Gynaecological emergencies in pictorial review - what the on-call Radiologist needs to know!

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Learning objectives

1. To recognise typical imaging characteristics of acute gynaecological emergencies that can present to the on-call Radiologist.

2. To consider the differential diagnosis for common presentations, including non-gynaecological conditions which can mimic pelvic pathology in the female patient.
Background

Gynaecological imaging, and ultrasound in particular, is increasingly being performed by ultrasonographers and gynaecological clinicians, potentially resulting in the general radiologist feeling inexperienced in managing acute gynaecological emergencies that may present to them whilst on-call. The clinical presentation can be varied, with much overlap between acute gynaecological conditions and other non-gynaecological entities, including those relating to adjacent organ systems. A sound differential diagnosis is thus essential in this patient group, which should be tailored to account for patient age and menstrual phase.
We have sub-divided this pictorial review into two broad categories:

I. Common acute gynaecological conditions, further distinguishing complications of early pregnancy from non-pregnancy related emergencies, and

II. Gynaecological conditions of a more chronic nature, but which may undergo acute complication and thus result in the patient presenting to the out-of-hours team.

A good clinical history and examination remains key in formulating an initial differential diagnosis, which should be tailored to each individual patient, particularly taking into account the patient’s age, phase of menstrual cycle if applicable, previous gynaecological history, risk factors, and additional laboratory findings. This is essential in guiding appropriate imaging as part of the diagnostic work-up.

Naturally, the on-call Radiologist will also need to consider other non-gynaecological conditions which may mimic the clinical presentation and should be considered in the differential diagnosis of the patient suffering from acute abdominopelvic pain. Whilst a detailed description of these entities lies beyond the scope of this review, we have listed common conditions to consider and act as an aide memoire.

I. ACUTE GYNAECOLOGICAL CONDITIONS:

A. EARLY PREGNANCY-RELATED

When a woman in her reproductive years presents to the emergency room with pain and vaginal bleeding, the most important initial consideration should be whether there is any chance of early pregnancy. The differential diagnosis in a pregnant patient presenting with these symptoms in the first trimester includes normal early intrauterine pregnancy, spontaneous abortion, ectopic pregnancy, and molar pregnancy.¹

First-trimester bleeding complicates nearly 25% of all pregnancies, half of which end in spontaneous abortion. Various causes of abnormal uterine bleeding include entities such as subchorionic hemorrhage, infection, abnormal placental position, and trophoblastic disease.²

1. Spontaneous and incomplete miscarriage
Spontaneous abortions are common in pregnant patients with pain and bleeding. Criteria to diagnose a failed IUP at sonography should be sufficiently generous to allow for follow-up of any potential viable pregnancy but not unnecessarily follow-up clear nonviable pregnancies.¹

The following thresholds at transvaginal ultrasound are recommended in the literature:

1. Nonvisualization of a yolk sac by the time the mean sac diameter is 8 mm
2. Nonvisualization of an embryo by the time the mean sac diameter is 16 mm
3. Nonvisualization of cardiac activity by the time the embryo is 5 mm in length³

Incomplete miscarriage with retained products of conception (RPOC) is usually diagnosed on ultrasound (Fig. 1), with MRI (Fig. 2) potentially useful in rare cases requiring further evaluation. Sonographic appearances are varied but most commonly include a thickened heterogenous endometrial stripe with associated vascularity.

### 2. Ectopic pregnancy

The most common location of ectopic pregnancy is in the fallopian tube, with 75%-80% in the ampullary portion, 10% in the isthmic portion, 5% in the fimbrial end, 2%-4% in the interstitial end (sometimes called cornual ectopic), and 0.5% in the ovary.⁴ Abdominal, cervical, and scar pregnancies are rare.¹

The classic triad of clinical findings in ectopic pregnancy is pain, bleeding, and an adnexal mass, although this is present only in about 45% of patients.⁵

Echogenic fluid visualized in a patient with a positive #-hCG level has a positive predictive value of 86%-93% in the diagnosis of ectopic pregnancy.⁶ This is most frequently found in the more dependent Pouch of Douglas, although more extensive haemoperitoneum may be visualised throughout the abdomen and pelvis (Fig. 3), particularly in the haemodynamically unstable patient.

