Pictorial Review - Ultrasound appearances of Pelvic Pain of Gynaecologic Origin in Non Pregnant Premenopausal Women

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Learning objectives

This review aims to:

1) Revisit the common causes of pelvic pain of gynaecological origin

2) Provide a structured ultrasound evaluation approach

3) Pictorially illustration of pathologies commonly encountered

Background

Pelvic Pain in female patients is a common problem in the Emergency Department. The majority of patients are premenopausal and a pregnancy test is a crucial determinator in the pathological pathway. Causes of Pelvic Pain can be divided into those of gynaecological and non-gynaecological origin.

Gynaecologic pain can be acute or chronic. Acute gynaecologic pain can result from infection, formation of a cyst/tumour and its associated complications, or torsion of a gynaecologic structure. Pain from chronic gynaecologic conditions include: endometriosis, adenomyosis, mittleschmerz, dysmenorrhea, pelvic congestion syndrome.

Pelvic ultrasound provides a safe, easily accessible tool for the evaluation of acute pelvic pain and if not diagnostic, provides invaluable information to guide the diagnostic pathway.

Imaging findings OR Procedure details

Chronic Pelvic Pain (endometriosis, adenomyosis, mittleschmerz, dysmenorrhea, pelvic congestion syndrome)

Endometriosis
Endometriosis is defined by the presence of ectopic endometrial tissue outside the uterus, most commonly implanted on the surface of the ovary, uterus, fallopian tube, or on the uterine suspensory ligaments and/or peritoneal surface of the pouch of Douglas. Patients present with chronic pain that is often cyclical in nature. Acute pain can occur from rupture of endometrioma.

Endometriomas are complex cystic masses. US finding of uniform low-level echogenicity or a ground-glass appearance is a result of repeated episodes of cyclic bleeding and corresponds to the finding of a "chocolate cyst" (Fig1). Large endometriomas may be depicted as multiple adjoining cystic structures; less frequently, they appear solid. Endometriomas larger than 3 cm often destroy portions of the ovary as normal ovarian tissue stretches to accommodate the cyst (Fig 2)

Adenomyosis

Adenomyosis is defined as the ectopic location of endometrial glands within the uterine myometrium, usually the inner third, with surrounding smooth muscle hyperplasia. Patients may present with vaginal bleeding and/or chronic pelvic pain. US imaging reveals asymmetrical uterine wall thickness with or without small myometrial cysts within the thickened wall (Fig 3)

Mittleschmerz

Pain from pre-ovulation - possibly related to leakage of fluid from a dominant follicle or alternatively pain secondary to the size of a dominant follicle in the ovary just prior to release of oocyte. Pain is typically unilateral, sharp and well localized.

Dysmenorrhoea

Severe pelvic pain during menses can be seen in young female patients who have recently started menarche (primary dysmenorrhoea) or in women in their 20's-30's (secondary dysmenorrhoea). Secondary dysmenorrhoea can be seen with various conditions - typically those that result in chronic pelvic pain (i.e. pelvic inflammatory disease/tubo-ovarian abscess, uterine fibroids, adenomyosis, ovarian pathology, endometriosis, pelvic venous congestion).

Pelvic Congestion Syndrome - Retrograde blood flow through pelvic varicose veins can result in chronic pelvic pain. (Fig 4) Patients typically complain of a deep, prolonged, dull ache associated with movement and activities that increase pelvic pressure.

Transvaginal ultrasound findings:
1) Multiple dilated structures around the uterus and ovaries with venous blood Doppler signal.

2) Dilated pelvic pain with a diameter greater than 4mm.

3) Slow blood flow (about 3cm/sec)

4) Dilated arcuate vein in the myometrium communicating between bilateral pelvic varicose veins.

