Pelvic congestion syndrome: the role of interventional radiology in the treatment of chronic pelvic pain

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ABSTRACT

Chronic pelvic pain is a common problem for female patients and is defined as pain that has been present for 6 months or more. Chronic pelvic pain with associated ovarian vein varicosities is termed pelvic congestion syndrome (PCS) and is an important but under-diagnosed condition. The aetiology of pelvic varicosities is reflux of blood in the ovarian veins due to the absence of functioning valves, resulting in retrograde blood flow and eventual venous dilatation. The cardinal presenting symptom of PCS is pelvic pain, usually described as a dull ache, without evidence of inflammatory disease. Clinical signs may include vulval varicosities extending on to the medial thigh and long saphenous territory as well as tenderness on deep palpation at the ovarian point; however, such signs are not always present.

Non-invasive imaging (ultrasound, CT and magnetic resonance venography) plays a central role in establishing the diagnosis, excluding alternative causes of pelvic pain and providing a road map for novel minimally invasive treatment options that are now available. Day-case percutaneous-directed venous embolisation is now accepted as a valuable treatment option for PCS with promising results from early clinical trials and is fast becoming the first-line treatment option for this condition. This paper aims to raise awareness of PCS among clinicians and reviews the pathogenesis, imaging assessment and minimally invasive treatment options that are now available.

INTRODUCTION

Chronic pelvic pain is a common problem for female patients presenting to their general practitioner and gynaecologist. It is defined as pain that has been present for 6 months or more. Perry[1] estimates that 2–10% of all gynaecological consultations are for pelvic pain and results in 20% of laparoscopies performed. The investigation of these patients involves a thorough gynaecological work-up, imaging and, in most cases, laparoscopy. The causes of chronic pelvic pain include many gynaecological and non-gynaecological conditions. Gynaecological causes include chronic pelvic infection, endometriosis, adenomyosis, fibroids and pelvic varicosities. Referred pain from the abdominal viscera and neurogenic and psychogenic factors have also been implicated.[2]

Chronic pelvic pain with associated ovarian vein varicosities is called pelvic congestion syndrome (PCS). Ovarian vein dilatation is seen in 10% of women, up to 60% of whom may develop PCS.[3] Despite its high prevalence, PCS remains an under-diagnosed condition because of its protean manifestation and the limited appreciation of this condition among practising physicians. In recent years, advancements in technology have paved the way for the availability of non-invasive imaging and minimally invasive, day-case-based treatment options for this common condition. The aim of this paper is to raise awareness of PCS among clinicians, to review the imaging options for establishing the diagnosis, and to review emerging minimally invasive treatment options that now exist.

NORMAL ANATOMY

During the first trimester of fetal life, the ovaries develop in the genital ridge on the posterior abdominal wall. This is approximately the same level as the mesonephric duct and the developing kidney. The developing ovaries derive their arterial supply from the aorta and develop venous drainage at this level. Early in the second trimester, the ovaries are drawn downwards into the pelvis. This is due to gradual contraction of the gubernaculum, a band of connective tissue joining the lower pole of the ovary to the labia majora, which later becomes the round ligament. During this descent, the ovaries maintain their arterial supply and venous drainage from their original location, close to the level of the renal vessels.

Thus, in the adult, the ovarian veins originate from the pampiniform venous plexus in the broad ligament and communicate with the uterine plexus. Both ovarian veins ascend anterior to the psoas muscle and the ureters. The right ovarian vein drains into the inferior vena cava in the majority of women, although, in up to 10% of women, it may also drain into the right renal vein.[4] The left ovarian vein drains into the left renal vein in most women. The veins normally measure 3–4 mm in diameter.[4]

A rich anastomotic venous plexus exists between the drainage of the pelvic viscera including the ovarian, paraovarian, uterine, vesicle, rectal and vulvar plexuses. In addition, there are venous connections between the rectal, vesicle and upper thigh venous systems. These venous connections are relatively valveless, which explains the distribution of the associated varicosities seen in PCS.

