Chronic pelvic pain in women - pictorial review

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Learning objectives

Chronic pelvic pain (CPP) is a common problem and presents a major challenge to health care providers because of its unclear etiology, complex natural history, and poor response to therapy. There are multiple and varied causes for CPP, and so this condition should be managed using a multidisciplinary approach. This presentation objectives are:

1 - To describe and illustrate the most frequent causes of chronic pelvic pain in women.

2 - To highlight the role of imaging in the accurate diagnosis of these entities.
Background

CPP, defined as nonmenstrual pain of at least 6 months duration, is a common and disabling condition that has a prevalence of 15% in women between the ages of 18 and 50 years old. Many conditions can produce chronic pelvic pain in women, such as gynecologic diseases, urologic abnormalities, problems in the gastrointestinal tract and musculoskeletal causes. Some of these conditions are easily diagnosed, but other causes of chronic pelvic pain might be extremely difficult to recognize. Consequently, this condition is best managed using a multidisciplinary approach. Clinical history, physical examination, laboratory results and even radiological examinations help in diagnosis orientation and exclusion.

This presentation will focus gynecologic, urologic, gastrointestinal and musculoskeletal causes of CPP.
Imaging findings OR Procedure details

Gynecologic causes

Endometriosis:

Endometriosis is defined as the presence of endometrial tissue in ectopic location. It affects mainly women in reproductive years presenting clinically as pelvic pain, dyspareunia and infertility. The most common locations are the ovary, the uterosacral ligaments, the torus uterinus, the vagina and the rectovaginal pouch, but it can appear in other organs such as the bladder, bowel and lung. Despite we are dealing with a benign disease, cases of malignization are referred in the literature, being the endometrioid carcinoma of the ovary the most frequently related with endometriosis. The radiologic evaluation is performed by ultrasound and magnetic resonance imaging (Fig. 1). The ovarian lesions present as cysts, with benign characteristics, frequently multiloculated and bilateral, with parietal hyperechoic foci, manifesting the presence of cholesterol deposits. The presence of malignancy criteria (thick walls with irregularities or papillary projections, vascularity, ascites) are important in the diagnosis of malignant transformation.

Adenomyosis:

Adenomyosis is a nonneoplastic condition, characterized by benign invasion of ectopic endometrium into the myometrium with hyperplasia of adjacent smooth muscle. The common symptoms include dysmenorrhea, menorrhagia and abnormal uterine bleeding but these do not allow diagnosis. Therefore imaging plays an important role because establishment of the correct preoperative diagnosis is critical to avoid unnecessary intervention. Transabdominal or transvaginal ultrasound (Fig. 2) are commonly used as the initial imaging modality for patients with clinically suspected adenomyosis. MR imaging is also an accurate, noninvasive modality for diagnosing adenomyosis (Fig. 3). Moreover, MR is useful in distinguishing adenomyosis from a leiomyoma in cases of enlarged uterus, which is perhaps the most clinically important distinction.

Uterine leiomyomas:

Leiomyomas are the most common uterine tumours. These benign tumours are found in up to 40% of women in their reproductive years. They are usually multiple and may be subserosal, intramural, or submucosal in location. Symptoms may be caused by the location of the leiomyoma and/or their mass effect. In most cases, US can accurately detect leiomyomas and distinguish them from extraterine disease. Twenty per cent of small leiomyomas may be occult by ultrasound. The leiomyomatous uterus is typically enlarged and its outline may be irregular or lobular. The most common
appearance of a leiomyoma is that of a well-marginated, hypoechoic, rounded and/or oval mass within the uterine body (Fig. 4). MRI is indicated when the US examination is indeterminate or limited. It allows precise determination of the size, location and number of leiomyomas. It is also very useful in differentiating a pedunculated subserosal leiomyoma from an adnexal mass. Also, MRI is the most accurate noninvasive diagnostic imaging investigation available so far for differentiation of a leiomyoma from adenomyosis (Fig 5). This distinction impacts clinical management, as an accepted surgical treatment of a leiomyoma is myomectomy, whereas standard treatment of debilitating adenomyosis is hysterectomy.

**Pelvic congestion syndrome:**

Pelvic congestion syndrome is a common cause of chronic pelvic pain. The symptoms of chronic dull pelvic pain, pressure and heaviness are often a result of dilated, tortuous and congested veins produced by retrograde flow through incompetent valves in ovarian veins. Several imaging modalities can be used to diagnose pelvic varices accurately. Venography is considered to be the standard reference for accurate diagnosis of pelvic varices. However this technique is rarely used now, since is invasive and expose the patient to ionizing radiation. Nowadays, US, CT and MRI have nearly replaced venography for diagnostic investigation of pelvic varicose veins. Transvaginal US is the initial modality used for patients with pelvic pain. Pelvic varices can be identified by using transvaginal US with colour Doppler and Doppler spectral analysis (Fig. 6). The diagnosis is established when a tortuous pelvic vein with a diameter greater than 4 mm is present with slow blood flow (about 3 cm/sec) and a dilated arcuate vein in the myometrium communicates between bilateral pelvic varicose veins (Beard, Lancet, 1984). On T1-weighted MRI images pelvic varices have no signal intensity; on T2-weighted MRI images they usually appear as an area of low signal intensity.

