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Transcatheter Ovarian Vein Embolization Using Coils for the Treatment of Pelvic Congestion Syndrome

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Abstract
Purpose To evaluate the therapeutic effectiveness of ovarian vein embolization using coils for pelvic congestion syndrome (PCS), a common cause of chronic pelvic pain in multiparous women.
Methods Between November 1998 and June 2005, 67 patients were diagnosed with PCS and underwent ovarian vein coil embolization. Through medical records and telephone interviews, the pre-embolization pain level and post-embolization pain control were assessed. In addition, in those cases where pain persisted after embolization or where patients were dissatisfied with the procedure, additional treatments and subsequent changes in pain scores were also analyzed. Evaluation after coil embolization was performed within 3–6 months (n = 3), 6 months to 1 year (n = 7), 1–2 years (n = 13), 2–3 years (n = 7), 3–4 years (n = 7), 4–5 years (n = 13), or 5–6 years (n = 17).
Results Among a total of 67 patients, 82% (55/67) experienced pain reduction after coil embolization, were satisfied with the procedure, and did not pursue any further treatment. Twelve patients (18%, 12/67) responded that their pain level had not changed, or had become more severe. Among them, 9 patients were treated surgically and the remaining 3 patients remained under continuous drug therapy.
Conclusion Ovarian vein embolization using coils is a safe and effective therapeutic method for treatment of PCS. It is thought that surgical treatment should be considered in cases where embolization proves ineffective.

Keywords Pelvic congestion syndrome · Veins, ovarian · Veins, therapeutic embolization · Venography

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Introduction

Chronic pelvic pain is defined as noncyclic abdominal and pelvic pain of at least 6 months' duration. It is a common problem in women, accounting for 10–40% of all gynecologic visits [1, 2]. Common causes of chronic pelvic pain include ovarian varicocele, endometriosis, pelvic adhesions, atypical menstrual pain, urologic disorders, irritable bowel syndrome, and psychosocial issues [2, 3]. The diagnosis and management of chronic pelvic pain are difficult, and exhaustive evaluation often identifies no specific organic cause [4]. In 1949, Taylor reported findings of pelvic venous congestion in women with chronic pelvic pain [5].

Pelvic congestion syndrome (PCS) is characterized by visible congestion of the pelvic veins on selective ovarian venography or sonography in multiparous, premenopausal women with a history of chronic pelvic pain [1, 2]. Traditional therapy for PCS has included both medical and

surgical approaches. However, several studies have reported that embolization of the ovarian vein for PCS is relatively simple and safe, with good therapeutic results [6–12]. Although it has been demonstrated that significant pain reduction was achieved in approximately 60–100 % of patients in previous studies, the numbers of cases are small in most studies and the most effective embolic materials and methods have not been established.

The purpose of our study was to evaluate the therapeutic effectiveness of ovarian vein embolization using coils for PCS, a common cause of chronic pelvic pain in multiparous women.

Table 1 Clinical characteristics of patients

Age (years)	39.1 ± 9 [25–64]
Parity	2.4 ± 0.3 [1–7]
Symptom duration (months)	32.9 ± 21.6 [6–243]
OV diameter (mm)	8.1 ± 1.6
Left OV embolization	64 (96%)
Right OV embolization	1 (2%)
Bilateral OV embolization	2 (3%)
Complications (%)	3
Follow-up (months)	44.8 ± 21 [3–67]

OV, ovarian vein

Table 2 Parity data of PCS patients

Parity	No. of patients (%)
P1	13 (19)
P2	33 (49)
P3	13 (19)
P4	2 (3)
P5	3 (5)
P6	1 (2)
P7	2 (3)

Materials and Methods

This study was approved by the institutional review board (IRB) of our hospital. Between November 1998 and June 2005, 67 patients were diagnosed with PCS and underwent ovarian vein coil embolization. The mean age of the patients was 39.1 years (range 25–64 years), and all patients were multiparous. The average parity was 2.4 (range 1–7) (Tables 1, 2). Through a review of their medical records and by telephone interview, the patients' pain levels prior to and after coil embolization were assessed, and both change in pain and satisfaction level for the procedure were evaluated. In addition, in cases with persistent pain after coil embolization or where patients were dissatisfied after the procedure, the timing and types of additional treatments and their results were examined. The times from coil embolization to evaluation were as follows: within 3–6 months (n = 3), 6 months to 1 year (n = 7), 1–2 years (n = 13), 2–3 years (n = 7), 3–4 years (n = 7), 4–5 years (n = 13), and 5–6 years (n = 17). The mean follow-up period was 44.8 ± 21 months.