AETIOLOGY AND PATHOLOGY

The underlying aetiology of pelvic varicosities is reflux of blood in the ovarian veins. The primary defect is the absence of functioning valves within the ovarian veins, resulting in retrograde blood flow and eventual venous dilatation.[5] Valves are absent from the orifices of the gonadal veins in 15% of women, and, in those where valves are present, they are incompetent in 40% on the left and 35% on the right.[6]

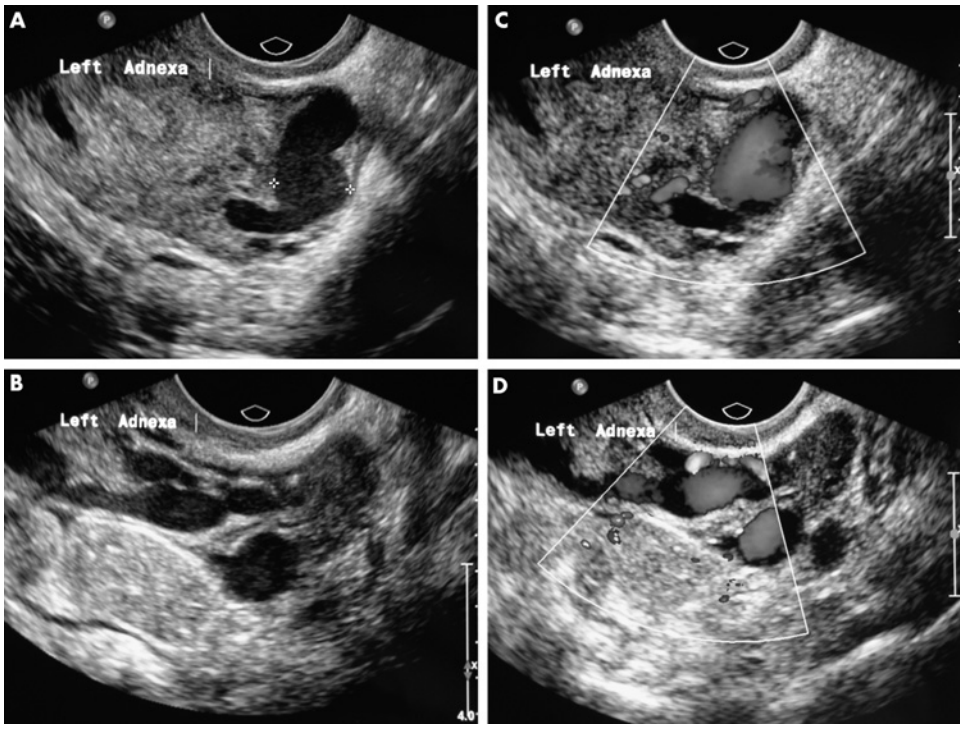

Figure 1 Transvaginal (A and B) grey-scale and colour Doppler ultrasound (C and D) showing dilated pelvic veins in a patient with chronic pelvic pain.

The precise aetiology of PCS is poorly understood. Some cases of pelvic varicosities have been associated with mechanical compressive causes, such as uterine malposition, causing kinking of the ovarian vein,[7] and the nutcracker syndrome, where the left renal vein is compressed between the aorta and superior mesenteric artery (SMA).[8] Hormonal influences may also affect the development of PCS, as evidenced by the higher incidence of PCS in premenopausal women and the near-absence of symptomatic pelvic varicosities in postmenopausal women. There is increasing prevalence of PCS in multiparous women, which may be related to both mechanical and hormonal factors.[9] Pregnancy increases the capacity of the pelvic veins by 60%, and, as noted above, the malpositioned gravid uterus results in venous kinking.[1]

CLINICAL FINDINGS

The cardinal presenting symptom is pelvic pain, usually described as a dull ache, which has been present for more than 6 months, without evidence of inflammatory disease.

Pain is typically described as more prominent on one side, although, on careful questioning, most patients will also report pain on the contralateral side. Symptoms are exacerbated by prolonged standing and may be worse during the premenstrual period, during pregnancy and postcoitally. Associated symptoms include a feeling of fullness in the legs and lower urinary tract symptoms (caused by varicosities in the trigone of the bladder).[10] Lower back ache, bloating, nausea and diffuse abdominal cramping may also be reported.