**Pelvic inflammatory chronic disease:**

Although less frequent than pelvic inflammatory acute disease, pelvic inflammatory chronic (PICD) disease may also be cause of chronic pelvic pain. Abdominal, anexial and uterine cervix mobilization pain, are typical symptoms of pelvic infection. However partially treated or atypical infection may not be associated with fever or peritoneal signs. Atypical salpingo-oophoritis is frequently associated with Chlamydia's or Mycoplasma's infection. Pelvic actinomycosis is also associated with longterm use of an intrauterine contraceptive device (Fig. 7). CT can be a helpful adjunct in determining the extent of disease, identifying associated complications, and further assessing patients who do not respond to antibiotic therapy. With progression to tubo-ovarian abscess, CT findings include bilateral thick-walled, low-attenuation adnexal masses with thick septations and often with an associated serpiginous structure corresponding to a dilated, pus-filled fallopian tube. Associated findings include thickening of the uterosacral ligaments, increased attenuation of the presacral fat secondary to oedema, and indistinct margins.
of adjacent bowel loops. Anterior displacement of a thickened broad ligament and loss of definition of the uterine border are suggestive of an adnexal origin for the inflammatory process and help distinguish a tubo-ovarian abscess from other causes of pelvic abscess such as diverticulitis.

**Adhesions - peritoneal inclusion cyst:**

A peritoneal inclusion cyst (PIC) is a non-malignant, reactive, mesothelial proliferation of peritoneal cells that results from insult to the peritoneum. The most common peritoneal insults are endometriosis, pelvic inflammatory disease, previous abdominal or pelvic surgery and trauma. PIC occur almost exclusively in premenopausal women with active ovaries, pelvic adhesions and impaired absorption of peritoneal fluid, which leads to formation of fluid-filled cysts that conform to the shape of the peritoneal cavity, and they may recur. At imaging ovaries are entrapped but clearly separate from the cystic locules. US is the modality used most often for detection of peritoneal inclusion cysts, and it is useful for imaging-guided aspiration. At US, peritoneal inclusion cyst appears as an anechoic cystic mass, with an area of through-transmission that abuts the ovary. CT an MR imaging depict unilateral or bilateral cystic masses with attenuation or signal intensity of fluid and without enhancing solid components or entrapped ovaries (Fig. 8).

**Ovarian remnant syndrome and ovarian retained syndrome:**

Ovarian remnant syndrome (ORS) is defined as persistence of functional ovarian tissue after bilateral oophorectomy with or without hysterectomy. This syndrome, that was first described 1970, manifests as chronic pelvic pain, dyspareunia, or pelvic mass in a patient who has undergone bilateral oophorectomy. Although small series of ORS have been reported, it is believed that the syndrome has greater incidence than was appreciated in the past, especially among patients with history of endometriosis. The sonographic appearance of ovarian remnants varies from small to relatively large cystic or multiseptated masses that contain a rim of vascularized ovarian tissue. Ovarian remnants can be differentiated from peritoneal cysts by documenting the presence of ovarian tissue in the wall of a mass. The ORS must be differentiated from retained ovarian syndrome (also referred to as the residual ovary syndrome). It refers to symptoms associated with an ovary that is not removed (conserved) at the time of hysterectomy and later develops encapsulating adhesions or a pathologic process resulting in pelvic pain (Fig. 9).

**Urologic causes**

**Urolithiasis:**

Urolithiasis is a universal problem, affecting patients across geographical, cultural, and racial boundaries. The prevalence of urinary stones has progressively increased in the
industrialized nations, and a similar trend is being observed in developing countries due to changing social and economic conditions. The rising prevalence of urinary stone disease has had a significant impact on the healthcare system due to the direct costs involved and the morbidity associated with complications such as infection and chronic renal failure. Concomitant with the increasing prevalence of urolithiasis is the growing utilization of imaging for diagnosis, treatment planning, and post treatment follow-up. Since its introduction, unenhanced CT has become the gold standard for the evaluation of urinary stone disease, replacing radiography and excretory urography (Fig. 10,11).

