Pelvic congestion syndrome: Findings at CT-angiography

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Learning objectives

To define pelvic congestion syndrome (PCS)

To review the CT anatomy of abdominal and pelvic veins

To describe the imaging findings at CT-angiography (CTA)

Background

INTRODUCTION:

Pelvic congestion syndrome (PCS) is a controversial syndrome but a common cause of chronic pelvic pain.

Chronic pelvic pain is a common and disabling condition that is defined as nonmenstrual pain of at least 6 months of duration. It's a common problem that affects millions of women worldwide. The prevalence of Chronic pelvic pain is 15% in women between 18 and 50 years. It has been estimated that approximately 40% of women seen in gynecologic outpatient visits complain of chronic pelvic pain. In the US, 15% of all hysterectomies are performed because of chronic pelvic pain.

Chronic pelvic pain may be caused by many conditions, as problems in the GI tract, urologic abnormalities, gynecologic disorders, and PCS. PCS is usually underdiagnosed, but should be considered after other causes have been ruled out. Multiparous women of childbearing age are most often affected. It is characterized by pelvic venous dilation as a result of retrograde flow through incompetent ovarian veins. The pathogenesis is multifactorial involving both, hormonal and mechanical factors, with multiple predisposing factors. In addition, entities that cause venous outflow obstruction, as the nutcracker syndrome, portal hypertension and acquired inferior vena cava syndrome, may develop secondary PCS.

Although transcatheter venography is the reference standard for the diagnosis of PCS, other, less invasive imaging techniques, as Doppler- US and CT-Angiography / MR-Angiography, are used with increasing frequency for initial diagnosis and treatment planning.

DESCRIPTION:
PCS was first described in 1857 by Dr Richet. It is characterized by chronic and dull pelvic pain that persist for more than 6 months. These symptoms are thought to be attributable to dilated, tortuous and congested veins within the pelvis. In fact, PCS is analogous to varicocele in men.

Anatomy of pelvic veins: Images of normal vascularization of the pelvis are shown (Figure 1, 2, 3 and 4).

PCS SCENARIOS:

PCS can be seen in a non-obstructing scenario, and then some authors recommend to call it pelvic venous insufficiency, or as a result of venous outflow obstruction from anatomic variants such as Nutcracker Syndrome. PCS may also be seen with other disorders as portal hypertension and acquired IVC syndrome, where collateral pathways must develop to maintain venous drainage.

We divided the PCS into three scenarios:

1.-Non-obstructing scenario (Figure 5):

Then, some authors prefer to call it "PELVIC VENOUS INSUFFICIENCY" (PVI), so PVI refers to the pathophysiologic mechanism of the retrograde flow through incompetent ovarian and pelvic veins.

There are multiple predisposing factors:

- Hereditary factors (family history of varicose veins)
- Hormonal influences
- Previous pelvic surgery
- Retroverted uterus
- Multiple pregnancies
- Polycystic ovaries (50% of patients present polycystic changes in the ovaries).

It is thought that both, hormonal influences and an increased demand on venous return during pregnancy, lead to a chronic venous distention that cause the valves incompetent, leading to reflux of blood down the ovarian veins and into the internal iliac veins of the...
pelvis. The accumulation of blood in the pelvic veins can cause mass effect on nearby nerves, which can lead to worsens the pelvic pain.

2.-Obstructing anatomic variant: (Figure 6)

A.-Nutcracker Syndrome or anterior Nutcraker: refers to the compresion of left renal vein (LRV) between Aorta and SMA.

B.-Posterior Nutcracker: refers to the compresión of retroaortic LRV between the Aorta and the underlying vertebral body.

3.-Secondary pelvic congestion syndrome (Figure 7):

Some times PCS can be seen with disorders that produce an obstruction of venous flow, as portal hypertension and obstruction of IVC, where colateral pathways develop to maintain venous drainaige.

**CLINICAL CHARACTERISTICS:**

Patients with PVI are typically of childbearing age and multiparous.

Women present with unilateral or bilateral lower abdominal and pelvic pain, which is generally chronic and dull.

Symptoms are exacerbated with menses, prolonged standing, and activities that increase abdominal pressure, and usually, symptoms are worse at the end of the day.

Patients may present with atypical nonsaphenous varicosities as in vulvar region or buttocks.

