

Bilateral ovarian vein coil embolization with crossover technique in pelvic venous disease: One year follow-up results

Pelvik venöz hastalıkta çapraz geçişli teknik ile iki taraflı over ven coil embolizasyonu: Bir yıllık takip sonuçları

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ABSTRACT

Background: In this study, we aimed to evaluate one-year clinical follow-up of patients who underwent bilateral ovarian vein embolization using crossover maneuvers between the ovarian veins via unilateral puncture.

Methods: Between January 2017 and September 2022, a total of 34 women (mean age: 39.6±4.9 years; range, 26 to 52 years) who had pelvic venous disease and underwent bilateral embolization of ovarian veins with unilateral puncture and collateral crossover were retrospectively analyzed. The patients were followed at one, six, and 12 months postoperatively. Symptoms were evaluated using physical examination findings and Visual Analog Scale scores and the need for reintervention was assessed.

Results: Of a total of 34 patients, 21 (61.8%) reported dysmenorrhea and 18 (53%) reported both dyspareunia and lower limb varices. There were no major complications during the procedure. The mean preoperative Visual Analog Scale score was 8.1±0.8, which decreased to 2.1±0.6 at 12 months. Reintervention was necessary for only one patient during one-year follow-up.

Conclusion: Although bilateral ovarian vein embolization with crossover to the contralateral side poses greater technical challenges than unilateral ovarian vein closure, it remains a viable technique with favorable outcomes and lower complication rates.

Keywords: Coil embolization, crossover technique, endovascular treatment, pelvic venous disease, pelvic venous disorder, pelvic congestion syndrome.

ÖZ

Amaç: Bu çalışmada, tek taraflı ponksiyon yoluyla yumurtalık damarları arasında çapraz geçiş manevraları kullanılarak iki taraflı yumurtalık damarı embolizasyonu geçiren hastaların bir yıllık klinik takibi değerlendirildi.

Çalışma planı: Ocak 2017 - Eylül 2022 tarihleri arasında pelvik venöz hastalığı olan ve tek taraflı ponksiyon ve kollateral çapraz geçiş ile iki taraflı yumurtalık damarı embolizasyonu yapılan toplam 34 kadın (ort. yaş: 39.6±4.9 yıl; dağılım, 26-52 yıl) retrospektif olarak incelendi. Hastalar ameliyat sonrası bir, altı ve 12. aylarda takip edildi. Semptomlar fizik muayene bulguları ve Görsel Analog Ölçeği skorları ile değerlendirildi ve yeniden müdahale gereksinimi incelendi.

Bulgular: Toplam 34 hastanın 21'i (%61.8) dismenore bildirirken, 18'i (%53) hem dispareuni hem de alt ekstremitte varisleri bildirdi. İşlem sırasında herhangi bir majör komplikasyon gözlenmedi. Ameliyat öncesi ortalama Görsel Analog Ölçeği skoru 8.1±0.8 iken, 12. ayda 2.1±0.6'ya düştü. Bir yıllık takip süresince yalnızca bir hastada yeniden girişim gerekli oldu.

Sonuç: Karşı tarafa çapraz geçişli iki taraflı over ven embolizasyonu, tek taraflı over ven kapatılmasına kıyasla daha fazla teknik zorluk sunsa da, olumlu sonuçları ve düşük komplikasyon oranları ile uygulanabilir bir teknik olmaya devam etmektedir.

Anahtar sözcükler: Koil embolizasyonu, çapraz geçişli teknik, endovasküler tedavi, pelvik venöz hastalık, pelvik venöz bozukluk, pelvik konjesyon sendromu.

