Diagnostic imaging of benign diseases of the female pelvis: US, HSG, CT and MRI findings

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Learning objectives

- Presenting a wide variety of benign gynecological form of typical and atypical presentation with different imaging techniques: ultrasound, HSG, CT and MRI.

- Show benign gynaecological pathology during pregnancy by ultrasound and MRI.

Background

INTRODUCTION

Benign gynaecological disorders are some of the most common causes of medical consultation. Symptoms vary from unspecific pelvic pain to hypovolemic shock due to ruptured ectopic pregnancy. Findings sometimes arise incidentally.

Ultrasonography (abdominal and transvaginal) is the technique of choice for initial diagnosis and allows, in a great percentage of cases, to establish final diagnosis. Nevertheless, when ultrasound results are not conclusive, we may resort to other imaging techniques such as CT in urgent cases, or MRI or hysterosalpingography (HSG) for non-urgent pathologies.

We present a wide variety of benign gynaecological diseases and their typical and atypical manifestations with different imaging techniques.

Imaging findings OR Procedure details

BENIGN GYNAECOLOGICAL DISEASES

NON-TUMOURAL CYSTIC LESIONS

# FUNCTIONAL CYSTS
They occur when the egg fails to mature during ovulation or corpus luteum regression. There are three types of ovarian cysts and these include: **follicular cyst**, **corpus luteum cyst** and **haemorrhagic cyst**.

- **Follicular Cysts**

  Occur when a dominant follicle fails to extrude the ovum. Although more frequent in premenopausal women, they can also be detected during the foetal period and perimenopause. Follicles are considered follicular cysts when their size exceeds 3 cm. Usually detected incidentally and resolve spontaneously within one or two cycles. When follicular cysts persist for several cycles, ovarian neoplastic cysts should be considered in differential diagnosis. On US, they present as anechoic masses with a thin wall, without septa or solid poles. On CT, they appear as homogeneous, hypodense, thin-walled masses (Fig. 1 on page 11) and show no contrast enhancement. On MRI, they behave like simple cysts, hypointense on T1-weighted images and hyperintense on T2-weighted images and absence of contrast enhancement.

- **Corpus Luteum Cysts**

  Occur when corpus luteum fails to regress or when excessive bleeding of the corpus luteum takes place after ovulation. When cyst diameter does not exceed 2.5 cm, corpus luteum is considered normal (Fig. 2 on page 11). Typically thick-walled, irregular and hypervascularised. On Doppler US, peripheral vascularisation is described as "ring of fire" or "vascular crown". On CT, they appear as hypodense nodules with increased peripheric vascularity of wall inside the ovary (Fig. 3 on page 12). They may rupture, causing acute abdomen (Fig. 4 on page 14).

- **Haemorrhagic Cysts**

  Both follicular cysts and corpus luteum cysts may bleed and cause a haemorrhagic cyst. Bleeding may be asymptomatic or cause severe pain. They are generally single cysts that disappear within one or two cycles, unlike endometriomas that persist. On US, they appear as heterogeneous masses containing internal echoes and exhibit some posterior shadowing (Fig. 5 on page 16). Usually hyperintense on MRI T1-weighted images, with or without fat suppression, hypointense on T2-weighted images and do not enhance following administration of contrast.

# PARAOVARIAN CYSTS
Paraovarian cysts do not arise from the ovary but from the paramesonephric, mesothelial, or mesonephric. Typically located on the mesosalpinx or wide ligament. Normal visualisation of both normal ovaries and stability of the lesion during the different phases of the menstrual cycle is key to their diagnosis. On US, they present as unilocular, thin-walled cysts. On CT, they appear as functional cysts. On MRI, they behave like simple cysts, hypointense on T1-weighted images and hyperintense on T2-weighted images absence of contrast enhancement.