When ectopic pregnancy is evaluated with US, an echogenic adnexal ring with trophoblastic tissue lining the tube may be seen (Fig. 4). Tubal hematomas can appear as a complex adnexal mass. Visualization of an embryo with a detectable heartbeat within the adnexa confirms the diagnosis of ectopic pregnancy. It is commonly taught to suspect ectopic pregnancy at color Doppler imaging when the "ring of fire" is visualized.
(Fig. 5), owing to the low-impedance high diastolic flow seen in pregnancy that can surround the tubal ring of an ectopic pregnancy. However, a hypervascular ring is also seen in association with corpus luteum cysts, which are much more common than ectopic pregnancies. Color Doppler imaging is most helpful when an ectopic pregnancy is not seen but is highly suspected. In that case, color Doppler imaging can be used to help find a mass surrounded by bowel loops.\textsuperscript{1}

The size of the ectopic pregnancy, presence of cardiac activity, and presence of free fluid are important features in triaging patients to surgery, medical treatment, or expectant management.\textsuperscript{1}

3. Molar pregnancy

Trophoblastic disease is the result of dispermic fertilization of an empty ovum, usually 46,XX, with no fetal tissue present. This can present with abdominal pain and bleeding.

A "bunch of grapes" appearance with hydropic villi and trophoblastic hyperplasia is seen at US. Late in the first trimester, a large echogenic mass with multiple cystic spaces within the endometrial cavity is a classic finding(Fig. 6).\textsuperscript{2} However, earlier in pregnancy the appearance may be similar to a normal IUP or a hematoma within a gestational sac. A $h$-hCG value of more than 100 000 mIU/mL with a heterogeneous appearance to the endometrium with multiple small cystic spaces is suspicious for molar pregnancy.\textsuperscript{1}

Involvement of the myometrium constitutes an invasive molar pregnancy, whereas malignant extrauterine expression is termed choriocarcinoma.

B. NON-PREGNANCY RELATED

1. Ovarian torsion

Ovarian torsion is the abnormal rotation of an ovary upon its vascular pedicle, leading to vascular compromise of the ovary. Symptoms include sudden onset of abdominal pain, nausea, vomiting, a palpable pelvic mass, leukocytosis or fever.\textsuperscript{7-9} Ovarian torsion accounts for 2.7% of all gynaecologic emergencies. It is most common in the first three decades of life and more common during pregnancy. Right adnexal torsion is more common than left due to the position of the sigmoid colon on the left.\textsuperscript{10}

Although torsion can occur in normal ovaries, risk factors for torsion in adults include a lead mass and/or a long mesosalpinx. In children and adolescents ovarian torsion
has been attributed to a hypermobile mesosalpinx.\textsuperscript{12} Patients with diffuse ovarian enlargement from ovarian hyperstimulation syndrome and polycystic ovaries are also at increased risk.\textsuperscript{8}

Due to the variable sonographic appearance on grayscale imaging, depending on the presence of partial or complete torsion, the duration of torsion, and the presence of an associated mass, the diagnosis of ovarian torsion can often present quite a challenge.\textsuperscript{7,9,12} The most suggestive grayscale appearance is a unilaterally enlarged ovary with multiple peripheral follicles measuring 8-12 mm (Fig. 7), which is described more commonly in patients with symptoms of <24 hours duration.\textsuperscript{12} Other grayscale sonographic appearances of torsion include solid, cystic, ground-glass (low-level echoes), and complex lesions with septations or debris.\textsuperscript{7,9,12} Fluid in the Pouch of Douglas is common but not always present. The ovary may be abnormally located due to the twisting of the pedicle, often located in the midline cranial to the uterine fundus.