Other signs are postcoital ache, dysmenorrhea, perineal pain, vulval and lower extremity varcosities.

**Images for this section:**
Fig. 1: Coronal reformated contrast-enhanced CT shows normal vascularization of the pelvis, with right ovarian vein (red arrows in A) draining into inferior vena cava (white arrow) and left ovarian vein draining into left renal vein (arrow in B).

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Fig. 2: Axial contrast-enhanced CT of the pelvis shows normal vascularization of the pelvis: internal pudendal veins (red arrow in A and B) tributary of the internal iliac vein (white arrow in A and B).

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**Fig. 3:** Axial contrast-enhanced CT at the inguinal level shows normal vascularization of the pelvis: obturator veins (red arrows), external iliac vein (blue arrows) and external pudendal veins and tributaries (white arrows).

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**Fig. 4:** Normal CT angiography in a 37-year-old woman. Axial (A, B, C) and coronal MIP(B). The left renal vein (arrow in A), left ovarian vein (arrow in B and D) and periuterine veins (C) were of normal caliber.

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Fig. 5: Non obstructive CPS in a 39-year-old woman with chronic pelvic pain. Coronal MIP (A, C) and axial (B) CT angiogram demonstrate reflux of contrast into non dilated left ovarian vein (arrow in A), with bilateral parauterine varices (circles in B and C).

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Fig. 6: Posterior Nutcracker syndrome in a 39-year-old woman. Axial (A, B) and Coronal MIP (C) CT angiograms demonstrate compression of the left retroaortic renal vein (arrowhead in A) between the aorta and vertebral body, with reflux of contrast into non dilated left ovarian vein (arrow in A) and left parauterine varices (circle in B and C).

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Fig. 7: CT Angiography in a 79-year-old man with pancreatic neuroendocrine tumor. Axial arterial phase (A) shows a heterogeneous solid mass in the body of pancreas with contrast enhancement in arterial phase (arrow in A). Axial venous phase (B and C) shows compressive effects of the mass with bilateral reflux of contrast into normal caliber ovarian veins (arrows in B), with bilateral parauterine varices (circle in C).

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Findings and procedure details

**IMAGING DIAGNOSIS:**

Although transcatheter venography remains the standard for diagnosing dilation and congestion of veins, other, less invasive modalities exist to show the presence of pelvic vein engorgement and suggest the diagnosis of PVI.

Some of these tests are:

1) **ULTRASONOGRAPHY (US):**

Ultrasonography is usually the initial modality used in patients with pelvic pain. The diagnosis of ovarian and pelvic varices is established by the identification of multiple dilated tubular structures around the uterus and ovary with venous blood Doppler signal.

There are **four diagnostic criteria** for establishing the diagnosis of PCS:

1. An ovarian vein with diameter # 8 mm
2. Some tortuous pelvic veins with at least one with a diameter greater than 4mm
3. Slow blood flow: #3cm/sec
4. Dilated arcuate vein in the miometrium that communicates with pelvic varicosities

50% of patients will present with cystic ovaries, as before mentioned.

2) **CT ANGIOGRAPHY (CTA):**

Pelvic varices are imaged as dilated tortuous enhanced tubular structures around the uterus and ovaries.

CTA is the imaging technique that we used in our center in patients with suspected SCP.

The diagnostic criteria for CTA consist of (Figure 8, 9, 10 and 11):

- # 4 ipsilateral parauterine veins of varying caliber, at least one measuring # 5mm
- Ovarian vein of # 8mm of diameter
Reflux into the left ovarian vein is defined as early opacification of the ovarian vein occurring simultaneously with opacification of the renal veins in late-arterial phase.

It is possible to grade the reflux:

1. **Grade I**: Only left ovarian vein is enhanced (not reaching the parauterine veins)

2. **Grade II**: The retrograde flow advanced into the left parauterine veins

3. **Grade III**: The retrograde flow crosses the midline through the uterus from the left into the right parauterine plexus.

Pelvic varices can vary in size and number and may extend into the broad ligament, reach the pelvic sidewall, or extend inferiorly to communicate with the paravaginal and thigh venous plexus.

As we discussed earlier there are also obstructive anatomical variants that can result in PCS, like Nutcracker Syndrome.