# PERITONEAL INCLUSION CYSTS

Peritoneal inclusion cysts are also referred to as peritoneal pseudocysts (according to anatomopathologists) or as adhesion syndrome (according to gynaecologists). Occur when peritoneal fluid is not reabsorbed in the ovaries of premenopausal women who also present pelvic adhesions. The fluid is trapped because the damaged peritoneum cannot reabsorb it and produces a cystic mass that can invade the whole ovary. The complexity of these cysts depends on the amount of adhesions. Differential diagnosis is made with paraovarian cysts, hidrosalpinx and even cystic ovarian tumours (Fig. 6 on page 18). On US and MRI, they behave like simple or multiple lesions with thin or thickened walls, difficult to distinguish from other entities.

TUMOURAL CYSTIC LESIONS

# TERATOMA

96% of teratomas are mature cystic teratomas, also called dermoid cysts. Mature cystic teratoma is a benign ovarian tumour, often found in children and women < 45 years. It may be bilateral in 15-20% of cases. Teratomas arise from pluripotent germ cells derived from the three primary germ layers (endoderm, mesoderm and ectoderm). They cannot contain bones, teeth, hairs, cartilage, skin, muscle or fat, among other components. They are mostly asymptomatic. The most frequent associated complication is ovarian torsion caused by tumour. Their imaging features vary depending on the percentage of elements they contain. On ultrasound, they display different presentations: cystic mass containing a hyperechogenic nodule (Rokitansky nodule) made of hairs, calcifications or bones (Fig. 7 on page 18), and a complex cystic mass containing septa and solid poles. The key for diagnosis is the detection of fat inside the lesion by CT or MRI.

# CYSTADENOMA
Cystadenomas account for 50% of benign ovarian cysts. Two types have been identified: **serous cystadenoma** and **mucinous cystadenoma**. Serous cystadenomas tend to be cystic lesions with thin walls and few septations. They can be bilateral in 20% of cases. Mucinous cystadenoma tends to be larger in size and often multiloculated, yet also thin-walled. Sometimes give a characteristic non-pathognomonic "stained-glass appearance". They are bilateral in 5% of cases. On US, they appear like cystic masses, with a single or multiple fine septations or a small papillary proliferation. On CT, they appear like thin-walled, hypodense, uni- or multiloculated lesions (Fig. 8 on page 19). On MRI, they exhibit as cystic lesions of varying intensity, depending on the amount of blood loss and, in mucinous tumours, on the amount of mucin.

**SOLID TUMOUR LESIONS**

# LEIOMYOMA

Leiomyomas are the most frequent tumours found in the female reproductive tract. They are benign tumours that originate from the myometrium. They affect 20% of women >30 years. Depending on the location, they can be subserous, intramural or submucosal. Submucosal myomas are located in the endometrial cavity and may be mistaken for endometrial lesions on HSG (Fig. 9 on page 21). Pedunculated-subserous myomas may mimic solid ovarian neoplasms (Fig. 10 on page 23). Myomas show variable appearances depending on histopathological changes that may be present: degeneration (hyaline, cystic, myxoid and red), haemorrhage, necrosis and calcification. Red degenerations involve massive haemorrhagic infarction of a myoma, due to obstruction of drainage veins at the periphery of the lesion. On T2-weighted MRI images, they appear as a heterogeneous hyperintense mass, with a hypointense halo. On T1-weighted sequences, this halo is hypointense when haemorrhage is acute or hyperintense when haemorrhage is subacute. No contrast enhancement is seen in any of the sequences (Fig. 11 on page 23). Myomas that do not present the above-mentioned histopathological changes are seen as hypoechoic solid masses on MRI and on T2-weighted MRI sequences, they typically appear as hypointense masses with intense contrast uptake.

# FIBROMA, THECOMA AND FIBRO-THECOMA

They are the most common solid benign tumours of the ovary. Although the concept of solid mass is a criterion of malignancy in ovarian tumours, these tumours are an exception. Thecomas and fibro-thecomas may produce oestrogens and be associated with endometrial hyperplasia and endometrial carcinoma. On US, they present as
heterogeneous lesions and exhibit posterior acoustic enhancement. On CT, they present as solid masses with low enhancement (Fig. 12 on page 24). Typically, they are hypointense on T2-weighted MRI and exhibit intermediate or hypointense signal on T1-weighted images. No or low signal intensity is observed after the administration of contrast, due to the high content of collagen. Differential diagnosis of these tumours is established with subserous myomas. An unusual presentation of these entities is the Meig’s syndrome (ascites and pleural effusion associated with benign ovarian tumours).