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Chronic pelvic pain can often be attributed to pelvic venous diseases (PeVDs). This condition is characterized by persistent pain in the abdominal and pelvic regions which lasts beyond six months, is non-cyclic, and may be associated with symptoms such as dysuria and dyspareunia.^[1-4] This group of diseases are often underdiagnosed due to the deep location of the pelvic veins and the non-specific nature of clinical symptoms. However, the difficulty in diagnosis is not attributed to the pathophysiology of the disease. The primary challenge in the diagnostic process arises from the non-specific symptoms and the deep anatomical location of the veins.^[1,4] It is estimated that PeVD affects 20 to 30% of young, multiparous women.^[5,6] However, only 10% of these women seek consultation from a gynecologist or phlebologist, and only half of those who seek help receive treatment for their condition.^[5-7]

The main pathophysiology of PeVD includes venous hypertension, similar to other venous system diseases. This type of venous hypertension is caused by insufficiency and enlargement of the ovarian vein (OV) and related uterine veins. In addition, conditions related to high estrogen (hormone therapy, pregnancy), which disrupts the vein wall structure, can be considered among other causes.^[4-12] In addition, pelvic venous insufficiency may also occur in syndromes that cause compression, such as Nutcracker and May-Turner, which are associated with the pelvic vein.^[13] Medical and surgical treatments were previously used for the treatment of PeVD. Currently, the application of sclerotherapy is included in the guideline recommendations. In addition to sclerotherapy, with the widespread use of endovascular treatments, embolization of deep pelvic veins (coils and plugs) is used to treat symptomatic PeVDs.^[2-8] In this treatment, embolization of the OV and iliac veins is applied. Although there are controversial opinions, embolization can be performed on a single OV, both OVs, or simultaneously on both OVs and the internal iliac veins. While performing this procedure, all pelvic venous structures must be closed either in several sessions or with multiple punctures. Both the high number of hospitalizations and the long radiation exposure of women are negative aspects of the procedure.^[2-8]

In the present study, we aimed to evaluate the clinical symptoms of patients who underwent bilateral OV embolization with crossover maneuvers through unilateral puncture over a one-year period

and to assess the necessity for any repeated procedures during this time.

PATIENTS AND METHODS

Study design and study population

This single-center, retrospective study was conducted at SBU Prof. Dr. Cemil Taşcıoğlu City Hospital, Department of Cardiovascular Surgery between January 2017 and September 2022. Patients who were diagnosed with PeVD and treated with embolization using coils were screened. Only those who underwent bilateral embolization via the crossover approach through unilateral puncture of the right femoral vein were included. Exclusion criteria were as follows: age under 18 years, having PeVD associated with renal vein or iliac vein compression, having a suspicion of another benign or malignant pathology located in the pelvis that could have similar symptoms and having a diagnosis of any type of neoplasia, missing follow-up data, pregnancy or breastfeeding, having unilateral pelvic vein insufficiency, having no venous insufficiency during pelvic imaging, inability to access patient data, inability to pass right OV from left OV via crossover technique, and incomplete follow-up data. Finally, a total of 34 women (mean age: 39.6±4.9 years; range, 26 to 52 years) were included. The study flowchart is shown in Figure 1. A written informed consent was obtained from each patient. The study protocol was approved by the Istanbul Prof. Dr. Cemil Taşcıoğlu City Hospital Ethics Committee (date: 05.02.2024, no: 7). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Demographic data, medical history, symptoms at the time of admission to the hospital, technique and duration of the procedure, quantity of coil applied during the procedure, and post-procedural success rate were examined. Post-procedural complications (bleeding, rupture), hospitalization (for procedure and post-procedural follow-up), one-year follow-up symptoms, and the need for reintervention were recorded. The primary outcome measure was symptomatic relief and the decrease in Visual Analog Scale (VAS)-pain scores. The secondary outcome measure was complication rate.