Initial pain grading was challenging and necessarily subjective; however, we simplified the scale by classifying the initial pain into three grades: mild, moderate, and severe. Pain was defined as mild (grade I) if the patient experienced intermittent discomfort continuously during everyday life, moderate (grade II) pain referred to patients with continuous discomfort during everyday life, and severe (grade III) referred to patients with continuous discomfort during everyday life that was more severe and required frequent analgesics.

The change in pain level after ovarian vein coil embolization is also subjective, and varied among individual patients. However, through the review of medical records and the telephone interview with patients, their condition after coil embolization was classified as follows: Cure (complete response) comprised the patients who reported complete relief of pain, and thus felt no discomfort at all during everyday life. Significant Pain Reduction described those cases where pain reduction was evident, patients were satisfied, thought that additional treatments were no longer required and, accordingly, did not receive additional treatments. No Change included patients who experienced slight reduction in pain but were not satisfied, or felt that their pain level had not improved after the procedure. Aggravation defined those cases where the pain level had increased compared with preprocedural levels. Among these, the Cure and Significant Pain Reduction groups were considered to have received effective treatment.

All patients underwent a comprehensive history and physical examination including a pelvic examination performed by a gynecologist. Patients also underwent diagnostic transabdominal and transvaginal ultrasonography (n = 67, 100%), computed tomography (CT; n = 15, 22%), and magnetic resonance image (MRI; n = 3, 5%). Sonography and other imaging studies (CT, MRI) were performed within 1 month of the selective ovarian venography in those with clinically suspected PCS. Selective ovarian venography was performed in patients with suspected pelvic congestion on noninvasive imaging studies in the absence of any other significant pelvic abnormality. Patients with significant pelvic abnormalities (e.g., large uterine fibroids, endometriosis, adenomyosis, ovarian mass) were excluded from the study.

With the patient in a supine position, venographic access was obtained with the Seldinger technique via the right

common femoral vein, or using the internal jugular venous approach. The guidewire was advanced into the inferior vena cava (IVC) and, after placement of a 6 Fr introducer sheath and a 5 Fr Cobra catheter (Cook, Bloomington, IN, USA), a selective left ovarian venography was performed to evaluate the left ovarian vein both during normal breathing and with Valsalva's maneuver. After the left ovarian venography, the right ovarian vein was selectively catheterized and venography was performed. A selective right ovarian vein study was performed with direct cannulation from the IVC. The IVC and the left renal vein pressures were not routinely measured. However, possible compression of the left renal vein by the superior mesenteric artery (SMA) was carefully considered while performing venography.

Indications for coil embolization included: (1) dilatation of the ovarian vein (>5 mm), (2) ovarian vein reflux into the pelvic cavity involving an incompetent valve, (3) severe congestion of the pelvic venous plexus, (4) significant stasis of contrast medium in the pelvic veins, (5) abnormal filling of the pelvic veins across the midline, and (6) filling of vulvovaginal or thigh varicosities. An enlarged or incompetent ovarian vein was treated with transcatheter coil embolization. Parallel ovarian vein trunks that entered the main trunk or that directly entered the left renal vein were embolized as well. However, we did not perform small collateral vein embolizations along the main ovarian vein, selectively.

Embolizations were performed using coils of optimal size and number (0.035–0.038 inch, 5–15 mm, Cook, Bloomington, IN, USA). An average of 5.8 coils (range 3–8) was used per embolized ovarian vein. No liquid sclerosants or other embolic substances were used. After embolization, repeat venography was performed to confirm occlusion of the ovarian vein as well as that of the concomitant parallel trunks.

Additionally, we evaluated any correlation between the initial symptom grade and the subsequent change in symptoms after coil embolization by applying the chi-square test and correlation analysis (with the DBSTAT program, version 4.1; DBSTAT Co., Chunchon, Korea). Parity was also correlated with clinical outcomes. Statistical significance was set at $p < 0.05$.