Color and spectral Doppler imaging (Fig. 7) may also be helpful, although again findings are variable. In early or milder degrees of torsion, venous flow is compromised before arterial flow decreases. Unfortunately, the presence of arterial and venous flow does not exclude torsion.\textsuperscript{13} In one study, up to 30\% of cases with surgically proven torsion still maintained venous flow.\textsuperscript{7,14}

Adnexal torsion may occasionally be diagnosed with CT or MRI (Fig. 8), especially in subacute cases where pain is less severe or intermittent. A twisted vascular pedicle may be better appreciated on coronal or sagittal views (Fig. 9). Fallopian tube thickening, smooth wall thickening of an ovarian cystic mass, ascites, and deviation of the uterus to the affected side may also be seen. Hemorrhagic complications (Fig. 10) are less common, but blood products can be identified within the tube, adnexal mass, and peritoneum. T1-weighted fat-saturated MRI or noncontrast CT can be helpful in these cases.\textsuperscript{15} Postcontrast MRI can be helpful in identifying nonvascularized ovaries suggestive of infarction.\textsuperscript{15-17}

**2. Pelvic inflammatory disease**

Pelvic inflammatory disease (PID) is an ascending infection from the vagina involving the cervix, uterus, fallopian tubes, and/or ovaries. Clinical symptoms include fever, purulent vaginal discharge, and acute pelvic pain worse on movement.\textsuperscript{13} Cervical excitation tenderness and adnexal tenderness are key clinical signs.\textsuperscript{18}
Ultrasound is used to visualize the extent of infection in the presence of a palpable adnexal mass (Fig. 11). Endometritis may have no discrete sonographic findings or may be seen as a thickened or slightly heterogeneous endometrial stripe. Salpingitis alone may have no sonographic findings, however, if the fallopian tube is dilated and pus-filled (pyosalpinx), a tubular structure with internal debris or a fluid-fluid level may be seen on ultrasound or cross-sectional imaging (Fig. 13, 14). As the infection worsens, an abscess involving the fallopian tube and ovary forms a tubo-ovarian abscess (TOA) which is often mass-like and heterogeneous in appearance (Fig. 12) with pronounced peripheral vascularity. It is estimated that TOAs complicate 10-15% of cases of PID. Adjacent structures can be involved such as small or large bowel, which can result in ileus or obstruction, or bladder wall, which can lead to dilatation of the pelvicalyceal system, especially if the vescico-ureteric orifice is involved. We illustrate a case complicated by acute pyogenic discitis of the upper sacrum (Fig. 15-17).

The presence of a TOA is generally an indication for hospitalization and intravenous antibiotics. The most serious complication of PID is ruptured TOA, which can rapidly lead to gram-negative endotoxic septic shock. Exploratory laparotomy at this point is considered mandatory.

The most common aetiology is Neisseria gonorrhoeae or Chlamydia trachomatis infection, with 30 to 40% of cases being polymicrobial. Infection with Actinomyces israelii, a saprophytic organism forming part of normal commensal oral and intestinal flora, has been associated with longstanding intrauterine device (IUD) use. (Fig. 18)

Pelvic inflammatory disease can lead to infertility and ectopic pregnancy if not diagnosed and treated early.

**Non-acute gynaecological conditions which undergo complication:**

1. **Torsion of ovarian fibroma/neoplasm**

In adults, 50 - 80 % of cases of ovarian torsion are associated with an ovarian tumour which acts as a lead point. (Fig. 19-20) The vast majority of these lead masses are benign, with dermoid and paraovarian cysts the most common. In post-menopausal women, lead masses may rarely include malignant aetiologies.

The lead mass is usually evident on ultrasound or cross-sectional imaging, and the features relating to adnexal torsion have already been discussed above.
2. Haemorrhagic/ruptured ovarian cyst

Functional or physiological ovarian cysts are hormone dependent, usually thin-walled cysts, the majority of which are asymptomatic. Three different types are described: i) Follicular, ii) Corpus luteal (CL), and iii) Theca lutein cysts. Occasionally these may present with pain or a palpable adnexal mass, especially if complicated by haemorrhage. Spontaneous rupture of a functional cyst may be associated with a small volume of pelvic free fluid resulting in peritoneal irritation (Fig. 21).