Diagnosis

After the clinical evaluation of the patients, transabdominal Doppler ultrasonography (USG) was performed for patients with clinical suspicion. Diagnostic criteria in Doppler USG were as

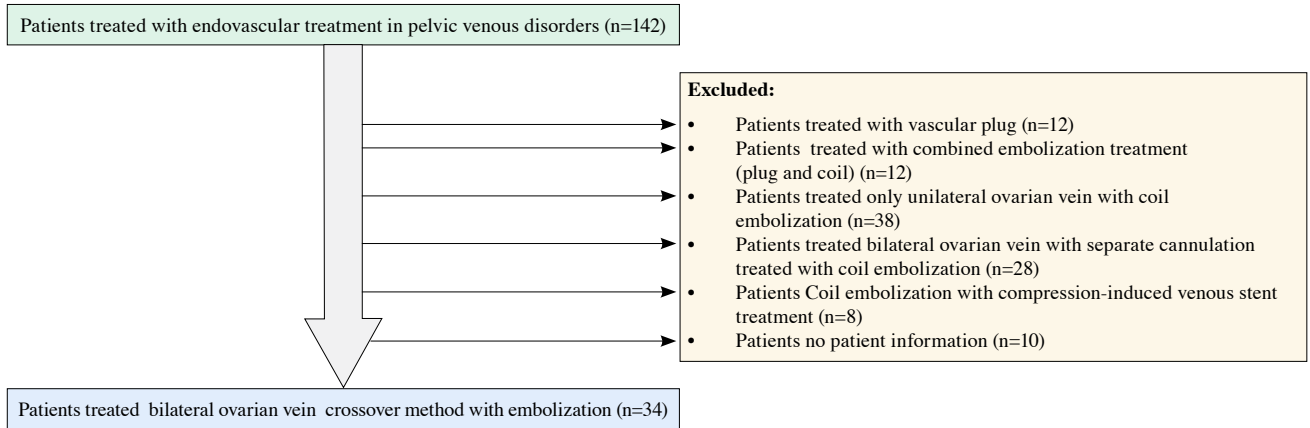


Figure 1. Study flowchart.

follows: (i) tortuous pelvic veins with a diameter of >6 mm; (ii) dilated arcuate veins passing through the myometrium and communicating with bilateral pelvic varices; (iii) reverse caudal or retrograde blood flow; and (iv) slow blood flow was considered as <3 cm/s.^[9,10]

Venographic images were obtained from the left OV during the procedure. Pelvic venous disease was defined as having one or more of the following criteria in venographic images: (i) incompetent pelvic veins with a diameter of >5 to 10 mm; (ii) moderate or severe dilatation of the ovarian plexus; (iii) venous reflux from the proximal to the distal with slow injection of the ovarian venous plexus; and (iv) it was considered the enhancement of the collateral veins in the midline.^[11,12] We considered compression syndrome in patients with either a dense collateral venous network in the left renal vein/left iliac vein, or when simultaneous repeated pressure measurements between the inferior vena cava (IVC)-left renal vein and IVC-left common iliac vein showed a pressure difference of more than 3 mmHg, along with the presence of symptoms. We accepted 15 mm as the cut-off value for the OV to avoid migration. For diameters of ≥ 15 mm, we considered surgical intervention or other embolization methods instead of coil embolization.

Procedural technique

The patient was placed in a supine position, and the surgical field was prepared using aseptic techniques. A 6F- or 7F-sheath was inserted into the right common femoral vein using the Seldinger technique under the guidance of USG.

Local anesthesia supplemented with midazolam was applied in patients suffering from anxiety. Following the intravenous administration of 5,000 IU of heparin, both the left renal vein and left OVs were accessed using a 0.035-inch hydrophilic guidewire and either a right guiding or C-2 Cobra catheter (Merit Medical Systems Inc., South Jordan, UT, USA).