Signs detected on examination may include vulval varicosities which extend on to the medial thigh and long saphenous territory. Tenderness may be elicited by deep palpation at the ovarian point (the point where the upper third meets the lower two-thirds of an imaginary line from the anterior superior iliac spine to the umbilicus). One study suggests that the combination of ovarian point tenderness and a history of postcoital ache may be 94% sensitive and 77% specific for pelvic congestion.[11]

DIAGNOSTIC IMAGING

Once the clinical suspicion has been raised, confirmation of pelvic varices is obtained by non-invasive imaging. Suspected PCS is initially investigated with pelvic ultrasound (US). Cross-sectional imaging is used to confirm the diagnosis and further reveal the anatomy, as well as exclude other causes of pelvic pain. Only once a diagnosis of pelvic congestion has been made on non-invasive imaging, or in the case of equivocal findings, is catheter-directed venography indicated. Catheter-directed venography is always indicated before embolisation.

US examination

Pelvic US is the most commonly used first-line investigation. This can be achieved either transabdominally or transvaginally depending on the skill of the operator. Transvaginal imaging provides better imaging of the pelvic venous plexus and is used as the initial imaging modality in our institute in patients with suspected PCS. US has the advantages of being relatively cheap and more widely available than cross-sectional imaging. It also avoids the use of radiation and exposure of the radiosensitive ovaries. A further advantage is the ability to scan the patient in a standing position or while performing a Valsalva manoeuvre, to accentuate the venous filling. The advent of colour duplex Doppler imaging has further enhanced this technique (figure 1).

The normal venous plexus appears as one or two straight tubular structures[12] with a normal diameter of <4 mm.[4] In PCS,

Box 1 Diagnostic criteria for pelvic congestion syndrome on transabdominal and transvaginal ultrasound[14]

a. Tortuous pelvic veins with diameter >6 mm.
b. Slow blood flow or reversed caudal flow.
c. Dilated arcuate veins in the myometrium, communicating between bilateral pelvic varicose veins.
d. Polycystic changes in the ovaries.

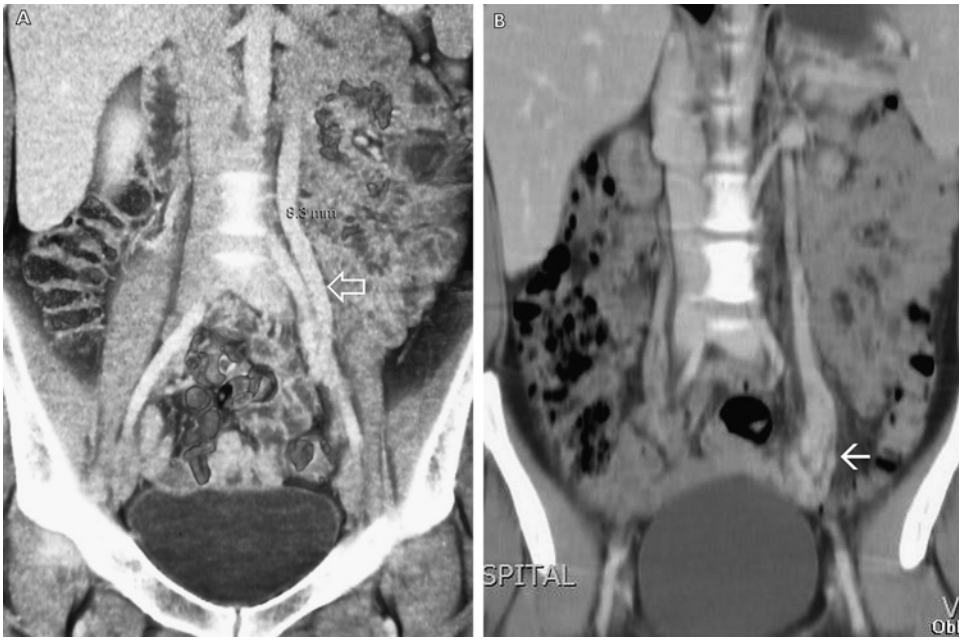

Figure 2 Coronal multiplanar reformatted CT appearances of ovarian vein dilatation (A and B) and parauterine pelvic varices (B) in patients with pelvic congestion syndrome.