Haemorrhage into a functional cyst in the ovary can present with acute pelvic pain due to rapid enlargement and stretching of the adjacent ovarian parenchyma. This pain is amplified when a haemorrhagic cyst ruptures resulting in peritoneal irritation by blood, although haemoperitoneum is not a common presentation.

On ultrasound, findings include a hypoechoic ovarian mass with no internal vascularity and variable internal architecture. The most common internal appearance is a retracting clot with varying amounts of residual fibrin strands producing a "lace-like" or "fishnet" pattern (Fig. 22). As the blood matures, the internal architecture may become more cyst-like or have a low-level homogeneous ground-glass appearance (Fig. 23), occasionally mimicking an endometrioma. Rarely, hemorrhage may be extensive enough to necessitate surgical intervention.

Ultrasound follow-up is recommended for larger (>4 cm) or atypical cases to ensure resolution. In general, haemorrhagic cysts are expected to decrease with time, whilst an endometrioma is less likely to become significantly smaller and will usually remain stable in size or increase gradually over time.

3. Endometriosis/ruptured endometrioma

Endometriosis is ectopically located endometrial tissue outside of the endometrial canal but within the peritoneal cavity.

This entity occurs in 15 to 25% of infertile women. However, 30 to 40% of endometriotic patients are infertile.
While many endometrial implants are often not visible by imaging due to their small size, endometriosis can be a cause of acute pelvic pain, dysmenorrhea, and adhesions.\textsuperscript{23} When old blood products collect around a focus of endometriosis, this can be visualized on ultrasound as an endometrioma. Implantation sites most commonly involve the ovary, although implantation upon other intraperitoneal structures, such as uterine ligaments, Pouch of Douglas, fallopian tubes, or sigmoid colon also frequently occurs.\textsuperscript{24} Bilateral ovarian involvement occurs in a third to half of these patients.\textsuperscript{10}

Rarer sites of implantation include the thorax, which can lead to the so-called catamenial pneumothorax or hemothorax. Subcutaneous tissue endometriotic deposits have also been described from inadvertent implantation following prior surgery or intervention.

Occasionally, an endometrioma may rupture, causing hemoperitoneum and pelvic pain.

Characteristic sonographic appearances of an endometrioma include diffuse low-level internal echoes, absence of internal vascularity, and increased through-transmission.\textsuperscript{22}(Fig. 24). When imaged by MRI, endometrial implants are often not well visualized unless blood products are contained in an endometrioma. They are classically hyperintense on T1-weighted images (Fig. 25) and typically demonstrate shaded low to intermediate signal on T2-weighted images (Fig. 26). This graded appearance is due to cyclic haemorrhage within the cyst resulting in blood degradation products of differing age. Low T2-W signal of the cyst wall is due to the presence of haemosiderin.\textsuperscript{10} Internal fluid-fluid levels or heterogeneous signal may be seen in endometriomas with variable stages of internal bleeding.\textsuperscript{24}

Treatment recommendations according to the American College of Obstetricians and Gynaecologists (ACOG) include Gonadotropin-releasing hormone agonist (GnRH-a) and laparoscopic surgery.\textsuperscript{10}

\textbf{4. Leiomyomata}

Leiomyomas (also called myomas or fibroids) of the uterus (Fig. 27) are common and estimated to occur in over 20\% of Caucasian women over the age of 30 and 50\% of African American women, with incidence increasing with age until menopause.\textsuperscript{25-27}

Leiomyomas are composed of smooth muscle and various amounts of fibrous connective tissue.\textsuperscript{28} After menopause, leiomyomas tend to regress in size due to decreased estrogen stimulation and may coarsely calcify.
Whilst symptoms related to leiomyomas are usually chronic, patients may present acutely with severe pelvic pain or bleeding. Menorrhagia and menometrorrhagia are most often related to large leiomyomas or those located in a submucosal location. Pain may also be related to mass effect. Acute symptoms of excruciating pelvic pain in the setting of leiomyomas may be related to the tumor outgrowing its vascular supply, resulting in ischemia or necrosis.