Radiation cystitis:

The pathologic changes of the urinary bladder associated with radiation therapy are, as in other organ systems, largely related to the endarteritis and microvascular occlusion that result. Although acute changes are seen up to 4 months after therapy, chronic radiation cystitis has a variable onset of 1-4 years after therapy. Irregular thickening of the bladder wall is the earliest change seen at CT and indicates radiation-induced cystitis (Fig. 12). Increased perivesical fat may be present. Later, with extensive bladder wall thickening, bladder capacity and distensibility may be reduced. Extensive areas of mucosal ulceration can result from radiation therapy. These may become encrusted with urinary salts and may calcify. Finally, fistulas have been reported to form between the bladder and any adjacent organ, including the vagina, rectum, skin and adjacent bowel.

Bladder neoplasm:

Bladder cancer is a common urologic cancer. Almost all bladder cancers originate in the urothelium. Transitional cell carcinoma constitutes the most frequent bladder neoplasm and can arise anywhere in the urinary tract. Bladder cancer has the highest recurrence rate of any malignancy. Although most patients with bladder cancer can be treated with organ-sparing therapy, most experience either recurrence or progression, creating a great need for accurate and diligent surveillance (Fig. 13,14).

Gastrointestinal causes

Inflammatory bowel disease:

Inflammatory bowel disease (IBD) is an idiopathic disease caused by a deregulated immune response to host intestinal microflora. The two major types of IBD are Crohn disease and ulcerative colitis. Crohn disease is a chronic granulomatous inflammatory disease of the gastrointestinal tract with a tendency toward remission and relapse. Crohn disease can affect any part of the gastrointestinal tract from the mouth to the anus, often involving multiple discontinuous sites. The small intestine is involved in 80% of cases, most commonly at the terminal ileum. The colon is affected either with or
without involvement of the small intestine (Fig. 15,16). Ulcerative colitis is characterized by a continuous pattern of bowel wall involvement, starting from the rectum, without evidence of skip lesions. Ulcerative colitis predominantly involves the large bowel but may extend to the terminal ileum, a condition referred to as "backwash ileitis". Extraintestinal manifestations may occur but are uncommon (Fig. 17)

**Diverticular disease:**

Diverticulosis is one of the most common colonic conditions in Western populations. The exact incidence is unknown but increases with age. Diverticulosis has been considered a rare condition in patients younger than 30 years old and only 5% of the general population younger than 40 years and up to 80% of people older than 80 years are affected by diverticulosis. Diverticulosis is particularly predominant in men below 60 years-old and in women above that age (Fig. 18). 10% to 25% of the people with diverticulosis will develop diverticulitis, which is localized on the left side of the colon in 95% of cases (Fig. 19).

**Musculoskeletal causes**

**Pelvic floor insufficiency:**

Functional disorders of the pelvic floor such as pelvic organ prolapse and defecatory dysfunction represent a common health problem especially in women. It is estimated that more than 15% of multiparous woman are affected by some sort of pelvic disorder. Signs and symptoms are present in 10-20% of this group, most commonly include pelvic pressure, protrusion of tissue through the pelvic floor and urinary incontinence. In addition to age, the risk factors for pelvic floor weakness include multiparity, menopause and obesity. The spectrum of dysfunction of the pelvic floor depends on the compartment involved and includes incontinence, constipation and prolapse, occurring in varying combinations. Clinical examination either underestimates or results in misdiagnosis of the site of prolapse in 4%-90% of patients and it is not reliable for assessing evacuation abnormalities. As a result dynamic imaging (obtained at rest, during squeezing, straining and defecation) has a central role in the diagnosis of pelvic floor dysfunction, and it is crucial when choosing a conservative versus a surgical treatment. Although dynamic cystoproctography is still the reference imaging technique for assessing functional pelvic abnormalities MRI has nowadays an increasing role in assessing pelvic floor dysfunction because of its multiplanar imaging capability, the intrinsic soft-tissue contrast it provides and the absence of ionizing radiation.

**Abdominal/pelvic hernias:**

Abdominal/pelvic wall hernias are a frequent imaging finding in the abdomen and pelvic cavity. Although most abdominal/pelvic hernias are asymptomatic, they may
develop acute complications that necessitate emergent surgery, or even being cause of recurrent/chronic pain. They are well evaluated with multidetector row CT, which allows assessment of unrepaired and surgically repaired hernias and of related complications. The multiplanar capabilities of multidetector row CT are especially important, since they allow excellent anatomic delineation, enhancement of the communication of imaging findings and optimal treatment planning (Fig. 20,21).
**Fig. 1:** 43 years-old nulliparous woman, pelvic MRI. Axial T1 (A), T1 fat suppression after gadolinium (B) and T2 (C) weighted images showing a lobulated thin walled left ovarian lesion, with high signal intensity on T1, that remains bright and without contrast enhancing on T1 fat suppression after contrast and with low signal intensity on T2 (shading).

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**Fig. 2:** Diffuse adenomyosis. Transvaginal US shows an enlarged uterus with heterogeneous echotexture and milimetric myometrial cysts.