**Acute Pelvic Pain - Gynaecological Causes (infection, cyst/tumour, or torsion originating from the uterus, fallopian tube, or ovary)**

**Gynecologic Causes of Acute Pelvic Pain**

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<tr>
<th>Uterus</th>
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<td><strong>Torsion</strong></td>
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<td>Fallopian Tube Torsion (rare)</td>
<td>Ovarian Torsion</td>
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**Pain Originating from the Uterus**

**Endometritis**

Endometritis is infection of the endometrial layer of the uterus. Non-pregnancy related endometritis is most commonly due to an STD (i.e. pelvic inflammatory disease/PID-see below), but can also be post-procedural, and be seen with chronic infections.

Pelvic inflammatory disease refers to a gamut of infectious conditions of the upper reproductive tract, including endometritis, salpingitis, and tub ovarian abscess (Fig 5) Pelvic inflammatory disease is the most common cause of gynaecologic pain in the
nonpregnant female and affects 11% of women at some point during their reproductive years. Although infection with Neisseria gonorrhoea and/or Chlamydia trachomatis is most frequent, other organisms such as anaerobes, G. vaginalis, and enteric gram-negative rods can cause PID.

Patients present with diffuse lower abdominal pain that typically worsens during or shortly after menses - also worse with sexual intercourse. Reported symptoms also include vaginal discharge (75%), fever (50%), vaginal bleeding (40%).

Early in the course of such an infection imaging may be normal. As the infection progresses, US demonstrates a loss of normal tissue planes and an ill-defined uterus. Uterine enlargement may be present and is most noticeable at Tran abdominal US. Thickening of the endometrium may be present but is non-specific.

**Degenerating Fibroid**

Uterine fibroids (leiomyomas) are the most common benign tumour in women, occurring in 20%-30% of women of reproductive age ([Fig 6-7](#)) they are often asymptomatic, but can present with vaginal bleeding and/or chronic pelvic pain/pressure. Acute pelvic pain occurs when a growing (oestrogen-responsive) fibroid outstrips its blood supply, e.g. during pregnancy or with oral contraceptive use, leading to cell death and release of pain and inflammatory mediators. Pain may be associated with a low-grade fever, uterine tenderness, elevated WBC count, or peritoneal signs. Ultrasound imaging of a degenerating fibroid may show a heterogeneous or cystic-appearing mass ([Fig 8](#)).

**Fibroid Torsion**

Subserosal and submucosal leiomyomas may become pedunculated and can undergo torsion of the pedicle with subsequent infarction, degeneration, and necrosis. These appear as juxtauterine masses with peripheral enhancement and necrotic centres on CT.

**Pain Originating from the Fallopian Tube**

**Salpingitis**

Infection of the fallopian tube most commonly occurs as an extension of endometritis (i.e. extension of PID into the fallopian tube). Salpingitis may progress to hydrosalphinx or pyosalpinx if left untreated. In pyosalpinx, US images show complex fluid with echogenic debris distending the fallopian tubes ([Fig 9](#)) other imaging clues include folding of the
tubular structure, tapering of the ends, and short linear echogenic foci projecting into the lumen. At later stages, tuboovarian abscesses may form. (Fig 10)

**Fallopian Tube Cyst/Tumour** A rare condition that is usually identified on imaging (ultrasound/MR).

**Torsion of the Fallopian Tube**

Isolated fallopian tube torsion is extremely rare and difficult to diagnose. It may only be revealed at pathology following surgery of the gynaecological tract.

**Pain Originating from the Ovary**

**Tubo-Ovarian Abscess (TOA)**

Tubo-ovarian abscesses are most commonly seen as a complication of PID, but can also be seen after pelvic surgery or can develop as a complication of an intraabdominal pathology such as appendicitis or diverticulitis. (Fig 10) TOA should be suspected in any patient with PID who has a palpable adnexal mass on pelvic examination, in patients who are severely ill with PID (requiring hospital admission), or in whom outpatient treatment for PID has failed. No historical or laboratory parameters can differentiate PID from TOA.