Results

Sixty-four patients underwent left unilateral embolization and 1 patient underwent right unilateral embolization. Two patients underwent bilateral ovarian vein embolization. The initial technical success rate of percutaneous transcatheter embolization using coils was 100%. Ovarian venous occlusion was confirmed on post-embolization venography in all cases. Immediate complications were noted in 2 patients (3%), specifically, migration of the coil to the pulmonary circulation and to the left renal vein,

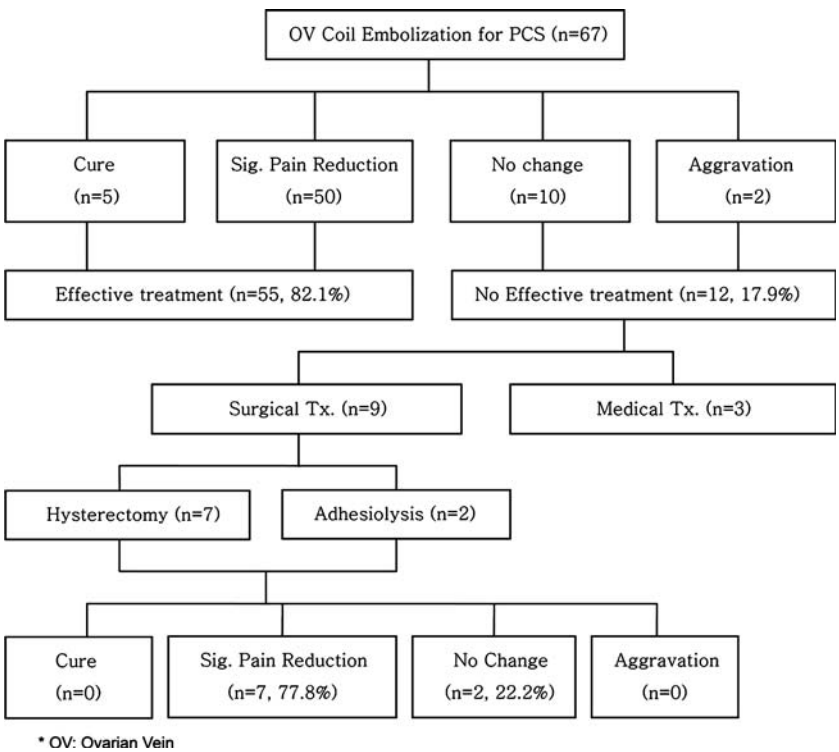

Fig. 1 Algorithm for treatment for PCS patients in our study group

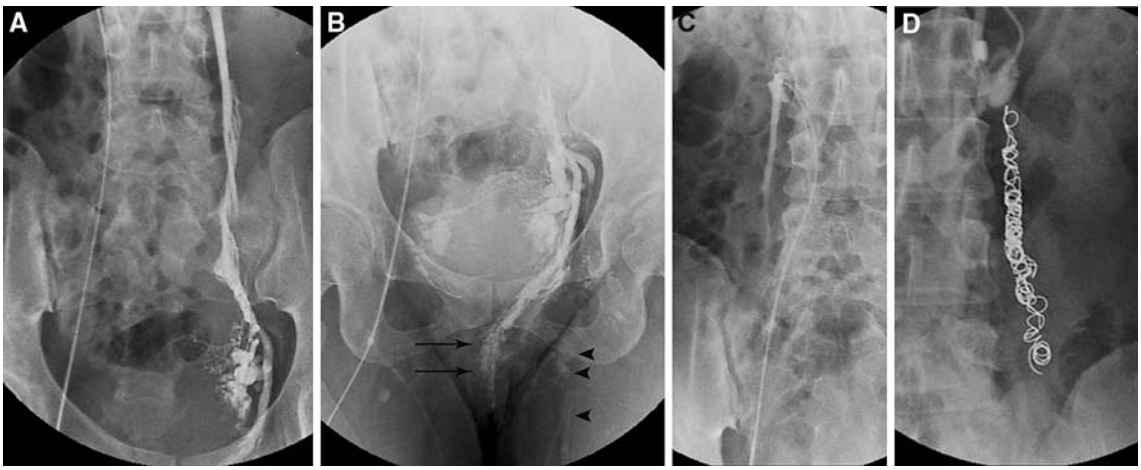

Fig. 2A–D A 36-year old patient. **A** Selective left ovarian venography with Valsalva maneuver shows a dilated ovarian vein and engorgement of the pelvic venous plexus. **B** Opacification of vulvovaginal (arrows) and left thigh varicosities (arrowheads). **C** Right ovarian venography shows a normal diameter for the right ovarian vein and no evidence of reflux. **D** Multiple coils are placed stepwise in the left ovarian vein in a caudocranial direction and venography immediately after embolization demonstrates complete occlusion of the left ovarian vein, without contrast opacification of the embolized ovarian vein

