Cardiovasc Intervent Radiol (2007) 30:1105–1111
DOI 10.1007/s00270-007-9160-0

REVIEW / STATE OF THE ART

Chronic Pelvic Pain due to Pelvic Congestion Syndrome: The Role of Diagnostic and Interventional Radiology

Arul Ganeshan · Sara Upponi · Lye-Quen Hon · M. C. Uthappa · Dinuke R. Warakaulle · Raman Uberoi

Received: 19 April 2007 / Accepted: 24 July 2007 / Published online: 6 September 2007

Abstract Chronic pelvic pain (CPP) is a common cause of gynecologic referral. Pelvic congestion syndrome, which is said to occurs due to ovarian vein incompetence, is a recognized cause of CPP. The aim of this paper is to briefly describe the clinical manifestations, and to review the role of diagnostic and interventional radiology in the management of this probably under-diagnosed condition.

Keywords Chronic pelvic pain · Ovarian vein embolization · Pelvic congestion

Introduction

Chronic pelvic pain (CPP) in females is defined as pain originating in the lower abdomen or pelvis with a duration of more than 6 months, which is not exclusively cyclical or intercourse-related and not usually relieved by narcotic analgesics [1]. CPP accounts for 10–40% of all gynecologic referrals and pelvic congestion syndrome (PCS) is one of its causes [2]. PCS is said to occur as a result of retrograde flow in an incompetent ovarian vein. Ovarian vein incompetence is seen in approximately 10% of women and up to 60% with this abnormality can develop PCS [3]. Because of the protean manifestation of PCS and the limited appreciation of this condition by both clinicians and radiologists, PCS remains an under-diagnosed cause of CPP.

The aim of this paper is to highlight this condition and increase awareness amongst radiologists, focusing on the imaging techniques and available treatment options, in particular endovascular intervention.

Etiology

The etiology of PCS is poorly understood and is likely to be multifactorial. Absence of ovarian vein valves is an important factor in its development [4]. The causes of ovarian varicoceles are multifactorial, involving both mechanical and hormonal factors. Dilatation of the ovarian veins can result in vascular incompetence and retrograde blood flow. Dilated veins are more frequently present with increased parity and PCS occurs more frequently in multigravid women [5]. The fact that PCS affects only premenopausal women suggests a correlation between PCS and ovarian activity. Pelvic vein kinking associated with uterine malposition can also lead to venous stasis, flow reversal, and subsequent varicosities [6, 7]. External vascular compression, including the nutcracker syndrome where the left renal vein is compressed between the aorta and the superior mesenteric artery, can also result in the development of pelvic congestion [8]. Secondary ovarian vessel congestion may be seen with a number of different disorders including portal hypertension or the acquired inferior vena cava syndrome.

Ovarian varicosities in women were first described by Richet in the 1850s but not until the mid-1930s was the

A. Ganeshan · S. Upponi · R. Uberoi (✉)
Department of Radiology, John Radcliffe Hospital, Headley Way, Oxford OX3 9DU, UK
e-mail: raman.uberoi@orh.nhs.uk

L.-Q. Hon
Department of Radiology, The Royal Hallamshire Hospital, Glossop Road, Sheffield S10 2JF, UK

M. C. Uthappa · D. R. Warakaulle
Department of Radiology, Stoke Mandeville Hospital, Mandeville Road, Stoke Mandeville HP21 8AL, UK

association between CPP and ovarian varicosities first mentioned by Cotte [9, 10]. Subsequently this was confirmed by Taylor in 1949 [4]. The investigative techniques for diagnosing PCS and treatment options have evolved more recently.

Clinical Manifestations

PCS is associated with dilatation of the pelvic veins and reduced venous clearance. Patients commonly present with pelvic pain without evidence of inflammatory disease. The pain is worse during the premenstrual period and pregnancy, and is exacerbated by fatigue and standing. PCS is often accompanied by a feeling of fullness in the legs.