US shows multiple dilated veins around the ovary and uterus (diameter >6 mm).[7] Reversed caudal blood flow may be seen in the ovarian veins, and dilated arcuate veins may be seen crossing the myometrium. Polycystic changes in the ovary are also a common finding, although this is not associated with the typical clinical presentation of polycystic ovary syndrome.[13] The main diagnostic criteria for PCS on US are shown in box 1.

CT/MRI examination

Multidetector CT (MDCT) and MRI show pelvic varices as dilated, tortuous, enhancing tubular structures in the uterine adnexa. Cross-sectional imaging may show extension of varices to the broad ligament and paravaginal venous plexus.[10]

Both MDCT and MRI allow a complete examination of the pelvic anatomy with multiplanar imaging. Multiplanar reformatted images can identify ovarian varices and provide information on any coexisting abdominal or pelvic pathology (figure 2). In some instances, they can reveal the cause of venous dilatation such as the nutcracker syndrome, showing dilatation of the left renal vein proximal to the point at which it passes under the origin of the SMA. MRI has the added advantage of avoiding radiation and is therefore the preferred cross-sectional modality. The disadvantages of cross-sectional imaging are that it can underestimate pelvic venous pathology, as it is conventionally performed with the patient in the supine position causing underfilling of the varices, and artefacts from metallic coils after embolisation limit the use of MRI for follow-up imaging.

On CT, the varicosities are isodense to other abdominal veins on post-contrast imaging. On MRI, they show no signal on T1-weighted sequences (flow-void artefact, figure 3A). Varices are commonly hyperintense on T2-weighted sequences, but can be hypointense or isointense, depending on the velocity of blood flow.[15] Gradient echo sequences show high signal intensity within the varices.

Contrast-enhanced magnetic resonance venography is likely to become the initial non-invasive investigation of choice in the diagnosis of PCS.[10] With magnetic resonance venography, the

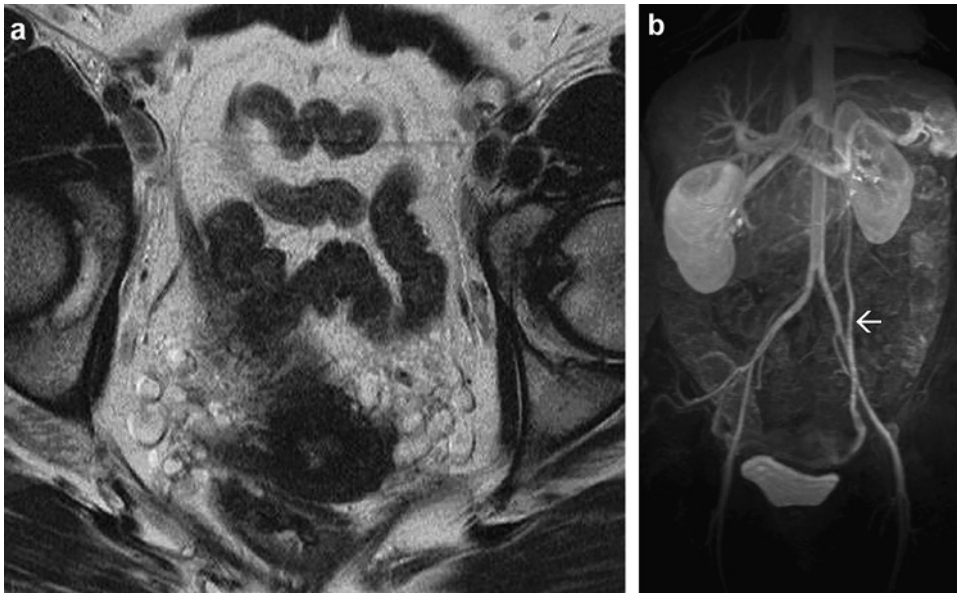

Figure 3 Axial T1 (A) and coronal multiplanar reformatted (B) images show the presence of parauterine and ovarian venous varicosity (open arrow), respectively, in a patient with pelvic congestion syndrome.