**Ovarian Cyst/Tumour**

Ovarian cyst/tumour can cause pain form enlargement, rupture or torsion. Enlargement and pelvic pain can occur just before ovulation or pregnancy. Cyst/tumour >5cm in size is an independent risk factor for ovarian torsion.

Rupture of an ovarian cyst associated with sudden-onset of unilateral pelvic pain may be accompanied by light vaginal bleeding. Blood from the rupture site may leak internally into the ovary (intracapsular haemorrhage) and cause hyper acute pain from stretching of the ovarian cortex, or may leak externally into the abdomen (extra capsular haemorrhage) resulting in haemoperitoneum.

Ultrasound plays a key role in the characterisation of adnexal cysts:

1) Simple cyst - anechoic fluid within a thin-walled cyst (Fig 11a)
2) Intracapsular haemorrhage into an ovarian cyst - fine network of thin linear/curvilinear echoes, sometimes called a fishnet or reticular pattern (Fig 11b)

3) Extra capsular haemorrhage of ovarian cyst - pelvic free-fluid (12)

4) Dermoid cyst - marked hyperechoic nodule with shadowing; material within the cyst may be hyper echoic or hypoechoic (Fig 13)

5) Endometrioma (pseudocyst) - homogenous low to medium-level echoes in a thick-walled, cystic mass.

**Ovarian Torsion ("compartment syndrome of the ovary")**

Accounts for ~3% of all gynaecologic surgical emergencies. 80% occur in women of reproductive age. 60-70% of cases are right-sided Three main predisposing factors are increased ovarian mass (i.e. due to a mass lesion or ovarian hyperstimulation syndrome), prior abdominopelvic surgery, and pregnancy (especially 1st trimester pregnancy). Torsion occurs by twisting of the ovary on 2 pedicles, namely the uteroovarian ligament and the infundibular ligament. Most commonly the whole fallopian tube and ovary complex is involved; however isolated fallopian tube torsion has also been described.

A review of several retrospective series of patients with adnexal torsion reports that the pain is often of sudden onset (40%-80%), sharp/stabbing (70%) or a dull ache. It can be unilateral (2/3) or bilateral (1/3) in location and moderate/severe in intensity. Pain often occurs after recent physical activity or sexual intercourse. Fever (up to 25%), associated nausea and vomiting (60%-80%), and prior pain (40%) are also reported. On examination pelvic tenderness (60%) and a palpable pelvic mass (50%-80%) are reported.

Diagnosis cannot be made on imaging alone, however imaging can aid in the diagnosis. Ultrasound shows an enlarged, commonly cystic, mass in adnexa (usually >5cm), with or without a small amount of pelvic free fluid.(Fig 14) Doppler ultrasound can show normal arterial flow (25%-60%) during initial venous congestion phase or if the torsion has spontaneously resolved. Recent clinical decision rules use a combination of 1) unilateral adnexal pain, 2) pain duration <8 hours, 3) vomiting, 4) absence of vaginal discharge or bleeding, and 5) ovarian mass >5cm by ultrasound to improve diagnostic accuracy.

**Specific Entities**
Pelvic pain in the setting of fertility treatment can be caused by ovarian hyperstimulation syndrome, ectopic pregnancy (rare, but reported), ovarian rupture, ovarian torsion and multiple gestations.

**Ovarian Hyperstimulation Syndrome (OHSS)**

OHSS is an iatrogenic complication of fertility treatment, especially during intrauterine insemination (IUI) or in vitro fertilisation (IVF). It often presents <48hrs after an infertility visit. Mild OHSS is defined as enlarged, cystic ovaries (cysts are <5cm) with or without mild pelvic pain. Moderate OHSS (incidence 3-6%) demonstrates enlarged, cystic ovaries (cysts are 5-12cm) accompanied by abdominal distension, nausea, vomiting, or diarrhoea. (Fig16) Severe OHSS (incidence 0.25-1.8%) is characterized by large, cystic ovaries (cysts are >12cm) in addition to severely impaired capillary permeability (i.e. ascites, hydrothorax, anasarca). Pelvic examination is contraindicated in OHSS secondary to the risk of ovarian rupture.