Pain can also increase after coitus and this can lead to patient anxiety and relationship difficulties. Symptoms such as bladder irritability and frequency secondary to varicosities in the trigone region mimicking urinary tract infection are also commonly recognized.

On examination, varicosities may be present on one or both sides of the vulva. Usually these varicosities extend onto the medial aspect of the upper thigh and can result in varicosities in the territory of the long saphenous system. Varicosities may also be seen on the buttocks. Ovarian point tenderness with a history of postcoital ache is said to be 94% sensitive and 77% specific for pelvic congestion [11].

Imaging for PCS

Imaging is vital in the assessment of PCS and is often used to confirm the clinical suspicion of this condition. Noninvasive investigations are recommended as an initial assessment, although direct visualization of tortuous and dilated ovarian veins by selective venography remains the gold standard.

Noninvasive imaging

Pelvic Ultrasound (US)

This is a simple procedure, which is often the first-line investigation. US is performed either transabdominally and/or transvaginally during the initial assessment of suspected PCS to rule out any other major abdominal or pelvic masses mimicking PCS-type symptoms. In addition it has been shown to be of value in the diagnosis of PCS, although there are no published randomized controlled trials assessing the efficacy of transabdominal or transvaginal US versus ovarian vein venography [12].

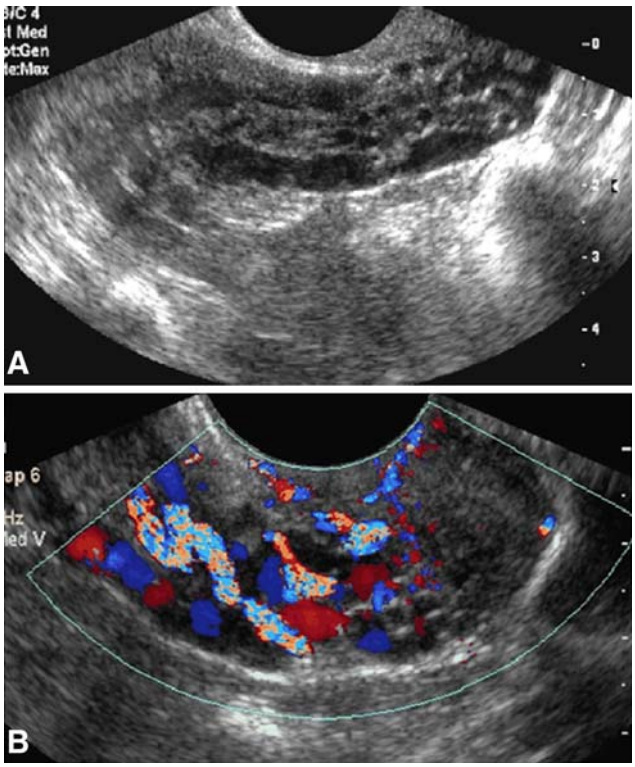

Fig. 1 Transvaginal **A** gray-scale and **B** color Doppler ultrasound showing dilated pelvic veins in a patient with chronic pelvic pain. (We are grateful to Dr T. Nicholson, St. James' Hospital Leeds, for supplying these images.)

The sonographic appearances of the normal pelvic venous plexus are of one or two straight tubular structures with a diameter of less than 4 mm [13]. In the case of PCS, multiple dilated veins around the ovary and uterus with venous Doppler signal of varying amplitude can be seen (Fig. 1). The presence of circular or linear venous structures with a diameter greater than 5 mm is indicative of pelvic varicosities [5, 14]. Other sonographic findings seen in PCS include reversed caudal blood flow in the ovarian veins, dilated arcuate veins crossing the uterine myometrium, and polycystic changes of the ovary. PCS patients with polycystic changes of the ovaries, however, were not found to be hirsute or amenorrheic with normal ovarian endocrine function [14, 15–17]. The sonographic appearances of the cystic changes in the ovaries in PCS can vary from a classic polycystic appearance to the presence of clusters of four to six cysts 5–15 mm in diameter in bilaterally enlarged ovaries [12].