**ENDOMETRIOSIS**

Endometriosis is characterised by the presence of endometrial tissue (stroma and glands), outside the endometrial cavity. This entity only affects women in their reproductive years. Different types have been described, depending on the location of endometrial tissue: **endometrioma** when located in the ovary, **adenomyosis** when located in the myometrium and **deep endometriosis** when endometrial tissue is found in any intraabdominal organ other than the uterus or the ovaries. Usually occurs in a clinical context of infertility or chronic pelvic pain, although it may also be asymptomatic or present with other symptoms, depending on organs affected. US is the imaging modality of choice for ovarian or urinary bladder endometriosis but MRI is more useful to assess affectation of other organs and extension.

- **Endometrioma** or **Ovarian Endometriosis**.

The most frequent manifestation of endometriosis. They are bilateral in 30% of cases. Also referred to as "chocolate cysts" for their macroscopic appearance due to cyclic bleeding. At imaging, they are "great simulators" and should be included in the differential diagnosis of practically all adnexal cystic lesions. On US, they typically correspond to cysts containing fine echoes and small hyperechogenic foci detected on wall (Fig. 13 on page 26), although this is not pathognomonic and may be observed in other entities. MRI presentation depends on time of bleeding. When haemorrhage is recurrent, endometriomas typically exhibit high signal intensity on T1-weighted images but with a loss of signal intensity on T2-weighted images, a phenomenon that is referred to as "shading" (Fig. 14 on page 28). Endometriomas may rupture and cause blood to flow to the pelvis (Fig. 15 on page 30) and adhesion syndrome (Fig. 16 on page 30, Fig. 17 on page 31).

- **Adenomyosis**

Characterised by the presence of ectopic endometrial tissue within the myometrium and associated with hypertrophy of the surrounding myometrial tissue. It may be diffuse, focal,
or present as a mass (polypoid, intramural or subserous), in which case it is known as adenomyoma. Adenomyosis can be diagnosed with US, MRI, and in some cases with HSG. Ultrasound features of adenomyosis include: an enlarged, globular uterus with small myometrial cysts.

Typically, MRI image of adenomyosis corresponds to a focal or diffuse thickening of the junctional zone (>12 mm) with small hyperintense foci on T2-weighted sequences that correspond to ectopic endometrial tissue with glandular dilatation (Fig. 18 on page 32). When ectopic endometrial tissue bleeds, T1-weighted sequences show hyperintense areas or foci. At HSG, adenomyosis can present as linear or saccular contrast on the surface of the endometrial cavity (Fig. 19 on page 34). On MRI, adenomyoma presents as a mass with well-defined margins whose intensity varies according to the amount of bleeding and time of evolution (Fig. 20 on page 34).

- Deep endometriosis

Defined as ectopic endometrial tissue that infiltrates the peritoneal surface, penetrating into the retroperitoneal space or the wall of the pelvic organs to a depth of >5 mm. Depending on the distribution of the lesions, we visualise an anterior compartment: vesicouterine pouch, urinary bladder and ureters and a posterior compartment: pouch of Douglas, posterior wall of uterus, uterosacral ligaments, rectovaginal septum, rectum and sigma (Fig. 21 on page 35). Clinical manifestations vary depending on affected organs. When urinary bladder is involved, it affects the posterior and dome. Usual symptoms include: hypogastric pain, long-term micturition problems, cyclic haematuria (only 30%), etc. On US, focal or diffuse thickening simulating bladder neoplasm (Fig. 22 on page 37). When endometriosis is implanted on the intestines or the ureters, it may cause ureterohydronephrosis or intestinal obstruction. On MRI, deep endometriosis has different imaging presentations: hyperintense foci on T1-weighted sequences (corresponding to haemorrhagic nodules), hypointense areas with small cystic foci on T2-weighted sequences (corresponding to ectopic endometrial tissue with glandular dilatation) (Fig. 23 on page 39), and hypointense masses with speculated margins that displace adjacent organs (corresponding to fibrotic tissue). This latter presentation may simulate metastatic peritoneal implants or lead to overstaging of concomitant adjacent neoplastic processes (Fig. 24 on page 39).