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Fig. 3: Adenomyoma (focal adenomyosis) on MRI. T1 (A) and T2 (B) axial weighted images and T2 sagittal weighted image, showing an enlarged uterus. The anterior wall of the uterus is thickened and a focally broadened junctional zone with hyperintense foci, on T1 and T2, which represent haemorrhage.

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Fig. 4: Leiomyoma on US. Transvaginal US, showing a anterior subserosal leiomyoma.

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Fig. 5: Leiomyoma on MRI. Pelvic MRI, axial T1 (A) and sagittal T2 (B) weighted images, showing an enlarged uterus with an anterior intramural leiomyoma, with the typical low signal intensity on T1 and T2, causing bladder compression. Uterine cervix retention cysts are also present.

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Fig. 6: 45 years-old woman with pelvic congestion syndrome. Transvaginal US in B Mode (A), colour Doppler (B) and Doppler spectral analysis (C), showing tortuous and dilated pelvic veins with retrograde flow (courtesy Dr. Jorge Ferreira).

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Fig. 7: 30 years-old woman with Actinomycosis' PICD. Contrast-enhanced pelvic CT showing a bilateral anexial thick walled hypodense tumour with thick septations and also enhancing thickened left fallopian tube filled with complex fluid. Pelvic fat inflammation is also demonstrated and obscures the normal pelvic fascial planes.

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Fig. 8: Peritoneal inclusion cyst. Transvaginal US (A) shows a multicystic anexial tumour with the cyst wall outlined by the left pelvic wall. The left ovary is entrapped within the cyst.
Axial T1 and sagittal T2-weighed MR images show the fluid-filled peritoneal inclusion cyst conforming to the peritoneum.

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**Fig. 9:** Retained ovary sydrome. Hysterectomized 44-years-old woman. Axial T1 (A), T2 (B) and T1 fat suppressed after gadolinium (C) weighted images showing a serous cystadenoma in the left ovary.

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Fig. 10: Urolithiasis. Unenhanced CT, coronal reformatted. Image shows a left distal ureteral stone. Note also homolateral hydronephrosis.

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**Fig. 11:** Urolithiasis. Axial contrast-enhanced CT showing left uretero-vesical junction stone.

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**Fig. 12:** Chronic radiation cystitis in a 65-year-old woman. Longitudinal US image of the bladder (A), showing parietal calcifications. In the same woman as in A, unenhanced CT, axial (B) and coronal reformatted image (C), showing moderate diffuse thickening of the bladder wall, with calcifications on the superior wall.

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Fig. 13: Vesical urothelial carcinoma. Longitudinal US image of the bladder (A) shows a large, hypoechoic and heterogeneous urothelial carcinoma within the bladder; in B the same lesion with colour Doppler showing that it is a vascularized, solid lesion.

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Fig. 14: 55-years-old woman with urothelial carcinoma. Axial contrast-enhanced CT images showing a large enhancing mass within the bladder which represents urothelial carcinoma (A). In B the same lesion presenting as a filling defect in the bladder lumen (courtesy Dr. João Leitão).

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Fig. 15: Contrast enhanced CT, coronal reformatted image showing wall thickening and dilatation of the terminal ileum. Note also adjacent mesenteric fat stranding (courtesy Dr. Luisa Lobo).

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Fig. 16: MR enterography. Coronal T1 GAD FAT SAT weighted images, showing avidly stratified enhancing distal ileum with parietal thickening (A,B), an ileal stricture (A) and surrounding fatty proliferation with increased mesenteric vascularity and augmented mesenteric lymph nodes (courtesy Dr. Luisa Lobo).

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**Fig. 17:** 19-years-old woman, with ulcerative pancolitis. Axial contrast-enhanced CT showing diffuse parietal colonic thickening, with adjacent fat stranding and increased vascularity.

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Fig. 18: Axial unenhanced CT shows diverticulosis of the sigmoid colon.

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**Fig. 19:** Diverticulitis. In two different patients axial unenhanced CT showing wall thickening in the sigmoid colon with adjacent inflammatory changes in the pericolic fat.

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**Fig. 20:** Right paraumbilical hernia in a 74-years-old woman. Unenhanced CT, axial (A) and coronal reformatted (B) images, showing herniation of small bowel, trough the abdominal/pelvic wall with adjacent fat stranding. Note also proximal bowel distension, with collapsed distal bowel.

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Fig. 21: Incisional hernia in a 77-years-old woman. Unenhanced CT, axial (A) and coronal reformatted (B) images, showing herniation of small bowel, trough the abdominal/pelvic wall with adjacent fat stranding. Note also proximal bowel dilatation, with collapsed distal bowel.

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Conclusion

Radiologists should be aware of these situations in order to recognize them, since nowadays recent advances in radiologic imaging and therapeutic procedures make it possible to diagnose accurately the conditions producing chronic pelvic pain in most women and to guide effective treatment.
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