The three main diagnostic criteria for diagnosing PCS on transvaginal or transabdominal US are [16, 17]:

(1) Tortuous pelvic veins with a diameter of greater than 6 mm. The mean diameter of the PCS group is about 8 mm.
(2) Slow blood flow (about 3 cm/sec) or reversed caudal flow.

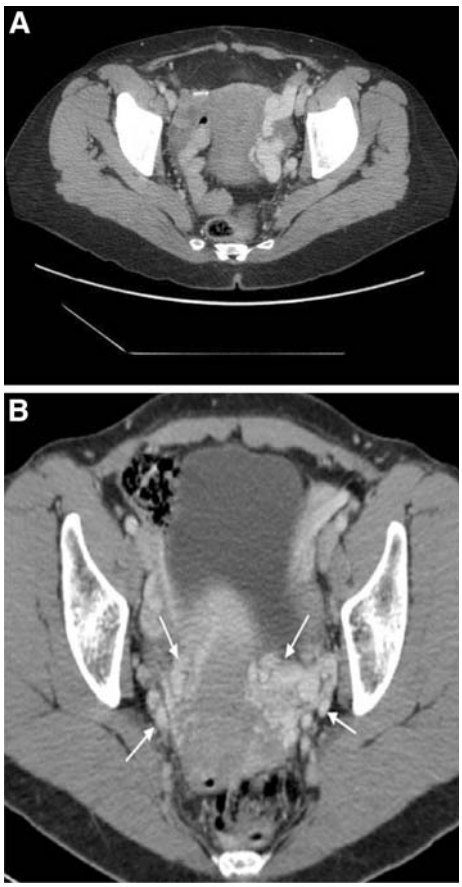

Fig. 2 Axial computed tomographic appearances of **A** left-sided and **B** bilateral parauterine pelvic varices in patients with PCS syndrome

(3) Dilated arcuate veins in the myometrium that communicate between bilateral pelvic varicose veins.
(4) Sonographic appearances of polycystic changes of the ovaries.

As with the sonographic diagnosis of testicular varicocele in men, the sonographic assessment of pelvic venous dilatation can be improved by standing the patient up and/or employing the Valsalva maneuver [18].

Computed Tomographic (CT) and Magnetic Resonance (MR) Imaging. On either CT or MR imaging studies pelvic varices in PCS appear as dilated, tortuous, enhancing tubular structures near the ovaries and uterus. In addition, the extension of varices to the broad ligament and paravaginal venous plexus can be appreciated (Fig. 2). With CT, the tubular nature of these structures and the pattern of enhancement after intravenous contrast medium administration distinguish them from lymphadenopathy or adnexal masses. Unlike such masses, pelvic varices appear isodense with other veins after contrast enhancement [19].

MR imaging is the preferred noninvasive technique as it avoids radiation and allows a complete examination of the pelvic anatomy due to its multiplanar imaging capability. On MR imaging, pelvic varices usually return no signal on