PELVIC INFLAMMATORY DISEASE (PID)

PID is an infection of the upper female genital tract (endometrium, tubes and ovaries) following and infection of the external genitalia. It is associated with Neisseria Gonorrhoeae and Chlamydia Trachomatis, although between 30-40% are polymicrobial. Other organisms involved are Actinomycyes Israeliii and Micobacterium Tuberculosis.
Risk factors associated with PID are: young women, sexual promiscuity, low socio-economic status, use of IUD and pelvic instrumentation. Although symptoms are mild and nonspecific, complications, if not treated early, may be very serious: infertility, high risk of ectopic pregnancy, recurrence of chronic pelvic pain. US is the first Imaging modality to be used when PID is suspected. MRI findings include: thickening of the endometrium (endometritis), enlarged ovaries (oophoritis), tubular or corkscrew dilatation of tubes with or without echogenic material (hydrosalpinx/pyosalpinx) and, in severe cases, pelvic collections (tubo-ovarian abscess). These CT findings may be much more difficult to visualize: hyperenhancement of endometrium, thickening and hyperenhancement of fallopian tubes walls, enlargement of ovaries with polycystic appearance (Fig. 25 on page 40) thickening of uterosacral ligaments and increased density within the pelvic fat. CT reveals the presence of tuboovarian abscesses better than US (Fig. 26 on page 42). The presence of gas within these abscesses is rare and suggests the possible non-gynaecological origin of the process (Fig. 27 on page 42). If treatment is not administered in time, complications such as adhesion syndrome, chronic pelvic pain, infertility, etc. may occur. One of the characteristics of PID and chronic endometriosis is the visualisation of the tubo-ovarian apparatus closely bound to uterus, giving a "clover-leaf" appearance (Fig. 28 on page 43).

When PID is produced by Actinomyces Israelii or M. Tuberculosis, the infection may be clinically silent for a long time and simulate malignant neoplasm of the ovary or the digestive tract at the time of diagnosis (Fig. 29 on page 44). When PID simulates ovarian neoplasm, MRI can help reach diagnosis (Fig. 30 on page 45). Tubo-ovarian abscess appears as a cystic mass with irregular thick walls, hypointense on T1-weighted sequences and hyperintense on T2-weighted sequences and contrast enhancement.

VASCULAR LESIONS

# OVARIAN VEIN THROMBOSIS

Ovarian vein thrombosis is a medical emergency that may occur after childbirth, pelvic surgery or trauma, as a complication of PID or chemotherapeutic treatment of tumour. In 80-90% of cases, the right ovarian vein is involved, possibly due to retrograde flow in the left vein preventing stasis and ascending infection. Diagnosis may be made by CT and MRI, although CT is the technique of choice. CT image characteristically reveals a filling defect within the ovarian vein (Fig. 31 on page 46).

# PELVIC CONGESTION SYNDROME
Pelvic congestion syndrome is a complex, less known pathologic condition that affects up to 10% of women. Its aetiology is not well known. It is characterised by the presence of varices of the ovarian veins and other pelvic veins (hypogastric, pudenda, etc.). This syndrome is often associated with varices of the lower extremities and polycystic ovaries. The most common symptom is chronic pelvic pain (>6 months). US findings show tortuous pelvic veins with a diameter greater than 5-6 mm, slow blood flow and dilated myometrial vessels that communicate with the varicose veins in the pelvis. Diagnostic criteria for CT and MRI include the presence of dilatation and tortuosity of pelvic vessels around the uterus and the ovaries (>4 mm), that sometimes extend up to the wide ligament, and dilatation of ovarian veins (>8 mm) (Fig. 32 on page 47).