Box 2 Diagnostic criteria for pelvic congestion syndrome on cross-sectional imaging[15]

a. Four or more ipsilateral tortuous parauterine veins, with at least one >4 mm.
b. An ovarian vein diameter >8 mm.

pelvic venous system can be imaged in a single breath-hold. Images are obtained after bolus injection of gadolinium with accurate automatic bolus detection and tracking systems. This technique provides excellent anatomical detail without increasing the scanning time when compared with US (figure 3B). The main diagnostic criteria for PCS on cross-sectional imaging are shown in box 2.

Catheter-directed venography

As non-invasive imaging has become the preferred diagnostic modality, catheter-directed venography is usually only performed immediately before embolisation. This is done to confirm the diagnosis, assess the venous anatomy, especially the collateral venous supply, and allow planning of embolisation and coil selection.

The left renal vein is selectively catheterised with a 4 Fr cobra or a 4 Fr multipurpose catheter through a jugular or a femoral venous access. Iodinated contrast is injected via the catheter with the patient in a semi-erect position during the Valsalva manoeuvre. This allows assessment of both venous distension and reflux. The right ovarian vein is catheterised directly via the inferior vena cava and similarly assessed. Diagnostic criteria for PCS on venography are shown in box 3. Confirmation of PCS via catheter-directed venography before embolisation is essential.

As mentioned above, the non-invasive imaging remains the first diagnostic modality. In our institute, patients with suspected PCS are initially screened with a non-invasive transvaginal US examination. An MRI study is subsequently performed to confirm the pelvic venous varicosity in patients with positive US findings. MDCT is used as an alternative imaging modality in patients who have contraindications for MRI. A transcatheter angiography is performed at the time of embolisation treatment to delineate further the size and nature of pelvic venous varicosities.

MANAGEMENT

Medical management with medroxyprogesterone acetate to increase venous contraction provides symptomatic relief for a short period, but benefits are not sustained.[16]

Historically, PCS, like its male counterpart, testicular varicocoele, was treated surgically with laparoscopic ligation of the gonadal veins. Since the advent of endovascular techniques, this has fallen out of favour.

Box 3 Diagnostic criteria for pelvic congestion syndrome on catheter-directed venography[12]

1. Ovarian vein diameter >10 mm.
2. Uterine venous engorgement.
3. Congestion of the ovarian plexus.
4. Filling of the pelvic veins across the midline and/or filling of vulvovaginal and thigh varicosities.

Box 4 Indications for ovarian vein embolisation

Pelvic varicosities with:
1. Chronic pelvic pain with no other cause for pelvic pain revealed on gynaecological or imaging work-up.
2. Dyspareunia with no other cause for dyspareunia revealed on gynaecological or imaging work-up.
3. Severe labial and perineal varicosities.

Transcatheter embolotherapy (TCE), introduced by Edwards *et al* in 1993,[17] has become the mainstay of treatment of PCS. This is carried out after diagnostic venography, as described above, with sclerosant foam and coils. Early experience of unilateral left ovarian vein embolisation had mixed results, with nearly 33% of patients experiencing only partial or no symptom relief. Bilateral ovarian vein embolisation is now accepted as the preferred technique via a jugular or femoral venous approach. This has excellent success rates. The indications for ovarian vein embolisation are shown in box 4.