Pelvic venous reflux was confirmed with the Valsalva maneuver during selective left gonadal venography. Subsequent to advancing the catheter

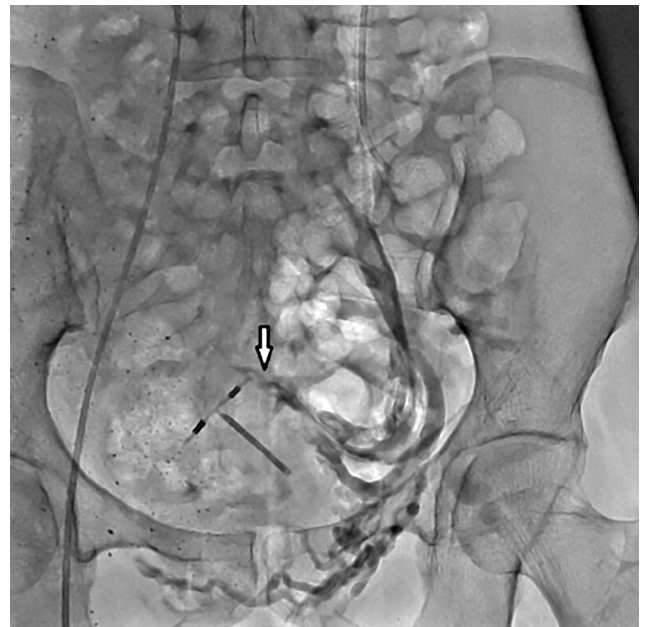


Figure 2. Confirmation of ovarian reflux and mapping for crossover using venography (Suitable venous structures for potential crossover are indicated with arrow).

to the distal portion of the left OV, reference mapping was performed. Using a 0.014-inch hydrophilic floppy wire and a microcatheter, attempts were made to access the right pelvic veins by navigating through the vein of optimal diameter for the contralateral passage (Figure 2). Successful access was followed by coil embolization (Concerto™, Medtronic Inc., MN, USA), which was initiated at the right OV and continued to the left pelvic veins until either the most proximal side was reached or the absence of pelvic leakage was confirmed (Figure 3). The coils we used are poly (lactic-co-glycolic acid) (PGLA)-coated peripheral coils. We primarily used detachable coils in the size range of 12 to 20 cm, with lengths varying between 30 and 50 cm. In all patients included in the study, coil embolization was applied to the contralateral OV, uterine veins, plexuses associated with the uterine veins, and ipsilateral OVs (Figure 4).

Some patients require the injection of a liquid embolic agent (Onyx™, Medtronic Inc., MN, USA) administered via a microcatheter considering the reflux flow rate during coil embolization. Upon completion of bilateral pelvic coil embolization through the left gonadal vein, selective venographies were performed to evaluate internal iliac vein reflux. After the procedure was completed, we took the first image from the left gonadal vein and left renal vein

after the coil was completed. The main goal of the control was to observe the result of the procedure we performed and evaluate success/failure. During this procedure, if there were connections between the left gonadal vein and the internal vein during the first evaluation, the aim was to evaluate them and to assess the collaterals between the pelvic veins. Additional venographies were performed to exclude Nutcracker syndrome and May-Turner syndrome patients. The procedure involved removal of the sheath from the right femoral vein and application of compression to the operation site to control bleeding.

Follow-up and outcome measures

Some patients require postoperative non-opioid analgesia, while opioid analgesics were rarely used. On the day of the procedure, the patients were hospitalized to evaluate whether there was any pathology such as hematoma after the procedure. The renal functions were also monitored. According to our clinical protocol, the patients are usually discharged the day after the procedure, if there are no complications. All patients were discharged on the first postoperative day in this study with non-steroidal anti-inflammatory drugs (NSAIDs).

Post-procedural follow-ups were performed at one, six, and 12 months. Subjective symptoms (pain, dyspareunia, menstrual pain, urinary urgency)