OVARIAN TORSION

Ovarian torsion results from the total or partial occlusion of the vascular supply to the ovary. Blood flow may be compromised even in the presence of Doppler signal within the ovary. The most common cause of ovarian torsion is the presence of cystic masses that are found in 50% of cases. Torsion of the right ovary is more common than the left. Torsion of a normal ovary, with no associated masses, occurs in preadolescent girls. The main symptoms are pain, nauseas, vomiting, leukocytosis and low-grade fever. Image findings correspond to an increase in the size of the ovary (>5cm) and visualisation of follicles in the periphery of the ovary (Fig. 33 on page 48). US is more sensitive than CT in the diagnosis of ovarian torsion, as it can detect the presence or absence of flow. CT shows a heterogeneous, hyporenchanced mass >5 cm corresponding to the ovary and the mass causing the torsion.

BENIGN GYNAECOLOGIC CONDITIONS IN PREGNANCY

Some pathologies are specifically associated with pregnancy: ectopic pregnancy, endometrial decidualization, luteoma of pregnancy and solitary luteinized follicle cyst of pregnancy.

ECTOPIC PREGNANCY

Ectopic pregnancy is defined as the implantation of a fertilized ovum outside the endometrial lining of the uterus. Its incidence has risen in the last decades due to the increase of risk factors such as PID, endometriosis, tubal surgery, infertility treatments, and advanced age primiparity. The most common site for and ectopic pregnancy is the fallopian tubes (98%). Other less common types of ectopic pregnancy include interstitial
(myometrial segment of the fallopian tube), cervical, scar of a prior caesarean section, and abdominal cavity pregnancy. On US, they appear as a small anechoic sac with a thick hyperechoic ring (Fig. 34 on page 49), and MRI reveals a round thick-walled mass, hyperintense on T2-weighted sequences (Fig. 35 on page 51).

DECIDUALISED Ovarian Endometriosis

Hormonal changes that occur during pregnancy rarely produce morphological changes in the endometria that may simulate ovarian neoplasms. These changes are due to the decidualisation of the ectopic endometrial tissue that is progesterone-induced. Typical US image shows papillary proliferation or excrescences within a cystic mass without septations; no ascitis is observed. Colour Doppler analysis detects multiple vascularisation signals with low resistance index within the solid part. On MRI, papillary proliferations are hyperintense on T2-weighted images (Fig. 36 on page 51). These changes disappear after pregnancy and the endometrium recovers its characteristic appearance. This process is usually asymptomatic but may sometimes produce massive haemorrhage caused by the rupture of pelvic vessels.

# Luteoma Pregnancy

Luteoma pregnancy is a solid lesion that arises under the stimulation of chorionic gonadotropin (hCG) on ovarian parenchyma that is replaced by a proliferation of luteinized stromal cells. 25% of luteomas produce androgens that may be responsible for virilisation of both the mother and the female foetus. On US, they appear as highly vascularised, hyperechoic, heterogeneous masses, unlike solid ovarian tumours that are usually hypovascularised. They spontaneously regress 2-3 weeks postpartum.

# Solitary Luteinized Follicle Cyst of Pregnancy

During pregnancy and puerperium, a large solitary cystic follicle (up to 25 cm) referred to as large solitary luteinized follicle cyst of pregnancy and puerperium (LSLFCPP) may occur. LSLFCPP is secondary to high maternal human chorionic gonadotropin (HCG) serum levels. It is usually unilateral, unilocular and thin-walled. LSLFCPP behave like simple cysts on US and MRI, without septations or solid components (Fig. 37 on page 52). It is a rare lesion but should be known, as it may occasionally complicate pregnancy, delivery and puerperium or simulate ovarian neoplasm.
Fig. 1: Follicular cyst. 24 year-old woman presenting with right lower abdominal pain. A,B) Unenhanced CT scan shows a hypodense mass measuring 5 x 4 cm with thin walls (arrows). C) Endovaginal ultrasound after three weeks demonstrates a decrease in the diameters of the cyst (1.4 x 1.3 cm)
Fig. 2: Corpus luteum. 38 year-old woman in workout for anemia. Enhanced CT shows an incidental finding of a small hypodense nodule with thick enhancing walls in the left ovary (arrow).
Fig. 3: Corpus luteum cyst. 29 year-old woman with right lower abdominal pain. A) transvaginal ultrasound shows a cyst with thick walls and peripheral intense vascularisation ("ring of fire"). B) Enhanced CT shows an intense enhancement of the cyst walls.
Fig. 4: Corpus luteum cyst rupture. 31 year-old woman consulting at the emergency unit for pelvic pain. Enhanced CT shows a hypodense nodule in the left ovary with peripheral enhancement that is discontinuous at a small point in the left ovary (blue arrow) and hyperdense fluid in Douglas pouch (yellow arrow). Findings consistent with corpus luteum cyst rupture and hemoperitoneum.
**Fig. 5:** Haemorrhagic cyst. Sonography in a 42 year-old woman for an unrelated cause shows a right ovarian cyst with inside echoes and acoustic enhancement (yellow arrow). Sonography was done at the 19th day of menstrual cycle. Differential diagnostic includes haemorrhagic cyst, endometrioma and tumor. CT shows a non-specific hypodense lesion (blue arrow). Later transvaginal sonography demonstrated no cyst.