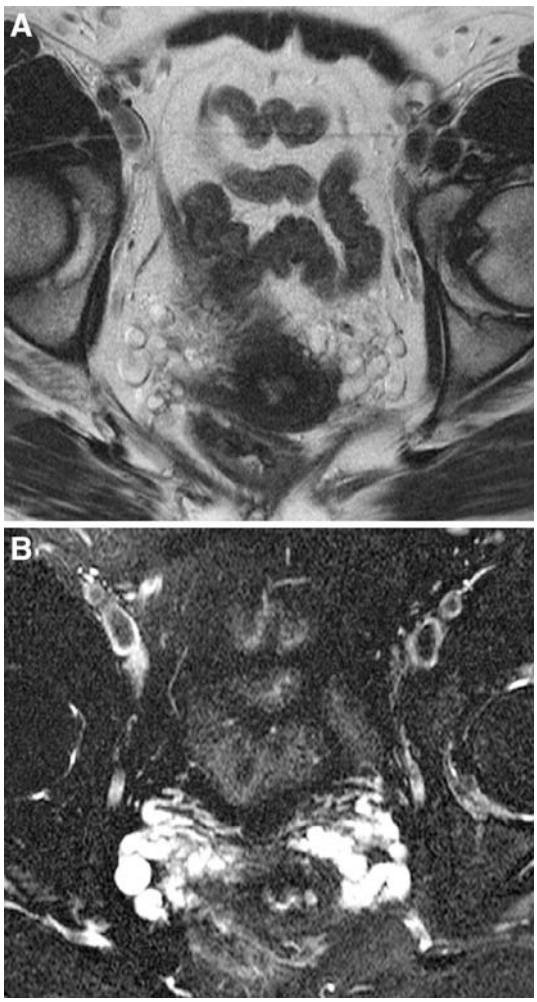

Fig. 3 **A** Axial T1-weighted and **B** STIR MR images displaying the presence of bilateral enlarged tortuous ovarian vein tributaries forming the parauterine pelvic varices. (We are grateful to Dr T. Nicholson, St James' Hospital Leeds, for supplying these images.)

T1-weighted sequences due to flow-void artifact (Fig. 3A). On T2-weighted sequences, varices are often hyperintense, but can also be hypo- or isointense, depending on the velocity of blood flow through the vessels [20] (Fig. 3B). Gradient echo sequences can show high signal intensity within the varices. Three-dimensional T1-weighted gradient echo sequences, in which the varices appear hyperintense, are also an effective way of demonstrating pelvic varices with MR imaging. In contrast-enhanced magnetic resonance angiography (CE MRA), images are obtained after the injection of a bolus of contrast (gadolinium) (Fig. 4). Sequential scans are obtained during arterial and mixed arterial–venous and venous phases. Different techniques are used to ensure optimal contrast of the venous system, including bolus timing, automatic bolus detection, bolus tracking, and care bolus. Recently, however, contrast-enhanced magnetic resonance venography (MRV) has becomes very popular and is likely to become

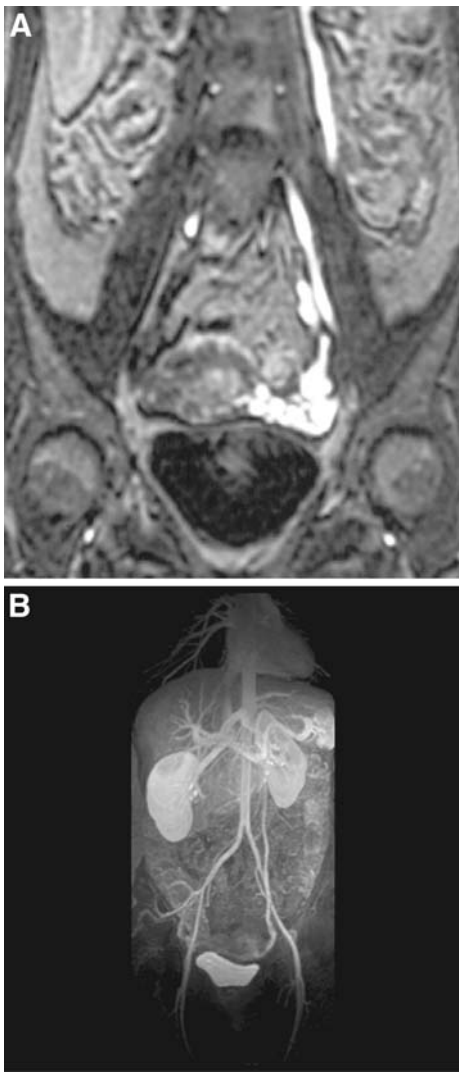

Fig. 4 Coronal **A** T1-weighted fat-saturated post-gadolinium sequence and **B** MIP three-dimensional projection of an enlarged left ovarian in a patient with known PCS who was subsequently treated successfully with the endovascular approach

the initial noninvasive investigation of choice in the diagnosis of PCS. Using MRV the pelvic venous system can be imaged in a breath-hold and the pulse sequence used is an enhanced three-dimensional fast gradient echo sequence, similar to the routine MRA. Images are obtained after bolus injection and accurate timing between the two events is achieved automatically using Smartprep (GE) or manually by using the timing features such as iDrive Pro (GE).