Necrosis or degeneration can be classified as hyaline, cystic, myxomatous, fatty, or carneous (red) degeneration. Hyaline degeneration is the most common form, occurring in up to 60% of leiomyomas; carneous degeneration is hemorrhagic infarction due to obstruction of venous return. As a result, at MR imaging, leiomyomas can demonstrate various signal intensities depending on the type of degeneration. Hyalinization is the most common type and is seen as low signal intensity on T2-weighted images. Edema is also a common histopathologic finding and shows high signal intensity on T2-weighted images with marked enhancement. Cystic degeneration appears as distinct, round areas of low signal intensity on T1-weighted images and high signal intensity on T2-weighted images and lacks enhancement. Myxoid degeneration appears as a cystic mass filled with gelatinous material and has high signal intensity on T2-weighted images. Myxoid stroma contributes to delayed enhancement. Red degeneration is a kind of hemorrhagic infarction; it appears as a peripheral rim of high signal intensity on T1-weighted images and of low signal intensity on T2-weighted images and completely lacks enhancement. This rim may become densely calcified over time.

If rapid growth is seen without an identifiable cause, the gynecologist should be aware of the rare possibility of malignant degeneration to leiomyosarcoma or a rare spontaneous occurrence of leiomyosarcoma (Fig. 28-30). These patients may present to the acute admissions unit with abdominopelvic discomfort and a palpable mass.

5. Hamatocolpos in imperforate hymen

Hematocolpometra secondary to an imperforate hymen and retrograde menstruation is a rare entity that should be considered in the differential diagnosis of abdominal or back pain in premenarchal adolescent girls. The clinical presentation can be misleading because it occasionally mimics a pelvic mass or presents with constipation and back pain, due to irritation of the sacral plexus or nerve roots and urinary retention, due to compressive effects form the distended vagina. The diagnosis may be easily overlooked because gynecologic examination is not routinely performed in this age group, so increased suspicion of this entity is essential. Sonography of the lower abdomen
reveals the characteristic appearance of a large cystic mass containing echogenic fluid, corresponding to the distended blood-filled vagina and uterus (Fig. 31), and therefore plays a crucial role in the diagnosis of hematocolpometra. Further assessment by MRI is possible (Fig. 32) to better delineate the underlying anatomy, although clinical examination can usually discriminate between the causes of hematocolpometra as both an imperforate hymen and a transverse vaginal septum can lead to obstruction of the vagina. 41,42

6. Complications of gynaecological malignancy

There are a number of complications relating to gynaecological malignancy which can result in acute presentation to the emergency department. This can result from acute complication relating to the primary malignancy itself, usually as a result of progressive disease, such as acute bowel obstruction, often in the context of disseminated peritoneal metastases in, for example, ovarian cancer. However, effects of oncotherapy may also precipitate an acute complication, such as radiation- or chemotherapy-induced enteritis (Fig. 33-35) or cystitis (Fig. 36-38).

Whilst an in-depth discussion of these conditions falls beyond the scope of this review, it is important for the emergency radiologist to keep this patient group in mind.

**Non-gynaecological conditions to consider in acute abdominopelvic pain:**

Whilst a detailed description of radiological findings in non-gynaecological disease lies beyond the scope of this pictorial review, there are a number of non-gynaecological conditions that the out-of-hours Radiologist will be aware of which may mimic gynaecological pathology in the patient presenting with acute abdominopelvic pain.

These include the following:

1. Urinary tract infection/Cystitis
2. Appendicitis
3. Diverticulitis
4. Renal colic
5. Epiploic appendagitis
6. Omental infarct
Other upper abdominal conditions such as peptic ulcer disease, cholecystitis and pancreatitis tend to give rise to symptoms predominantly within the epigastric region and both upper quadrants, although there may be considerable overlap, especially in complicated cases, such as those with visceral perforation.