TCE is found to be technically successful in 98% of cases.[18] In the latter study, Venbrux *et al* performed transcatheter embolotherapy of the ovarian veins with a sclerosing agent and coils on 56 women after diagnostic venography. Forty-three patients went on to have a second session to embolise the

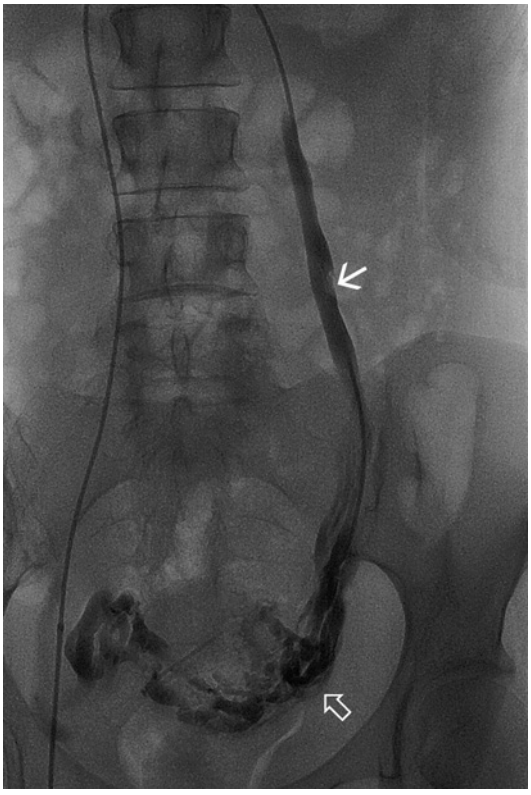

Figure 4 Digital subtraction angiography. Contrast injected selectively into the left ovarian vein showing retrograde reflux of contrast in an enlarged ovarian vein (closed arrow) in a patient with chronic pelvic pain. Congestion of tributaries of the ovarian vein in the pelvis can also be seen (open arrow).

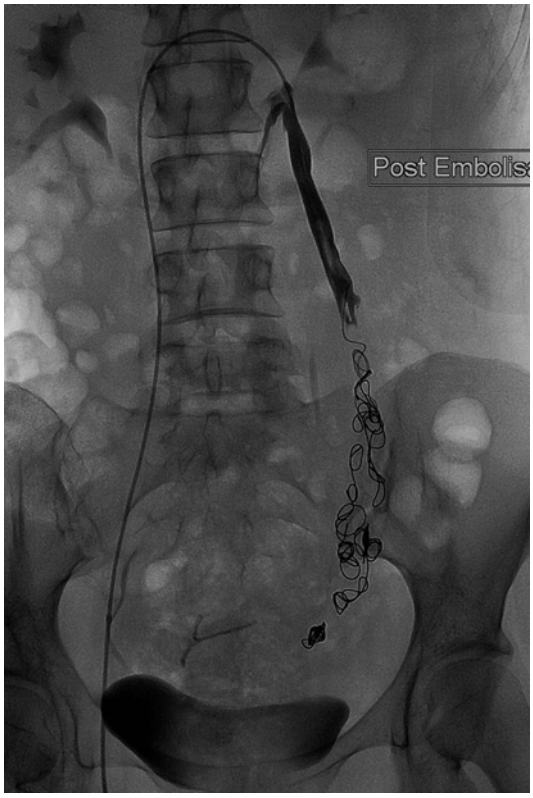

Figure 5 Embolisation of left ovarian venous varicosity via the femoral venous approach for a patient with pelvic congestion syndrome symptoms.

internal iliac veins. All 56 cases were technically successful, although in two patients the coils placed in the internal iliac veins embolised and had to be snared. Patients reported a 65% decrease in pain scores, which was maintained at follow-up 1 year later. Maleux *et al*[19] noted a technical success rate of 98% in 41 patients, using glue as an embolic agent. The only complication, in two cases, was migration of the glue, which was treated conservatively.

Improvement in symptoms occurs within the first 2 weeks and is seen in 70–85% of patients. Recurrence rates of 8% are reported.[10 18] Although the long-term follow-up data on efficacy and safety are still limited, a 2006 study by Kim *et al*[20] showed that 83% of 127 patients showed clinical improvements at 4 years after embolisation, with no significant hormonal changes and two successful pregnancies being reported (figures 4–6).

In the future, the use of TCE for PCS will increase as more clinicians become aware of this evolving percutaneous technique. There will also be more clinical trials in assessing the long-term validity of TCE as well as the efficacy of various embolic materials, including particles, liquid agents and coils in the treatment of PCS. Alternative percutaneous ablative measures such as laser or radiofrequency-based techniques will also be experimented with in the near future for treating this complex condition.