**Fig. 6:** Right peritoneal inclusion cyst and left functional cyst. 40 year-old woman presenting with acute diverticulitis. A) Abdominal ultrasound shows incidental thin-walled cystic lesion with no septa in both ovaries. B) CT shows the hypodense, homogeneous, thin-walled non-enhancing nodules in both ovaries (right blue arrow and left yellow arrow). C) CT in the follow-up for diverticulitis shows persistence of right ovaric cyst (blue arrow) and disapearence of left cyst. Surgery demonstrated right peritoneal inclusion cyst.
Fig. 7: Cystic mature teratoma. 31 year-old woman with abdominal mass. A, B) Abdominal ultrasound demonstrates a pelvic mass with hyperechogenic areas with acoustic shadowing suggesting calcifications. C, D) Contrast enhanced CT demonstrates heterogeneous pelvic mass with mixed densities including fat, water, soft tissues and calcium.
**Fig. 8:** Mucinous cistadenoma. A) transvaginal ultrasound in an asymptomatic 26 year-old woman shows a cystic mass with thin walls and multiple internal septa in right ovary. B) Contrast enhanced CT demonstrates a hypodense mass with some septa in the right ovary (blue arrow). Normal left ovary (yellow arrow).
**Fig. 9:** Submucosal myoma. 28 year-old woman in work-up for sterility. HSG a left intracavitary filling defect with smooth margins is seen (arrows). Sonography showed a myoma.

**Fig. 10:** Subserosal myoma vs fibroid. 68 year-old asymptomatic woman with known uterus with myomas. A) RM shows a retrouterine lobulated right hypointense lesion on T2, measuring 4.5 x 3.5 cm, that suggests ovarian fibroid (blue arrows). B) Transvaginal ultrasound depicts normal ovaries and a subserosal myoma from the posterior wall of the uterus.
Fig. 11: Red degeneration in myoma. 36 year-old woman with known huge uterine myoma that enters the emergency unit for acute diverticulitis. A) Abdominal ultrasound shows an incidental cystic mass with smooth and thin walls and no doppler. Some days after MRI shows a big heterogeneous myoma with hypointense halo in T2 (white arrow) and hypointense in T1 weighted images (yellow arrow). After contrast administration no enhancement is seen (blue arrows).
**Fig. 12:** Ovarian fibroid. 64 year-old woman with an incidental adnexal mass incidentally discovered during work-up for lumbalgia. Abdominal CT after administration of iodinated contrast demonstrates a left ovarian mass with smooth well defined borders and minimal contrast enhancement (arrows).
**Fig. 13:** Endometrioma. 33 year-old woman with long-standing abdominal pain during menstruation. Transvaginal ultrasound shows a cystic left ovarian massa with smooth well defined margins, thick walls and fine echoes (arrow).
**Fig. 14:** Endometrioma. 40 year-old woman with right hip pain. Indicently discovered left ovarian nodule that is hyperdense in T1WI (blue arrow) and hypointense with "T2 shading sign" (yellow arrow).

