total abdominal hysterectomy, bilateral salpingo-oophorectomy, omentectomy, para-aortic lymph node dissection and appendicectomy. Histological examination of the specimens showed a well-differentiated serous ovarian adenocarcinoma involving one ovary, with a benign serous cystadenoma in the contra-lateral ovary. There was no spread of disease outside the ovaries. No further treatment was recommended postoperatively, as this was a well-differentiated stage Ia ovarian cancer. A few months later the patient presented to the gynaecological clinic complaining of severe menopausal symptoms, mainly hot flushes.

Further discussion
Many menopausal symptoms, such as hot flushes, are temporary and in the majority of cases resolve with time. However, in our case the patient is young and due to the sudden fall in oestrogen concentration, induced by an iatrogenic menopause, she would be expected to experience symptoms. Clinicians are often reluctant to prescribe hormone replacement therapy (HRT) to this group of women due to fear that supplementation may lead to recurrence of the disease. Although data are limited, available evidence suggests that there are no significant differences in survival and recurrence rates in women using HRT compared to non-users, after surgery for epithelial ovarian cancer. When HRT is commenced in the early postoperative period care should be taken to implement measures in order to reduce the risk of venous thromboembolism (e.g. early ambulation, use of antithrombotic stockings and low molecular weight heparin).

**Table 3**

<table>
<thead>
<tr>
<th>Risk</th>
<th>RMI</th>
<th>Percentage of women</th>
<th>Risk of malignancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;25</td>
<td>40%</td>
<td>&lt;3%</td>
</tr>
<tr>
<td>Moderate</td>
<td>25–250</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>High</td>
<td>&gt;250</td>
<td>30%</td>
<td>75%</td>
</tr>
</tbody>
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Ultrasound features: multilocular cyst; solid areas; evidence of metastases; bilateral lesions and presence of ascites.

Alternative options include lifestyle changes, such as weight loss and exercise, use of selective serotonin reuptake inhibitors (SSRIs) and selective serotonin norepinephrine reuptake inhibitors (SNRIs), complementary therapies (e.g. phytoestrogens) or alternative treatments such as acupuncture and vitamin E. However, the safety and efficacy of these treatments have not yet been established.

FURTHER READING

Practice points
- Tuboovarian abscesses (TOA) can complicate pelvic inflammatory disease in up to 15% of women.
- Serum CA125 levels are elevated in the presence of TOA and tend to decrease following treatment.
- Intravenous triple antibiotic therapy including a broad-spectrum beta-lactam, such as ceftriaxone or cefuroxime in combination with metronidazole or clindamycin for anaerobic coverage and gentamycin is the recommended treatment for TOA.
- If there is no response to medical treatment of TOA within 48–72 h the patient should be evaluated for surgical management.
- Complications of the presence of ovarian cysts in pregnancy include torsion, rupture, haemorrhage and obstruction of labour.
- The incidence of ovarian torsion in pregnancy is higher than in non-pregnant women.
- Maternal serum CA125 levels increase in the first trimester of pregnancy and decline subsequently during the second and third trimesters.
- If elective surgery is indicated in pregnancy it should be performed in the early to mid-second trimester, if possible.
- Laparoscopic surgery appears to be safe in pregnancy.
- Approximately 5–18% of ovarian masses in premenopausal women are malignant.
- Women with ovarian cancer are often symptomatic.
- Use of hormone replacement therapy after treatment of epithelial ovarian cancer does not appear to affect survival or recurrence rates.