COMPLICATIONS

TCE for PCS is performed as a day case. Complications with the TCE procedure are rare (<3%): most commonly thrombophlebitis, recurrence of varices and coil migration.

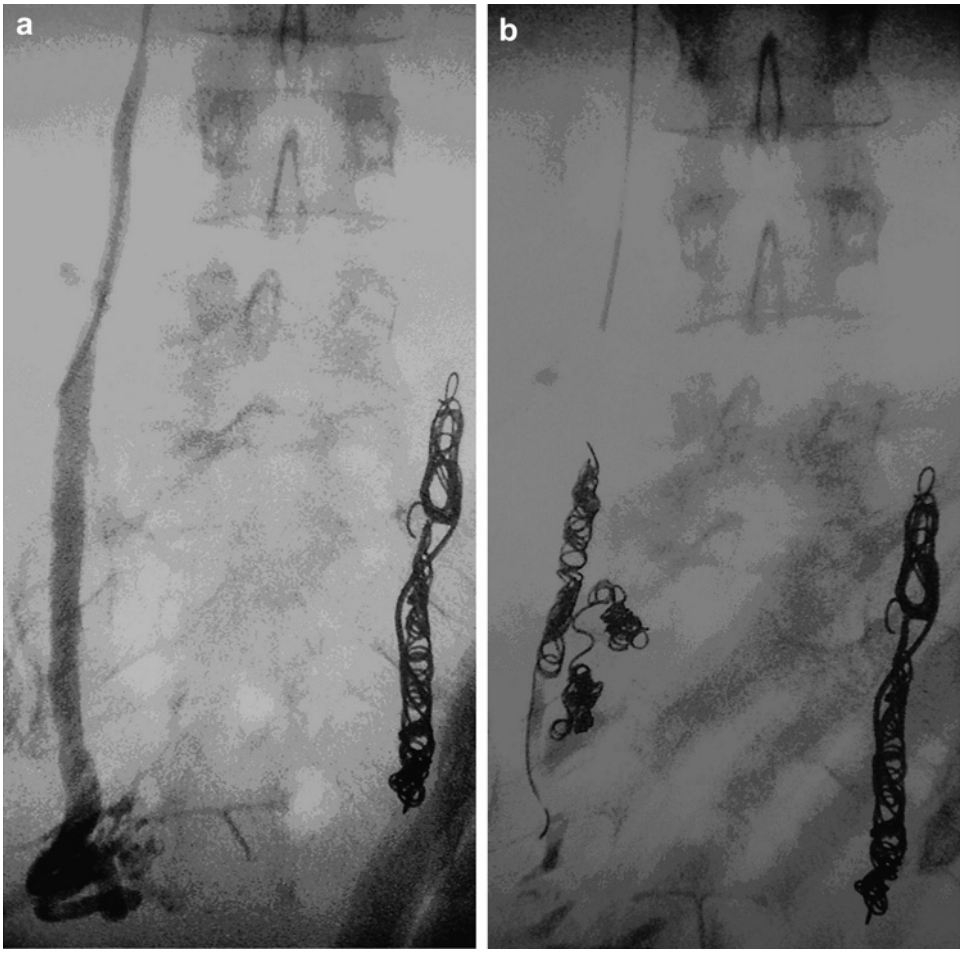

Figure 6 (A) Bilateral ovarian vein embolisation via jugular venous approach for another patient with severe pelvic congestion syndrome symptoms, which resolved within 3 months of endoluminal treatment. (B) Completion embolisation image in the same patient with bilateral ovarian vein reflux resulting in significant PCS.

Key learning points

- Pelvic congestion syndrome (PCS) is an important but under-diagnosed cause of chronic pelvic pain in women, with a significant impact on quality of life.
- The primary underlying abnormality is the absence or incompetence of valves at the orifices of the ovarian veins.
- The aetiology of PCS is poorly understood, but is related to both mechanical factors and hormonal factors.
- Not all women with pelvic varicosities will develop PCS.
- Diagnostic imaging is now predominantly non-invasive including ultrasound, CT and MRI.
- Transcatheter embolisation of the ovarian veins is a well-established technique used in the management of PCS, with a high technical success rate and a low complication rate.