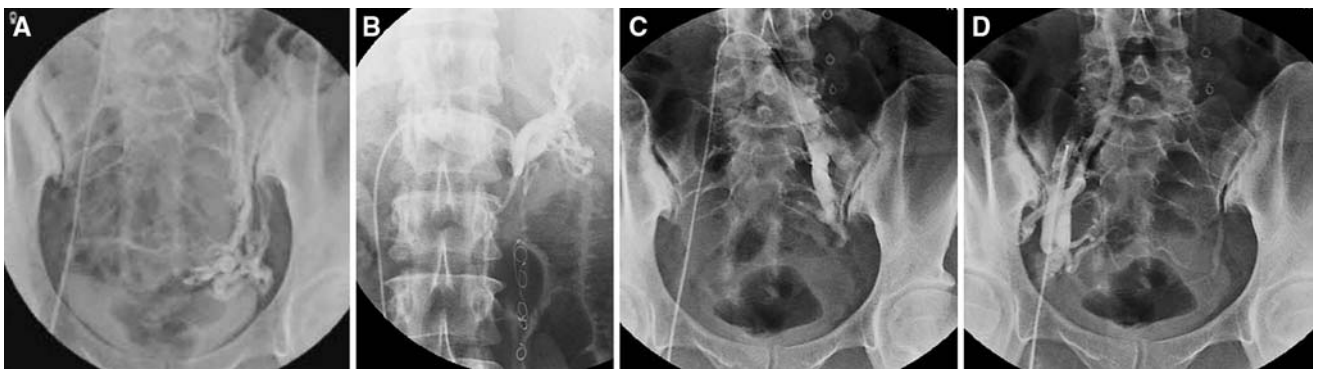

Fig. 3A–D A 41-year old patient. **A** Initial selective left ovarian venography shows reflux in the left ovarian vein and pelvic venous engorgement. **B** Follow-up left ovarian venography 4 months after coil embolization shows well-positioned coils without opacification of the left ovarian vein. **C, D** Follow-up venography of both internal iliac veins shows a normal diameter for both pelvic veins and no evidence of abnormal reflux

respectively. These coils were removed using a snare loop without clinical sequelae. No other procedural or delayed complications were noted.

Of the 67 patients who underwent coil embolization, 55 (82%) were satisfied and reported either a complete absence of pain or a significant reduction in pain with no residual discomfort during daily activities (Figs. 1, 2). These patients did not receive any further interventions or drug treatment. Five (8%, 5/67) of these patients reported a complete absence of pain, and were assigned to the Cure group. Fifty (75%, 50/67) patients were assigned to the Significant Pain Reduction group. These patients reported evident pain reduction which was not complete, but sufficient that they were satisfied with the treatment.

Twelve patients (18%, 12/67) reported no change or an increase in the severity of their pain compared with pre-procedural levels, necessitating surgery or continuous drug treatment. Ten of these patients (15%, 10/67) were assigned to the No Change group and were not satisfied with the results of the procedure. Two patients (3%, 2/67) reported a worsening of pain following the procedure. Of these 12 patients, 9 underwent surgical treatment and the remainder were treated pharmacologically. Follow-up venography was performed on 2 of the 9 patients who underwent additional surgery, which revealed that the ovarian vein coil embolization was well maintained in these patients, and that on internal iliac venography there was an obvious reduction in pelvic congestion compared with initial studies (Fig. 3).

Seven of the 9 patients who underwent surgery were treated by hysterectomy and uterosacral nerve ablation. The remaining 2 patients were diagnosed with pelvic

adhesions and underwent laparoscopic adhesiolysis. Interestingly, none of these 9 patients reported a complete absence of pain after these surgical treatments: 7 reported a significant reduction in pain (7/9, 78%) and 2 had to be maintained on a continuous medication regimen (2/9, 22 %). In patients undergoing additional surgery following coil embolizations, the interval between embolization and subsequent surgery was 3 months ($n = 2$), 4 months ($n = 6$) or 13 months ($n = 1$).

In the 3 patients who refused additional surgery or other aggressive treatment despite inadequate pain reduction with pharmacologic therapy, the interval from coil embolization to examination time was 6 months, 2 years, and 4½ years. These patients reported persistent pain despite medical treatments.

The patients who received effective treatment reported a significant reduction in pain during the initial 2–3 months following coil embolization. It was also observed that patients who did not report any significant improvement in pain level during the initial 2–3 months following embolization did not report any further improvement in the following months.