**Images for this section:**

![Chronic Pelvic Pain-Endometrioma](image)
**Fig. 1:** Figure 1 Endometrioma. Longitudinal transvaginal US image of the adnexa depicts a large, well-defined, complex cystic mass with low-level internal echoes and color doppler showing peripheral vascularity.

**Fig. 2:** Fig 2 Endometrioma with a haemorrhagic component. (a) Transverse transabdominal US image of the adnexa demonstrates a lobulated mass with a heterogeneous echotexture.
Fig. 3: Fig 3 Adenomyosis-Transvaginal Doppler Ultrasound image shows asymmetrical uterine wall thickness with small myometrial cysts within the thickened wall and increased vascularity around the affected area.
**Fig. 4:** Fig 4 Ultrasound and color doppler of the pelvis shows multiple, dilated and tortuous pelvic veins near the patient's uterus on the patient's left side. Color Doppler ultrasound of the same area demonstrates extensive venous blood Doppler signal.
**Fig. 5:** Pelvic inflammatory disease with a tuboovarian abscess. (a) Transverse transvaginal US image of the pelvis reveals right dilated folding tubular structures with thickened walls, internal echogenic fluid, and debris and associated with tubo-ovarian abscess.
Fig. 6: Fig 6 Transabdominal US shows (a and b) multiple heterogeneous broad based fibroids distorting the uterus
**Fig. 7:** Fig 7 Trans abdominal ultrasound reveals a large submucosal fibroid
**Fig. 8:** Degenerating fibroid. Transabdominal US image of the uterus shows a foetus in the endometrial cavity (blue arrow) and a complex cystic mass with internal echogenicity in the fundus suggestive of degenerating fibroid (red arrow).
Fig. 9: Fig 9-Transverse transvaginal US image of the pelvis reveals bilateral dilated folding tubular structures with thickened walls
**Fig. 10:** Fig 10-Transverse transvaginal US image of the left adnexa demonstrates a well-defined mass with thick walls and internal echoes (Tubo ovarian abscess)
Fig. 11: Fig 11 A) Simple left ovarian cyst B) and C ) Intracapsular haemorrhage into an ovarian cyst
Fig. 12: Fig 12 Haemorrhagic ovarian cyst. a) Transvaginal US image of the adnexa shows a complex hemorrhagic cyst with the characteristic lacelike echogenic pattern of fibrin strands that form as blood clots and retract. b) Small amount of free fluid following rupture (white arrow)
**Fig. 13:** Transverse transvaginal US image shows well-delineated, largely isoechoic adnexal masses with central echogenic region (white arrow) (b) Axial contrast-enhanced CT image demonstrates attenuation similar to that of fat within the right adnexal mass (arrows), a finding diagnostic for teratoma.
**Fig. 14:** Ovarian torsion-Longitudinal transvaginal US image shows an enlarged ovary (maximal diameter, >5 cm) with few peripheral nonovulatory follicles and a small amount of free fluid (arrow) around the inferior margin
**Fig. 15:** Ovarian torsion- Sagittal MRI T2 weighted image shows an enlarged ovary (maximal diameter, >5 cm) with multiple peripheral nonovulatory follicles
**Fig. 16:** Ovarian Hyperstimulation Syndrome demonstrates enlarged, cystic ovaries (cysts are 5-12cm)
Conclusion

Multiple entities, including normal physiologic changes may cause acute pelvic pain in premenopausal women. For initial diagnostic imaging TV ultrasound is the modality of choice and helps in distinguishing gynaecological from non-gynaecological and surgical from non-surgical pathology. Correlation with clinical history and knowledge of ultrasound appearance of various normal and abnormal gynaecologic conditions allow their accurate diagnosis and expeditious management.

Personal Information

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