Current research questions

1. What is the long-term outcome of transcatheter embolotherapy (TCE) of pelvic congestion syndrome (PCS)?
2. What are the best embolic agents for TCE in patients with PCS?

Key references

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CONCLUSION

PCS is a debilitating condition with significant physical and psychosexual consequences. The aetiology is multifactorial and currently poorly understood. Radiology departments have an important role in both diagnosis and treatment using transcatheter embolisation. Current data show a high rate of technical success for the procedure, and results of long-term follow-up are encouraging. To improve outcomes, future research should be directed at the prevention of collateral development.

MULTIPLE-CHOICE QUESTIONS (TRUE (T)/FALSE (F); ANSWERS AFTER THE REFERENCES)

1. **Regarding aetiology and clinical presentation of pelvic congestion syndrome (PCS):**

(A) A congenital abnormality involving the relationship of the left renal vein, aorta and SMA can result in dilatation of the left ovarian vein

(B) Pelvic venous varicosities can present with urinary urgency and frequency

(C) Tenderness over the ovarian point and postcoital pain are highly sensitive signs for PCS

(D) Women with PCS and polycystic ovaries on ultrasound (US), typically present with irregular menses, hirsuitism and obesity

(E) PCS is more common in postmenopausal women

(F) The right ovarian vein enters in the right renal vein in 10% of patients

(G) The incidence of PCS decreases with increasing parity

(H) Uterine malposition is a risk factor for PCS

2. **Regarding the investigation of PCS:**

(A) US can demonstrate reverse flow in the ovarian veins

(B) Cross-sectional imaging overestimates the degree of venous dilatation

(C) Ovarian vein varicosities are high signal on T1-weighted MRI

(D) Ovarian vein varicosities are high signal on gradient echo MRI

(E) Diagnostic venography is necessary before embolisation

(F) The ovarian vein should measure >8 mm to confirm the diagnosis of PCS on cross-sectional imaging

(G) The ovarian vein should measure >8mm to confirm the diagnosis of PCS on venography

(H) PCS may involve the veins crossing the myometrium

3. **Regarding the management of PCS:**

(A) First-line therapy is medical management

(B) Transcatheter embolotherapy (TCE) is a well-established technique

(C) Unilateral embolisation has a low rate of recurrence

(D) Embolisation is achieved with sclerosant foam alone

(E) Technical failure rate is high in TCE

(F) Symptom control is achieved relatively quickly following TCE

(G) The recurrence rate following TCE is 8%

(H) There is a high rate of premature ovarian failure following TCE

4. **The following imaging investigations for PCS involve ionising radiation:**

(A) MRI
(B) CT
(C) Transabdominal US
(D) Transvaginal US
(E) Magnetic resonance venography
(F) Laparoscopic assessment
(G) Digital subtraction angiography
(H) Magnetic resonance angiography

5. **Recognised treatments for PCS include:**

(A) Transcatheter embolisation
(B) Laproscopic assisted venous ligation
(C) Medroxyprogesterone acetate
(D) Arterial stenting
(E) Catheter-directed arterial embolisation
(F) Penicillin
(G) Steroid
(H) Aspirin

Competing interests None.

Provenance and peer review Not commissioned; externally peer reviewed.

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ANSWERS

1. (A) T; (B) T; (C) T; (D) F; (E) F; (F) T; (G) F; (H) T
2. (A) T; (B) F; (C) F; (D) T; (E) T; (F) T; (G) F; (H) T
3. (A) F; (B) T; (C) F; (D) F; (E) F; (F) T; (G) T; (H) F
4. (A) F; (B) T; (C) F; (D) F; (E) F; (F) F; (G) T; (H) F
5. (A) T; (B) T; (C) T; (D) F; (E) F; (F) F; (G) F; (H) F

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