Multiplanar reformatted (MPR) images may not only identify ovarian varices, but can also demonstrate the cause of venous dilatation in some instances such as the nutcracker syndrome. In addition, these images also have the advantage of providing information regarding any coexisting abdominal or pelvic pathology.

The criteria for diagnosing pelvic varices with cross-sectional imaging, as defined by Coakley et al., are the presence of at least four ipsilateral tortuous parauterine veins of varying caliber with at least one measuring over 4 mm in maximum diameter, or an ovarian vein diameter of >8 mm [20]. These criteria, however, are relatively arbitrary, and the subjective assessment of the reporting radiologist remains a pivotal factor in determining the significance of pelvic varices.

Both MRI and CT unfortunately can underestimate pelvic venous pathology as conventional cross-sectional imaging is generally performed in the supine position and ovarian and pelvic venous varices may therefore not be prominent. Furthermore, artifact from metallic embolization coils also limits follow-up of treated patients with MRI.

Invasive Imaging

Vulval varicography, peruterine venography, and laparoscopy were used extensively in the confirmation of the diagnosis of PCS, prior to the development of noninvasive imaging methods and are now of historical interest only [7].

Venography

This technique was first described by Tavernier and Lange in 1965, who reported a patient in whom the tip of a catheter being used for left-sided selective renal venography by chance came to lie at the orifice of the left ovarian vein [21]. The technique was then further modified by others, including Ahlberg and Edlundh, in the investigation of PCS [22, 23].

The venographic technique involves an initial left venogram performed during the Valsalva maneuver with the patient in a semi-upright position. Venography can be performed through either the jugular or femoral approach. A jugular approach is preferred, however, if embolization is to be performed at the same time as the venogram. Selective catheterization of the left renal vein can be performed with a 4 Fr cobra or multipurpose catheter. This is followed by selective catheterization and injection of iodinated contrast into the ovarian veins, also performed in a semi-erect position during the Valsalva maneuver to assess the venous distention and reflux.

The right ovarian veins usually drain directly into the inferior vena cava (IVC) and can be accessed directly from the IVC. A 4 Fr cobra or multipurpose catheter can be used for cannulating the right ovarian vein, although a sidewinder catheter is often preferred if the study is being performed through femoral access. Once the ovarian vein is cannulated, the remainder of the procedure is similar to that for the left side (Fig. 5A).

Fig. 5 A, B. Digital subtraction angiography. **A** Contrast injected selectively into the right ovarian vein showing retrograde reflux of contrast in an enlarged ovarian vein in a patient with CPP. Congestion of tributaries of the ovarian vein in the pelvis can also be appreciated. **B** No retrograde reflux or parauterine venous congestion is seen following coiling of the left ovarian vein, an indicator of a successful endovascular outcome

In addition to routine pelvic venography, investigations such as a balloon catheter stress test can be used to identify subtle and residual pelvic varices. The balloon occlusion catheter test can be performed at the same time as or 4–6 weeks after pelvic vein embolization. Using a balloon occlusion catheter the right and then left internal iliac veins in turn are selectively cannulated. When the balloon catheter is inflated, balloon occlusion venography is performed with hand injection of contrast medium. If a further more detailed study is needed the catheter can also be advanced into the tributaries of the internal iliac veins to look for residual pelvic varices by further hand injections of contrast. If varices are diagnosed the volume of injected contrast medium injected prior to reflux into the contralateral internal iliac vein is recorded to determine the volume of slurry sclerosant and Gelfoam that will be needed for embolization.