The composition of the initial symptom grade classes prior to coil embolization was as follows: mild (grade I), 4 patients; moderate (grade II), 45 patients; and severe (grade III), 18 patients. There were no statistically significant correlations between the initial symptom grade and the clinical outcome after coil embolization (Table 3). Also, there was no statistically significant correlation between parity and either the initial symptom grade or the clinical outcome after coil embolization. The parity (P) data of patients for the total 67 cases were 49% ($n = 33$) for P2, and 19% ($n = 13$) each for P1 and P3. The other data were as follows: P4 (3%, $n = 2$), P5 (5%, $n = 3$), P6 (2%, $n = 1$), and P7 (3%, $n = 2$) (Table 2).

Discussion

PCS is a condition of chronic pelvic pain typically affecting young multiparous patients. This lower abdominal pain is variable in intensity and duration, sometimes extending to the posteromedial thigh and buttock areas, and often accompanied by dyspareunia, bladder irritability, and urgency [1, 6]. Chronic lower abdominal pain without an obvious etiology is a frequent but poorly understood complaint in women of child-bearing age [1, 2].

PCS is characterized by dull pelvic pain of variable intensity that persists for more than 6 months. The pain is exacerbated by movement which causes a sudden increase in intra-abdominal pressure, such as walking, bending, standing, lifting or sexual intercourse [1–5].

The causes of pelvic venous congestion are probably multifactorial, involving both mechanical and hormonal factors. During pregnancy, the vascular capacity of the ovarian veins may increase 60 times and remain this way for months after delivery [13]. Dilatation of ovarian veins causes vascular incompetence and retrograde venous flow. Dilated veins are more frequently observed with increasing parity [3, 13, 14]. The fact that PCS affects mainly premenopausal women suggests a correlation between PCS and ovarian activity [14]. A hormonal etiology is also suggested by the fact that PCS most often occurs after pregnancy and seldom persists after menopause. A clinical study has reported an improvement in unexplained pelvic pain after pharmacologic ovarian suppression [15]. Congested pelvic venous flow can be directed into the lower extremities through the collateral channels of obturator, inferior gluteal, external or internal pudendal veins, or other pelvic venous collaterals. Moreover, the congested pelvic venous blood may flow into the internal iliac vein or the superficial and deep venous systems of the lower extremities [16, 17]. Therefore, patients with unexplained labial and thigh venous dilatation must have ultrasound examination of pelvic veins as well as lower extremity venous systems.

One study has reported an absence of ovarian venous valves in up to 15% on the left side and up to 6% on the right side [16]. Of our 67 patients, 64 had an abnormality only in the left ovarian vein and, accordingly, underwent selective left-sided embolization. Both ovarian veins were embolized in 2 cases, and an abnormality limited to the right ovarian vein was noted in only 1 patient. The reasons for the higher incidence of ovarian vein reflux on the left side have not been evaluated, but may be related to the absence of ovarian venous valves in some instances. Similar to our observations, ovarian venous abnormalities were

Table 3 Relationship between initial symptom grade and symptom changes after transcatheter ovarian vein coil embolization

There was no statistical significance between initial symptom groups, $p > 0.05$

Initial symptom grade	Symptom change after embolization				
	Cure	Significant Pain Reduction	No Change	Aggravation	Total
Mild (grade I)	1	2	1	0	$n = 4$
Moderate (grade II)	2	33	8	2	$n = 45$
Severe (grade III)	2	15	1	0	$n = 18$
Total	$n = 5$	$n = 50$	$n = 10$	$n = 2$	$n = 67$

more commonly observed on the left side in many previous studies [6–8], needing only selective left ovarian vein embolization in many instances.

Retrograde venous flow and incompetent ovarian venous valves may also be noted incidentally in asymptomatic women. Belenky et al. [17] reported that 22 of 27 left-kidney donors were found to have retrograde ovarian venous flow. Thirteen (59%) of these 22 subjects also reported chronic pelvic pain. After nephrectomy, pelvic pain was observed to resolve completely in 7 patients (54%), improve in 3 (23%), and persist in 3 (23%). They also reported a 9.9% prevalence rate of ovarian varices in the general population. These findings suggest that more than half (59%) of the patients with ovarian varices have PCS and that most (77%) might benefit from ovarian vein embolization or ligation. This report reiterates the hypothesis that ovarian venous reflux induces pelvic vein congestion which, in turn, is an important cause of chronic pelvic pain. A corollary of this observation is that chronic pelvic pain may be treatable by managing the underlying ovarian venous reflux.