**Fig. 15:** Peritubaric adhesions. Hysterosalpingography in work-up for sterility in a woman with known history of endometriosis. Right tubaric obstruction and left hydrosalpinx with tubaric permeability and intraperitoneal atypical distribution of iodinated contrast caused by peritoneal adhesions (arrows).
Fig. 16: Adhesion syndrome caused by endometriosis. 35 year-old woman with known history of pelvic endometriosis. MRI demonstrates both ovaries (blue arrows) and dilated hyperintense on T2 WI fallopian tubes (yellow arrows) abnormally located in contact with uterine walls (blue arrows). Surgery demonstrated multiple adhesions encasing ovaries and fallopian tubes with bilateral hematosalpinx.
**Fig. 17:** Adhesion syndrome and hematosalpinx. 32 year-old woman presenting with intestinal oclusion with sigmoid stenosis and hydronephrosis secondary to endometriosis. TC after surgery demonstrates two fluid collections at ovarian fossae where it is impossible to distinguish ovaries from fallopian tubes (yellow arrows). MRI demonstrates ovarian cysts (white arrows) and right fallopian tube with blood contents (blue arrow).
**Fig. 18:** Adenomyosis. 41 year-old woman with spontaneous abortion at the 13th week. Transvaginal ultrasound suggests bicornuate or septate uterus. MRI demonstrates septate uterus at T2WI (yellow arrow) and a focal thickening of the union line of right cavity with hyperintense foci (blue arrow) that correspond to adenomyosis.

**Fig. 19:** Adenomyosis. HSG shows multiple saccular images at the endometrial surface (blue arrows). Bilateral hydrosalpinx (yellow arrows).
Fig. 20: Adenomyoma. MRI of a 45 year-old woman with history of long-standing dysmenorrhea. Hemorrhagic hyperintense nodule in T1 (yellow arrows) and T2 (blue arrows) weighted images measuring 2 cm in myometrium.
**Fig. 21:** Deep endometriosis. Sagital MRI demonstrates two pelvic compartments of deep endometriosis: anterior compartment (yellow stars): urinary bladder and anterior serosal lining of uterus. Posterior compartment (blue stars): serosal posterior lining of the uterus, retrocervical space, rectovaginal septum, rectum and sigmoid colon.
**Fig. 22:** Urinary bladder endometriosis. 47 year-old woman that presented at the emergency unit for left urinary colic pain. Abdominal ultrasound demonstrates a nodular thickening of posterior bladder wall (arrow) that suggests urinary bladder tumor. Surgery demonstrated endometriosis.

![Image](image1.png)

**Fig. 23:** Deep endometriosis. 38 year-old woman with dysmenorrhea and dyspareunia and painful defecation. MRI demonstrates retrocervical endometrial implant (white arrows), nodular hyperintense in T1 implants in the anterior rectal wall, sigmoid colon (yellow arrows) and right broad ligament (blue arrows). Ovarian endometriomas with blood in different evolutive stages.

![Image](image2.png)
Fig. 24: Deep endometriosis and rectal neoplasm. 45 year-old woman with history of endometriosis that presents with rectal bleeding. Colonoscopy showed rectal tumor. A) Enhanced CT demonstrates thickening of rectal wall and a soft tissue mass extending anteriorly towards uterus. B, C and D) MRI demonstrates a retrocervical spiculated nodule hypointense in T2WI that corresponds to a fibrotic nodule of deep endometriosis (yellow arrows). It is difficult to distinguish between tumor (blue arrows) and endometriosis.
Fig. 25: Pelvic inflammatory disease. Oophoritis. 29 year-old woman presenting at the emergency unit with fever, hypogastric pain and leucorrhea. Enhanced CT shows enlarged ovaries with multiple cysts (arrows).