Although US, CT, and MR imaging can demonstrate dilated pelvic veins in the majority of cases, selective venography remains the gold standard in diagnosing PCS. The technique offers detailed images of the venous anatomy prior to embolization, allows observation of retrograde reflux, demonstrates the presence or absence of contralateral venous filling, identifies internal iliac venous drainage, and also displays any extension of venous congestion into the inguinal, vulval, perivesical, rectal, and lower limb veins. Presence of one or more of the following venographic appearance is suggestive of PCS [13]:

(1) ovarian vein diameter of >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.

Treatment

The treatment options for PCS remained unsatisfactory until recently due to the poor understanding of this condition and postulation of various etiologies ranging from psychosomatic origin to vascular causes. Early gynecologic treatment concentrated on malposition of the uterus as it was thought that this caused venous kinking and vascular obstruction. Surgical ventrosuspension of the retroverted uterus, however, was found to be of little benefit. In 1984 Rundqvist found that extraperitoneal resection of the left ovarian vein relieved the symptoms of PCS [24]. Subsequent published literature described anatomic abnormalities, with the proposed etiology being incompetent ovarian veins, and the surgical approach was then modified from resection to laparoscopic ligation of the ovarian veins [25]. The use of medroxyprogesterone acetate (MPA) to increase venous contraction remains the main medical treatment option [26]. Although a number of meta-analyses found MPA to be effective in reducing pain at the beginning of treatment, the benefit was not sustained, and therefore MPA can only be used for a short period for symptomatic relief.

Transcatheter embolotherapy (TCE), since its introduction in 1993 by Edwards et al., has revolutionized the treatment of PCS [27]. The procedure is usually carried out at the time of diagnostic venography using a combination of sclerosant foam and coils (Fig. 5B). During early endovascular treatment period of PCS, patients were treated with unilateral left ovarian vein embolization. However, with this approach nearly 33% of patients experienced only partial or no symptom relief. By early 1990s bilateral ovarian vein embolization became the norm. Bilateral ovarian vein embolization, however, can technically be challenging, especially if the right ovarian vein is extremely small or not visualized. In these situations it is acceptable to embolize only the left ovarian vein as the right ovarian vein is probably not responsible for symptoms (Fig. 6).

Currently TCE is found to be technically successful in 98–100% cases with recurrence rates of less than 8% [28]. Improvement of symptoms occurs within the first 2 weeks and was recorded in 70–85% of treated patients [28, 29].