Clearly, the differential diagnosis will be adjusted according to patient age, associated findings and laboratory investigations. However, a quick review for these common conditions should still be performed during image reading, even if an obvious gynaecological abnormality is detected on initial reading, to exclude co-existent disease. This is of particular relevance in the pregnant patient and those found to have a chronic/non-acute gynaecological entity, which may not account for the patient's acute presentation.
Fig. 1: Incomplete miscarriage. TVUS depicting thickened endometrium (white arrows) due to retained products of conception following incomplete spontaneous abortion in the first trimester.

**Fig. 2:** Incomplete miscarriage. Sagittal T2-W MR image depicts endometrial fluid and retained products of conception which protrude through the open cervical os in a 25 year old woman who presented with vaginal bleeding and pelvic pain following incomplete spontaneous miscarriage.

Fig. 3: Ectopic pregnancy. Transabdominal ultrasound in the tranverse plane depicts a significant volume of free fluid in the right iliac fossa, which contains diffuse low level echoes in keeping with haemorrhage/haemoperitoneum.

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Fig. 4: Ectopic pregnancy. Transabdominal ultrasound of the right adnexum demonstrates a hyperechoic tubal ring with central cyst, confirmed on other images to be separate from the right ovary, representing an early tubal ectopic pregnancy within the right Fallopian tube. The embryo could not be identified on these transabdominal images.

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Fig. 5: Ectopic pregnancy. The peripheral hypervascular so-called "ring of fire" is demonstrated at the outer margins of the tubal ring on colour flow Doppler.

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Fig. 6: Molar pregnancy. Sagittal transvaginal view of the uterus shows multiple cysts distending the endometrial cavity (arrows). The #-hCG level was 180 000 mIU/mL. Histologic evaluation demonstrated a partial molar pregnancy.

Fig. 7: Ovarian torsion, intermittent. (A) Grayscale image of ovary demonstrates markedly enlarged ovary with peripheral hemorrhagic follicles (arrow). (B) Spectral Doppler tracing demonstrates some preservation of arterial vascularity despite torsion.

Fig. 8: Ovarian torsion. Axial T2-W MR image demonstrates an enlarged congested right ovary (red arrow) with multiple follicles, the majority seen at its periphery, and an increased signal oedematous component within the central stroma. A small volume of dependent free fluid is present in the Pouch of Douglas. Note the polycystic appearance of the left ovary (white arrow).

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Fig. 9: Ovarian torsion. Coronal oblique T2-W MR image depicts a thickened congested vascular pedicle of the right ovary at its right inferolateral aspect (red arrow). Note the trace of pelvic free fluid (white arrow) adjacent to the uterine cervix.

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**Fig. 10:** Ovarian torsion. Axial T1-W MR image demonstrates increased stromal signal within the enlarged congested right ovary indicating an intraparenchymal haemorrhagic component due to venous congestion.

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**Fig. 11:** Pelvic inflammatory disease. Transvaginal ultrasound images demonstrate a heterogenous echobright left adnexal mass adjacent to left ovary in a septic patient with lower abdominal pain.

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Fig. 12: Pelvic inflammatory disease. Post-contrast coronal CT image of a complex left adnexal mass with thickened enhancing wall, internal septation and fluid internal components. The left ovary could not be identified separately. These appearances are in keeping with a left tuboovarian abscess.

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**Fig. 13**: Pelvic inflammatory disease. Axial T2-W MR image demonstrates a thick-walled, serpiginous fluid-filled structure in the left adnexa (white arrow) which contains heterogenous intraluminal content with intermediate signal tissue and debris (red arrow), in keeping with a left pyosalpinx.

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Fig. 14: Pelvic inflammatory disease. Sagittal T2-W MR image in the same patient demonstrates the left pyosalpinx (white arrow) adjacent to a thickened pelvic loop of fluid-filled small bowel (red arrow) due to localised ileus secondary to pelvic sepsis.

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Fig. 15: Pelvic inflammatory disease. Midline sagittal T2-W MR image of the pelvis demonstrates a complex left tubo-ovarian complex (white arrow) in a different patient, complicated by a sacral discitis (red arrow). There is destruction of vertebral end plates adjacent to the complex disc-based infective collection. A transurethral catheter is in-situ (blue circle).