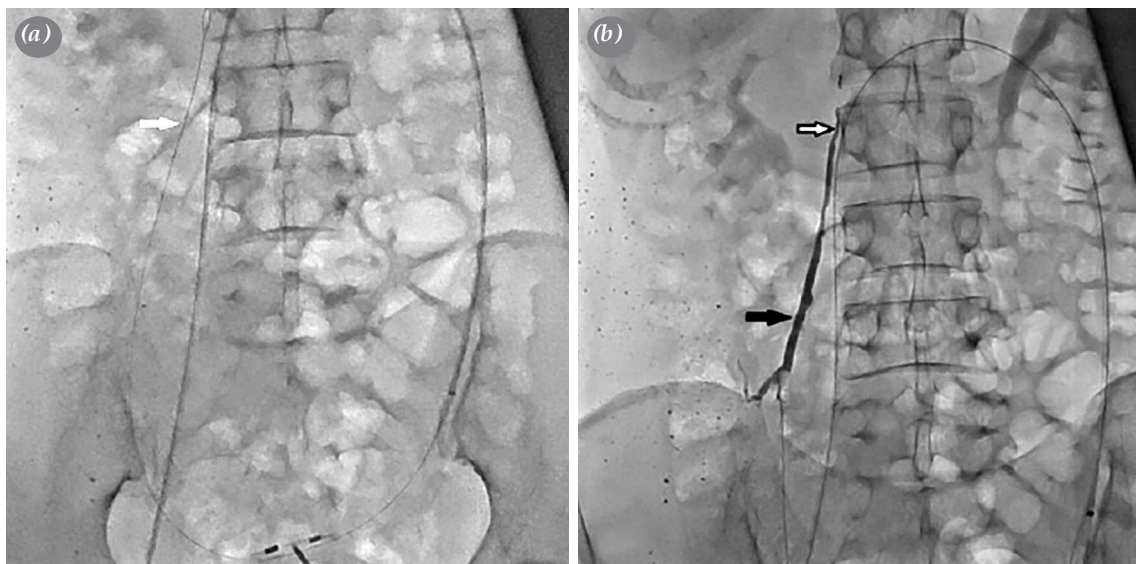


Figure 3. After achieving contralateral crossover using a 0.014-inch floppy guidewire and a microcatheter, venography of the right ovarian vein is performed to prepare for coil embolization. The white arrow in (a) indicates the guidewire within the right ovarian vein, the black arrow in (b) points to the right ovarian vein, and the white arrow indicates the point where the right ovarian vein drains into the vena cava.



Figure 4. Embolization is completed using coils and liquid embolic agents, starting from the mid-portion of the right ovarian vein to the proximal portion of the left ovarian vein. (a, b) Shows the first coil in the right ovarian vein, followed by continuation towards the distal portion of the right ovarian vein and the utero-ovarian veins. (c, d) In addition to coils, liquid embolic agents are frequently used for embolization (the white arrows indicate the radiopacity of the liquid embolic agent). (e) Shows the point where embolization is completed at the proximal portion of the left ovarian vein. Furthermore, the left ovarian venography demonstrates that contrast medium does not fill the distal bed (the black arrow indicates the contrast medium in the left ovarian vein).

and the VAS scores were recorded. The recurrence of symptoms was defined as no improvement in the VAS score or the need for reintervention.^[14]

Clinical success was defined as the disappearance or alleviation of relevant symptoms. The VAS was used to measure outcomes, which were scored from 0 to 10, where 0 indicated “no pain” and 10 indicated “the worst possible pain”.^[14]

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 21.0 software (IBM Corp., Armonk, NY, USA). Continuous data were expressed in mean \pm standard deviation (SD) or median (min-max), while categorical variables were expressed in number and frequency. The normal distribution of the data was analyzed using the Shapiro-Wilk test and coefficient of variation (CV). The Friedman test was used to compare more than two groups with non-normally distributed dependent variables. A *p* value of 0.05 was considered statistically significant.

RESULTS

In this study, a total of 34 patients underwent embolization to the right and left OVs in a single session using the crossover maneuver from right femoral access to the left OV. Sixteen of the patients had a history of endovascular treatment due to limb venous disease. All patients complained of chronic pelvic pain. Single or multiple clinical symptoms were observed (Table 1).