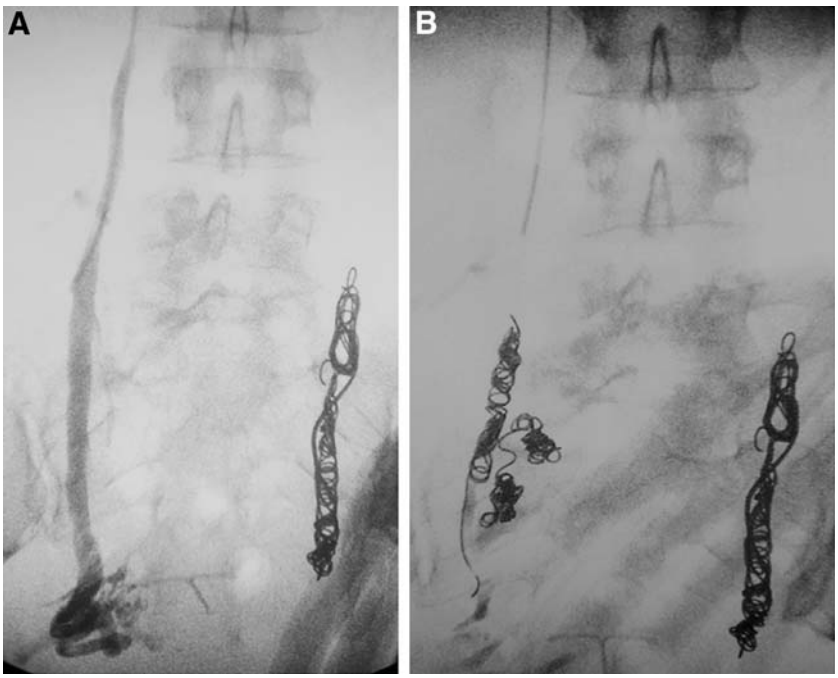

Fig. 6 A patient who underwent previous unilateral successful embolization complained of a recurrence of pelvic pain a few years later. A repeat selective angiogram showed retrograde reflux of contrast in the ovarian vein on the opposite side with evidence of parauterine venous congestion. Embolization of the affected side relieved her symptoms completely

The main drawback of the available literature on PCS is the paucity of extensive long-term follow-up data on the efficacy and the safety of the TCE. A recent study by Kim et al., is encouraging, however, and shows that 83% of patients continue to show clinical improvements 4 years after TCE with no significant changes in their hormone level [29].

Foam sclerosing agents and metallic embolization coils are used together to occlude the veins. Placement of embolic material should begin as distally as possible after the injection of the sclerosant and progress proximally within 2–3 mm of the renal veins or IVC, with care taken to ensure that embolic materials do not dislodge into these vessels. If there is any evidence of free communication between the ovarian venous plexus and internal iliac vein tributaries, embolization of the internal iliac veins is also recommended as part of the complete treatment as this improves the success rate and reduces the rate of recurrence [28]. However, this can be carried out as a staged procedure.

The embolization procedure can be carried out on a day-case basis. The success rate of embolic treatment is better with multiparous patients and worse with patients complaining of dyspareunia. No significant difference in clinical outcome has been demonstrated between patients with unilateral versus bilateral disease. Complications of TCE are rare (less than 4%), and include ovarian vein thrombophlebitis, recurrence of varices, migration of embolic material, and radiation exposure to ovaries. Long-term follow-up data show that TCE has no demonstrable negative effects on the menstrual cycle or fertility [29].

Conclusion

PCS is a common, but probably under-recognized, debilitating condition with a vascular etiology that has protean manifestations. A number of imaging techniques are available to confirm the diagnosis, with selective ovarian venography remaining the gold standard. In the treatment of PCS both medical and surgical approaches have been tried with limited success. More recently, however, TCE has been shown to be both a safe and effective alternative which has revolutionized the treatment of PCS. Radiologists performing diagnostic investigations for women with CPP should be aware of the imaging appearances of PCS, and clinicians managing such patients should be made aware of TCE as an alternative treatment option.

References

1. Robinson JC (1993) Chronic pelvic pain. Curr Opin Obstet Gynecol 5:740–743
2. Klocks S (1995) Psychosomatic issues in obstetrics and gynaecology. In: Rayanas KJ, Barbieri RL (eds) Gynaecology principles and practices. Mosby, St Louis, pp 399–402
3. Belenky A, Bartal G, Atar E, et al. (2002) Ovarian varices in healthy female kidney donors: Incidence, morbidity, and clinical outcome. AJR Am J Roentgenol 179:625–627
4. Taylor HC Jr (1949) Vascular congestion and hyperemia: Their effect on function in the female reproductive organs. Clinical aspects of the congestion fibrosis syndrome. Am J Obstet Gynecol 57:637–653
5. Giacchetto C, Catizone F, Cotroneo GB, et al. (1989) Radiologic anatomy of the genital venous system in female patients with varicocele. Surg Gynecol Obstet 169:403–407