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Fig. 16: Pelvic inflammatory disease complicated by discitis. Midline sagittal T1-W unenhanced MR image from a dedicated lumbar spine protocol shows S1/S2 discitis (red arrow) and complex left tubo-ovarian abscess (white arrow). Increased T1-W signal of the inner rim of the left tubo-ovarian abscess is due to granulation tissue.

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Fig. 17: Pelvic inflammatory disease complicated by discitis. Midline sagittal T1-W MR image following administration of intravenous gadolinium-based contrast agent demonstrates enhancing inflammatory presacral tissue (red arrow) associated with the septic discitis. The T1 hyperintense rim of the left tubo-ovarian abscess appears a little more prominent on these post-contrast images, indicating a degree of superadded peripheral rim enhancement.

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**Fig. 18:** Pelvic inflammatory disease. Axial CT image demonstrates bilateral heterogenous tubo-ovarian complexes (white arrows). The presence of an intrauterine contraceptive device (red arrow) raises the possibility of Actinomyces as infective organism.

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Fig. 19: Adnexal torsion with lead mass. Coronal CT image shows a large left ovarian cyst (red arrow) in an abnormal position due to torsion of the left adnexa. The partially-imaged oedematous left ovary and adjacent engorged vascular pedicle is visible at the left inferolateral aspect (blue arrow). Normal right ovary lies inferior to the left ovarian cyst (white arrow).

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**Fig. 20:** Adnexal torsion with lead mass. The left gonadal vessels (green arrow) on this axial post-contrast CT image could be traced inferiorly from the abdomen to the site of torsion, with the engorged vascular pedicle and oedematous left ovary seen immediately distal to this, adjacent to the large left ovarian cyst representing the lead mass.

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**Fig. 21:** Ruptured corpus luteum cyst. Coronal contrast-enhanced CT image depicts a peripherally-located ruptured cyst with hyperenhancing wall (red arrow) of the left ovary (blue arrow) with a small volume of intraperitoneal free fluid (white arrow).

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**Fig. 22:** Haemorrhagic ovarian cyst (HOC). Grayscale ultrasound image in a 25-year-old woman with acute pelvic pain showing a well-defined, complex cyst with internal septation in a reticular pattern suggestive of a haemorrhagic ovarian cyst. There is a retracting blood clot (black arrow) and multiple fibrin strands (white arrowheads).

**Fig. 23:** Haemorrhagic ovarian cyst (HOC). Grayscale ultrasound image of the right ovary depicts a complex cyst containing thin septations with multiple low-level echoes distributed relatively diffusely, mimicking an endometrioma. Follow-up study 6 weeks later confirmed significant resolution, in keeping with a haemorrhagic cyst.

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Fig. 24: Haemorrhagic ovarian cyst and endometrioma. TVUS in a patient with a co-existing endometrioma and hemorrhagic cyst in the same (right) ovary. The left-sided image depicts a haemorrhagic cyst which contains fine internal fibrinous strands suggesting clot formation. The cyst depicted in the right-sided image has a more homogenous internal matrix, containing uniform low-level echoes throughout - a typical appearance of an endometrioma (so-called "chocolate cyst").

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**Fig. 25:** Endometrioma. Axial T1-W MR image of the pelvis demonstrates a large right endometrioma with shaded increased signal layered posteriorly within it, consistent with blood degradation products.

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**Fig. 26**: Endometrioma. Corresponding axial T2-W image of the same lesion depicted in Fig. 25 demonstrates typical gradation of T2-W signal/shading (white arrow) within the right endometrioma due to cyclical haemorrhage, resulting in blood degradation products of varying age within the same lesion.

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Fig. 27: Uterine leiomyoma. Large leiomyoma in the lower uterine segment in a 28-year-old pregnant woman. Sagittal fat-suppressed T2-weighted MR image shows a large leiomyoma (long arrows) in the anterocaudal part of the uterus, protruding into the endometrial cavity which demonstrates typical appearances with predominantly low signal intensity, with some central high signal in keeping with a degree of cystic degeneration. Note the gravid uterus (short arrows) and placenta (+).