**The diagnostic criteria for Nutcracker Syndrome are (Figure 12, 13 and 14):**

1. Ao - SMA distance: # 5mm
2. Ao- SMA Angle : # 15º
3. Dilated pre-stenotic LRV

Is important to emphasize, that Nutcraker Syndrome, should not be diagnosed if no symptoms are present. In that case, you can report the findings of reduced distance and angle between SMA and Aorta, as "Nutcraker phenomena" (Figure 15 and 16).

Based on the criteria previously mentioned we have retrospectively reviewed the imaging findings on CTA of 42 female patients who presented with chronic pelvic pain performed in our institution from January 2014 to September 2016. 29 patients showed pelvic varices on CTA. In 15 cases a venous outflow obstruction was identified. The remaining 14 patients presented a reversed flow in the ovarian vein without an obstructive cause.

**Images for this section:**
Fig. 8: Non obstructive CPS in a 65-year-old woman with chronic pelvic pain. Axial (A, B, C) and Coronal MIP (D) CT angiogram demonstrate reflux of contrast into dilated left ovarian vein (arrow in A, B and C), with bilateral parauterine varices (circles in C and D).

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**Fig. 9:** Non obstructive CPS in a 42-year-old woman. Axial (A, B) and Coronal MIP (C) CT angiogram demonstrate reflux of contrast into dilated right ovarian vein (arrow in A) with right parauterine varices (arrow in B). Note that ROV has a very long trajectory, leading into inferior vena cava just below the right renal vein (arrows in C).

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Fig. 10: Non obstructive CPS in a 38-year-old woman with chronic pelvic pain. Axial (A, B) and Coronal MIP (C, D) CT angiogram demonstrate reflux of contrast into dilated left ovarian vein (arrow in A and C), with bilateral parauterine varices (circles in B and C).

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Fig. 11: Non obstructive CPS in a 36-year-old woman with chronic and dull pelvic pain. Axial (A, B), Coronal (C) CT angiography demonstrate reflux of contrast into normal caliber left ovarian vein (arrow in A and C), with bilateral parauterine varices (circles in B). Volume Rendering shows a non-dilated left ovarian vein (arrow in D).

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**Fig. 12:** Anterior and posterior Nutcracker Syndrome in a 25-year-old woman. Axial (A, B and C) and Coronal (D) CT angiography demonstrate a circumaortic left renal vein with compression of the left renal vein between the aorta and superior mesenteric artery (arrow in A) and between the aorta and vertebral body (arrow in B and C), with reflux of contrast into non dilated left ovarian vein (arrow in D) and left parauterine varices (circle in E).

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Fig. 13: Nutcracker syndrome in a 37-year-old woman. Axial (A, B and C) and Sagittal (D) CT angiograms demonstrate compression of the left renal vein (circle in A) between the aorta and superior mesenteric artery (arrow in D), with perirenal collateral vessels and reflux of contrast into dilated left ovarian vein (circle in B) and bilateral parauterine varices (circles in C).

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Fig. 14: CT angiogram post treatment of Nutcracker syndrome. Axial (A, B and C ) and Coronal MIP (D) demonstrate stent in LRV ( arrow in A and D), coils in left parauterine varices ( circle in C) , with normal sized LOV (circle in B) and no parauterine varices.

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Fig. 15: Nutcracker phenomenon in a 30-year-old woman without symptoms. Axial (A, C, D) and sagittal (B) CT angiogram incidentally detected marked narrowing of the left renal vein between the superior mesenteric artery and the abdominal aorta (arrow in A and B). The left ovarian vein (arrow in C) and periuterine veins (D) were of normal caliber.

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Fig. 16: Nutcracker phenomenon detected on a CT scan performed in a 39-year-old man with a history of testicular seminoma. Axial (A, B and D) and Coronal MIP (C). CT demonstrates compression of the left renal vein (arrow in A) between the aorta and superior mesenteric artery, with left adrenal collateral vessels (arrow in B and C). Left testicular prosthesis (arrow in D).

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Conclusion

PCS is a not-well-known clinical entity that affects mainly multiparous women of reproductive age. PCS is considered an underdiagnosed cause of chronic pelvic pain. The pathogenesis is considered to be ovarius venous incompetence due to hormonal or anatomic factors, resulting in pelvic varices.

Knowledge of the radiologic findings at CTA is essential to suspect the diagnosis and to refer the patient for an appropriate therapy

Personal information

References