6. Lefevre H (1964) Broad ligament varicocele. Acta Obstet Scand 41:122–123
7. Giacchetto C, Catizone F, Cotroneo GB, et al. (1989) Radiologic anatomy of the genital venous system in female patients with varicocele. Surg Gynecol Obstet 169:403–407
8. Scultetus AH, Villavicencio JL, Gillespie DL (2001)The nutcracker syndrome: Its role in the pelvic venous disorders. J Vasc Surg 34:812–819
9. Richet MA (1857) Traite practique d'anatomie medico-chirurgicale. E Chemeror, Libraire Editeur, Paris
10. Cotte G (1928)Les troubles functionelles de l'appareil genital de la femme. Masson et Cie, Paris
11. Beard RW, Reginald PW, Wadsworth J (1988) Clinical features of women with chronic lower abdominal pain and pelvic congestion. Br J Obstet Gynaecol 95:153–161
12. Park SJ, Lim JW, Ko YT, et al. (2004) Diagnosis of pelvic congestion syndrome using transabdominal and transvaginal sonography. AJR Am J Roentgenol 182:683–688
13. Kennedy A, Hemingway A (1990) Radiology of ovarian varices. Br J Hosp Med 44:38–43
14. Maleux G, Stockx L, Wilms G, et al. (2000) Ovarian vein embolization for the treatment of pelvic congestion syndrome: Long-term technical and clinical results. J Vasc Interv Radiol 11:859–864
15. Adams J, Reginald PW, Franks S, et al. (1999) Uterine size and endometrial thickness and the significance of cystic ovaries in women with pelvic pain due to congestion. Br J Obstet Gynaecol 97:583–587
16. Beard RW, Highman JH, Pearce S, et al. (1984) Diagnosis of pelvic varicosities in women with chronic pelvic pain. Lancet II:946–949
17. Park SJ, Lim JW, Ko YT, Lee DH, Yoon Y, Oh JH, Lee HK, Huh CY (2004) Diagnosis of pelvic congestion syndrome using transabdominal and transvaginal sonography. AJR Am J Roentgenol 182:683–688
18. Mayer Al, Machan LS (2000) Correlation of ultrasound and venographic findings in pelvic congestion syndrome. J Vasc Interv Radiol 11 [Suppl]:221
19. Pagani JJ, Thomas JL, Bernardino ME (1982) Computed tomographic manifestations of abdominal and pelvic venous collaterals. Radiology 142:415–419
20. Coakley FV, Varghese SL, Hricak H (1999) CT and MRI of pelvic varices in women. J Comput Assist Tomogr 23:429–434
21. Tavernier J, Lange D (1965) La phlébographie utéro-ovarienne gauche. Press Med 73:863–866
22. Ahlberg NE, Bartley O, Chidekel N (1965) Circumference of right gonadal vein: an anatomical and statistical study. Acta Radiol 3:503–512
23. Edlundh KO (1964) Pelvic varicosities in women. Acta Obstet Gynaecol Scand 43:399–407
24. Rundqvist E, Sandholm LE, Larsson G (1984) Treatment of pelvic varicosities causing lower abdominal pain with extraperitoneal resection of the left ovarian vein. Ann Chir Gynaecol 73:339–341
25. Takeuchi K, Mochizuki M, Kitagaki S (1996) Laparoscopic varicocele ligation for pelvic congestion syndrome. Int J Gynaecol Obstet 55:177–178
26. Swanton A, Reginald P (2004) Medical management of chronic pelvic pain: the evidence. Rev Gynaecol Pract 4:65–70
27. Edwards RD, Robertson IR, MacLean AB, et al. (1993) Case report: Pelvic pain syndrome—successful treatment of a case by ovarian vein embolization. Clin Radiol 47:429–431
28. Venbrux AC, Chang AH, Kim HS, et al. (2002) Pelvic congestion syndrome (pelvic venous incompetence): impact of ovarian and internal iliac vein embolotherapy on menstrual cycle and chronic pelvic pain. J Vasc Interv Radiol 13:171–178
29. Kim HS, Malhotra AD, Rowe PC, et al. (2006) Embolotherapy for pelvic congestion syndrome: long-term results. J Vasc Interv Radiol 17:289–297