Fig. 26: Pelvic inflammatory disease. Tubo-ovarian abscess. 38 year-old woman that presents at the emergency unit with symptoms of complicated pyelonephritis. Enhanced CT shows uterohydronephrosis secondary to a left multiseptated pelvic cystic lesion with peripheral enhancement (blue arrow) and a tubular shaped peripherally enhancing structure (yellow arrow). Findings correspond to tubo-ovarian abscess and pyosalpinx in the setting of pelvic inflammatory disease.
Fig. 27: Ovarian abscess originated in the bowel. 69 year-old woman with a history of hysterectomy that presents to emergency unit for hypogastric pain and fever. CT demonstrates thickening of sigmoid walls, thickening of mesenteric fat and a complicated fluid collection with two components, an anteriorly located component with thick enhancing wall and gas bubbles (yellow arrows) and a posteriorly located component with thin non-enhancing walls (blue arrows). The anterior component shows restriction suggesting ovarian abscess and the posterior component shows enhanced diffusion that suggests adhesive syndrome. After gadolinium administration a sinus tract from vagina to left ovary is demonstrated (white arrow).
**Fig. 28:** Different patients with adhesion syndrome secondary to inflammatory pelvic disease (B and C) and to endometriosis (A, C, E and F). In all cases ovaries and fallopian tubes (orange arrows) are abnormally located next to uterus in "clover-leaf" appearance. In A, a retrocervical fibrotic focus is seen (purple arrow).
Fig. 29: Pelvic inflammatory disease caused by Actinomyces. 48 year-old woman with a history of abdominal pain and diarrhea. Enhanced CT demonstrates an adnexal mass with solid and cystic component (yellow arrows), an eccentric sigmoid mural thickening, infiltration of adjacent mesenteric fat and right hydronephrosis (blue arrow) mimicking malignant tumor.
Fig. 30: Pelvic inflammatory disease caused by Actinomyces. 38 year-old woman presenting with hypermenorrhea, dysmenorrhea and pelvic pain without fever. CT demonstrated an enlarged uterus with multiple perioterine fluid collections extending to adnexal and infiltration of adjacent mesenteric fat (yellow arrows). DWI showed restriction of diffusion that suggested abscesses and helped to distinguish those from normal ovarian follicles.
Fig. 31: Ovarian vein thrombosis. 46 year-old woman in work-out for anemia. Enhanced CT shows partial thrombosis of left ovarian vein (yellow arrows) and thickening of endometrium. Excision of endometrium showed polypoid adenomyoma. No hidden neoplasm was found and thrombosis was thought to be related to regional disease.
**Fig. 32:** Pelvic congestion syndrome. 49 year-old woman with long-standing pelvic pain. Enhanced CT shows dilated periuterine veins (blue arrows) and left ovarian vein (yellow arrow).
**Fig. 33:** Adnexal torsion in normal ovary. 11 year-old girl with intermitent hypogastric pain in the last month that worsened during the last 24 hours. No fever and normal white blood cells count. Sonography showed enlarged right ovary with multiple peripherals follicles (arrowheads) and presence of Doppler signal.
**Fig. 34:** Interstitial ectopic twin pregnancy. Hypogastric pain in a 6.5 w pregnancy. The patient had previously been treated with caesarean and left fundus myomectomy. Transvaginal ultrasound showed two anecoid cysts with thick peripheral wall in left uterine fundus (arrows).

**Fig. 35:** Interstitial ectopic twin pregnancy. MRI demonstrates two hyperintense nodules with thick walls on T2WI located in the myometrium of uterine fundus that correspond to two gestation sacs in the intramural portion of left fallopian tube (arrows).
Fig. 36: Ovarian endometrioma pregnancy. Left ovarian endometrioma in a 30 year-old pregnant woman. A) First trimester sonography shows an adnexal cystic mass with large papila. The massa is located posterior to uterus, at the pouch of Douglas (blue arrows). B) MRI demonstrates a haemorrhagic lesion in the pouch of Douglas (white arrows) with hyperintense papillary proliferations on T2WI. Findings typical of decidualised endometrioma.
**Fig. 37:** Solitary luteinized follicular cyst of pregnancy. 31 year-old pregnant woman with large cyst with no septa or solid components in left upper abdomen detected during second trimester of pregnancy. MRI demonstrates a hyperintense thin-walled lesions on T2WI.
**Conclusion**

- Benign diseases of the female pelvis is highly prevalent.

- Sometimes, the presentation may be incidentally or simulating malignancy.

- The radiologist should know the typical and atypical manifestations of this pathology, with different imaging techniques (ultrasound, HSG, CT and MRI), to avoid diagnostic errors.

- Ultrasound (abdominal and transvaginal) is the technique of choice in the initial study.

- Do not forget that during pregnancy may appear that although benign gynaecological pathology may complicate the course of pregnancy or simulate neoplasms.

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Personal Information