Traditional therapy for PCS has included both medical and surgical approaches [18, 19]. However, many studies have now reported that embolization of the ovarian vein as treatment for PCS is not only relatively simple and safe compared with traditional surgery, but also exhibits good results [4, 6–12]. Although the numbers of study subjects are variable and the methods used to assess changes in pain levels after embolization have not been standardized, it has been demonstrated that significant pain reduction was achieved in approximately 60–100% of treated patients.

Edwards et al. [10] described a patient who underwent the first transcatheter embolization for ovarian varices in 1993. Prolonged symptomatic relief was observed in this patient with PCS following bilateral ovarian venous embolization. Tarazov et al. [7] reported 6 women with pelvic pain syndrome and marked left ($n = 5$) or bilateral ($n = 1$) ovarian varicoceles who were treated by transcatheter retrograde venous embolization using a Gianturco steel coil. Pelvic pain and dysmenorrhea completely resolved in all 6 cases, and the benefit was sustained during a follow-up period ranging from 1 to 4 years. This study design was quite similar to ours, with a relatively long-term follow-up. However, the shortcoming of this study was the small number of study subjects.

Capasso et al. [8] described a series of 19 patients with chronic pelvic pain treated with ovarian vein embolization using enbucrilate and macrocoil. Relief of pain was complete in 11 of 19 patients (56%), partial in 3 (16%), and absent in 5 (26%). Cordts et al. [4] described a study of 9 women, 8 of whom (89%) experienced immediate relief after treatment with coils and an absorbable gelatin sponge. Symptom relief varied from 40% to 100% at the mean 13.4-month follow-up. Maleux et al. [6] described a series of 41 patients who underwent ovarian vein embolization using a mixture of enbucrilate and lipiodized oil or mini-coils. In this series, clinical follow-up revealed variable symptomatic relief in 10% of cases and total relief of symptoms in 59% of cases. One of the important characteristics of the reports described in this section is that, in addition to coils, other supplemental embolic materials were used. However, the therapeutic effects were not significantly different from our results. Therefore, we think that coil embolization is sufficient for the embolization of the ovarian vein in most cases.

Recently, Kim et al. [9] reported 127 patients with PCS who underwent embolotherapy using coils, Gelfoam, and a mixture of sodium morrhuate. In their report, 83% of the patients exhibited clinical improvement at long-term follow-up, 13% had no significant change, and 4% exhibited a worsened condition. Interestingly, although they reported a larger cohort of patients than ours and used coils with other embolic substances for ovarian vein embolization, their results are quite similar to ours. Also, Kim et al. [9] performed secondary internal iliac vein embolotherapy in 108 of 127 patients (85%) to reduce the theoretical risk of recurrence of varices, which they believe contributed to the success reflected in their results. We also believe that such attempts can be very valuable. However, numerous collateral venous pathways are present in the pelvic cavity, so it may not be possible to prevent completely the recurrence of pelvic venous congestion by internal iliac vein embolization alone. Furthermore, we think that the main endpoint for evaluating embolization success for PCS should not be the presence of varices themselves, but the status of the chronic pelvic pain. We think that secondary internal iliac vein embolization may be reserved for cases where the primary ovarian vein embolization is inadequately clinically successful, because our results, as well as those of previously reported studies, showed comparable clinical outcomes in comparison with their results.

In those cases where treatment with transcatheter embolization has failed, various medical and surgical treatments can be pursued. In our study, of the 12 patients in whom coil embolization was ineffective, 9 underwent surgical treatment. However, none of these patients reported complete pain control after surgery. These observations suggest that, in some cases, chronic pelvic pain is not caused solely by pelvic vein congestion but also by a variety of other complex factors.

This study had some limitations. First, there is a potential for recall bias caused by the retrospective study design. Second, the grading systems for pain both pre- and postprocedurally are controversial and necessarily

subjective. Another limitation of our study is the lack of laparoscopic diagnosis of PCS before the embolization procedure and an inability to differentiate patients with chronic pelvic pain caused by PCS as opposed to those with pain caused by other factors with incidental pelvic venous congestion. Further studies on the most effective embolic materials and regarding the standardization of embolization techniques are required. Also, a randomized controlled study is necessary.

In conclusion, it appears that ovarian vein embolization using coils is a safe and effective method of treating of PCS. Surgical treatment should be considered in cases where embolization proves ineffective.

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