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Fig. 28: Sarcomatous transformation within an intramural uterine leiomyoma. This coronal T2-W MR image depicts a large heterogenous mass which is largely well-defined with a hypointense signal rim/capsule. The lesion lies within the myometrium (red arrows), and results in displacement and effacement of the distorted endometrial cavity (white arrow).

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**Fig. 29:** Sarcomatous transformation within an intramural uterine leiomyoma. On this coronal T2-W MR image, we can see that whilst the myometrial lesion is largely well-defined, there is a more solid intermediate soft tissue component which has breeched the outer capsule at its left inferolateral aspect (yellow arrow) and appears to invade adjacent pelvic fat. The displaced endometrial cavity (white arrow) is again shown.

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Fig. 30: Sarcomatous transformation within an intramural uterine leiomyoma. This sagittal T2-W MR image confirms the myometrial location of the heterogenous mass which lies within the posterior uterine wall, distorting the endometrial cavity (white arrows) at its anterior aspect.

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**Fig. 31:** Haematocolpometra. Transabdominal ultrasound image of the lower abdomen of a 12-year-old patient presenting with abdominal and back pain demonstrates a thin-walled cystic mass (V) posterior to the urinary bladder (B) measuring 13.7 cm × 5.6 cm × 5.2 cm, which contains echogenic fluid, representing the distended vagina. There is also fluid with echogenic material in the distended endometrial cavity (e). The findings are typical of heamatocolpometra due to obstruction of the vagina, leading to retrograde menstruation.

© Drakonaki E. Hematocolpometra Due to an Imperforate Hymen Presenting With Back Pain Sonographic Diagnosis. JUM (2010);29:321-322
**Fig. 32:** Haematocolpos. Sagittal T2-W MR image in an adolescent with a history of amenorrhoea, demonstrates a grossly distended vagina (white arrows) containing intermediate signal blood degradation products, resulting in effacement and distortion of the urinary bladder. There is also a trace of fluid in the endometrial cavity which is of similar signal intensity. An imperforate hymen was evident on clinical examination.

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Fig. 33: Chemotherapy-induced ileitis. This contrast-enhanced coronal CT image demonstrates marked mural thickening of pelvic ileal loops (white arrows), with preservation of mural layering and mucosal hyperenhancement resulting in a targetoid appearance in cross-section. Prominent loops of proximal small bowel in the left upper quadrant (red arrows) and the ascending colon (blue arrow) are not thickened but are fluid-filled. The patient complained of profuse diarrhoea and abdominal pain and a diagnosis of ileitis induced by recently-commenced chemotherapeutic agents was made.

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Fig. 34: Chemotherapy-induced ileitis. Axial T2-W MR image in the same patient as Fig. 33, demonstrates mural thickening and oedema within the fluid-filled distal ileum (white arrows).

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Fig. 35: Chemotherapy-induced ileitis. Axial T1-W MR image following administration of intravenous gadolinium-based contrast medium demonstrates diffuse enhancement of the thickened ileal wall (white arrows) in keeping with an underlying inflammatory process.

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**Fig. 36:** Radiation induced cystitis. Sagittal T2-W MR image demonstrates a diffusely thickened oedematous bladder wall (red arrow) in a patient recently treated with external beam pelvic radiotherapy following hysterectomy for cervical carcinoma. There is also a small volume of free fluid in the pelvis and inflammatory change in the adjacent pelvic fat in keeping with recent pelvic irradiation.

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Fig. 37: Radiation induced cystitis. This coronal T2-W MR image of the same patient demonstrates marked high signal oedematous change within all layers of the bladder wall (red arrow) with significant mucosal thickening and oedema (blue arrow) of particular prominence.

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Fig. 38: Radiation induced cystitis. Axial STIR MR image demonstrates the grossly oedematous bladder wall (red arrow) with marked inflammatory changes also within the adjacent pelvic fat (blue arrows) and a trace of free fluid, in keeping with recent pelvic irradiation.

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Conclusion

A sound knowledge of imaging features of those conditions resulting in acute gynaecological emergencies and their mimics is essential to the on-call Radiologist.
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