All procedures were performed under local anesthesia. Low-dose opioids were administered to only one patient after anxiety developed during the procedure. The mean number of coils applied to the bilateral OVs and collaterals was 16.1 ± 3.1 . During the procedure, minimal extravasation was observed in minimal collaterals during the transition to the contralateral side in four patients. Coil embolization was completed by moving from the other branches to the contralateral side in these patients. In follow-up imaging, extravasation did not continue, and no additional procedure was needed. There were no cases of bleeding requiring surgical intervention or migration, which was considered a serious complication (Table 2).

The mean VAS score was 8.1 ± 0.8 ; however, the scores gradually decreased to 2.1 ± 0.6 at 12 months ($p < 0.05$). While all patients initially complained of pelvic pain, it continued in 18 patients at one month and in only one patient at 12 months. Since pelvic

Table 1. Demographic data and clinical symptoms

	n	%	Mean±SD	Min-Max
Age (year)			39.6±4.9	
Median live birth range				2-6
BMI (kg/m ²)			26.1±3.4	
History				
Polycystic ovarian syndrome	11	32.4		
Vulvar/vaginal varicosities	8	23.5		
Lower limb varices	24	70.6		
Limb varices surgery	16	47		
Clinical symptoms				
Pelvic pain standing position	34	100		
Pelvic pain sitting	28	82.4		
Dyspareunia	18	53		
Dysmenorrhea	21	61.8		
Postcoital-pain	14	41.2		
Dysuria	7	20.6		
Varices in lower limbs	18	53		
Lower back pain	4	11.8		
Other: depression, headaches etc.	6	17.6		

SD: Standard deviation.

Table 2. Perioperative data and postoperative complications

	n	%	Mean±SD	Median	Min-Max
Perioperative data					
Anesthesia, locale	34	100			
Need opioid	1	3			
Number of using coil			16.1±3.1		
Procedure time (min)			78.5±24.7		
Minor complications					
Perioperative extravasation	4	11.8			
Access site hematoma	1	3			
Low back pain	12	35.3			
Major complications					
Migration to lung	0	0			
Migration renal vein	0	0			
Contrast-induced acute renal failure	0	0			
Pelvic bleeding (need to surgery)	0	0			
Hospital stay (day)				1	1-4

SD: Standard deviation.

venous insufficiency continued in the internal iliac vein of this patient, reintervention was performed (Table 3). The change between the months during follow-up was significant ($p<0.05$). While VAS

decreased gradually until the sixth month, it did not change at 12 months compared to the six-month scores ($p<0.05$). Routine imaging was not performed in patients who underwent the procedure. However,

Table 3. Preoperative, 1st-6th-12th Visual Analog Scale and clinical symptoms

	Preoperative		1 st month		6 th month		12 th month	
	n	Mean±SD	n	Mean±SD	n	Mean±SD	n	Mean±SD
Visual Analog Scale		8.1±0.8		4.8±1.3		2.6±0.7		2.1±0.6
Clinical symptoms								
Pelvic pain	34		18		3		1	
Dyspareunia	18		4		2		2	
Dysmenorrhea	21		12		6		2	
Postcoital-pain	14		10		3		3	
Dysuria	7		2		2		2	
Recurrence								
New embolization			0		0		1	

SD: Standard deviation.

since there was no significant improvement in clinical complaints during follow-up, control imaging was performed and a collateral connection was observed between the pelvic veins and the internal iliac vein, and this vascular structure was closed.

DISCUSSION

Various treatment methods have been used for PeVD, with embolization proving effective and safe in many studies.^[5-7,15-17] Despite this, embolization remains a Class IIa or IIb recommendation in the international and national guidelines,^[2-4] and no consensus exists on an endovascular treatment algorithm or which pelvic veins should be embolized, particularly in cases of reflux. Studies report success with embolizing all major pelvic veins or unilateral OV, although the question of whether all pelvic escape points must be treated still remains to be elucidated.^[5,7,8,10,18] In the present study, we reported the post-procedural and one-year follow-up results of patients who underwent both right OV and left OV coil embolization by providing a contralateral passage through the left OV. Our study results showed that although bilateral OV embolization with crossover to the contralateral side was technically more difficult than unilateral OV closure, it seemed to be a feasible method owing to its favorable follow-up results and low complication rates.

Currently, randomized trials and criteria to qualify patients for PeVD treatment are lacking. However, symptoms such as chronic pelvic pain, dysmenorrhea, and lower extremity varicose veins are common among affected women, particularly

premenopausal individuals, probably due to weakening effect of estrogen on venous walls.^[5-12] In our study, all patients presented with pelvic pain and dysmenorrhea, consistent with previous reports.

Although coils, plugs, and other embolizing agents are commonly used in the treatment, studies show no significant clinical superiority between materials.^[2-8,19,20] In our study, coils were chosen for their low complication risk and thrombogenic properties, contributing to clinical recovery. Symptomatic improvement was gradual, likely due to post-procedural thrombosis in the pelvic veins. Pain diminished significantly as of the first month, with NSAIDs aiding this process. At the end of one year, substantial symptomatic improvement was observed.

Debates persist regarding the extent of pelvic vein embolization. Some authors treat only the left gonadal vein, others treat bilateral gonadal veins or all four major pelvic veins.^[8,16,21-25] However, studies often lack homogeneous patient groups to compare outcomes. In this study, bilateral OV embolization achieved significant symptomatic improvement and reduced VAS scores. Only one patient required reintervention, highlighting the technique's efficacy in minimizing recurrence.

Recurrence rates vary widely due to different definitions, techniques, and follow-up durations.^[3,4,8,22-29] While early success rates exceed 80% in most studies, long-term outcomes are less consistent due to variations in embolized veins and materials used. In our study, bilateral

coil embolization effectively closed collateral veins and minimized pelvic venous flow, thereby reducing the recurrence risk. In addition, coil embolization was applied to bilateral OV, and only one patient required reintervention at 10 months. Although her symptoms first eased, they showed a gradual increase during the six-month follow-up. In the control imaging, the OVs were found to be thrombosed, but there was an increase in diameter and reflux in the internal iliac veins, which was not present before the procedure. Coil embolization was eventually applied to the internal iliac veins in this patient.

Although complications of coil embolization are rare, they may be serious including embolic migration or venous perforation.^[8,19,22] Proper planning, gentle handling of catheters, and matching coil sizes to vein diameters are crucial to minimize the procedural risks. No major bleeding or migrations occurred in this study, although minor extravasation was observed during contralateral transitions in four patients. None of these patients required reintervention.

In the study by Ignacio Leal Lorenzo *et al.*,^[30] similar to our study, embolization using the crossover technique was evaluated. The authors assessed the efficacy and safety of n-2-butyl cyanoacrylate using a unilateral basilic vein approach and crossover technique for bilateral OV embolization. While similar outcomes were achieved in the aforementioned study, both studies differ in terms of the embolic agent used.

Bilateral OV embolization via crossover is advantageous, allowing single-session treatment and reducing hospital stays and procedural risks. However, careful assessment of pelvic collaterals and gentle catheter manipulation are essential to avoid complications. Despite its benefits, the main limitations to this study are its single-center, retrospective design with relatively small sample size and short follow-up. In addition, we were unable to compare this technique with other treatment modalities. Future research should include longer follow-up and randomized comparisons of different techniques and materials.

In conclusion, although bilateral OV embolization with crossover to the contralateral side is technically more difficult than unilateral OV closure, it is a feasible method owing to its favorable follow-up results and low complication rates.

Data Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions: Idea/concept, design, analysis and/or interpretation, writing the article: M.A.Y., S.K.; Control/supervision, materials: S.K., İ.S., Ö.G., A.O.K.; Data collection and/or processing, literature review, critical review: İ.S., Ö.G., A.O.K.; References and fundings: M.A.Y., İ.S., Ö.G., A.O.K.

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