Comparative study between endovascular coiling and laparoscopic excision of symptomatic ovarian vein

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Background

Pelvic venous disorders (PeVD) are a network of disease syndromes that cause chronic pelvic pain and/or lower extremity symptoms in women.

Aim

The aim of this study was to compare the endovascular and laparoscopic interventions for symptomatic ovarian veins reflux assessing the technical feasibility, complications, and early clinical and radiographic outcomes from 6 weeks to 6 months.

Patients and methods

This study was conducted on 40 women complaining of chronic pelvic pain. The patients were classified into two groups: the first group (20 patients) was laparoscopically treated by resection of part of the ovarian (gonadal) vein near the site of connection with left renal vein or inferior vena cava (according to the side of vein refluxing), and the other group was treated by endovascular coiling and sclerotherapy of the refluxing gonadal vein. They were followed up from 6 weeks to 6 months.

The endovascular procedure was carried out under local anesthesia via the transfemoral vein approach with routine supine position and then the left ovarian vein was cannulated using a 5-Fr catheter. Then, renal venography with Valsalva technique was done to detect reflux of the left ovarian vein. Embolization was typically performed using a 'sandwich' technique, which combines metallic devices (coils) with 2 or 3% atheoxysclerol foam.

Although the laparoscopic operation was carried out under general anesthesia with right lateral position for handling of the left gonadal vein and left lateral position for handling of the right gonadal vein. Endoscopic titanium clips were used for occlusion of proximal end of the gonadal vein without traction to prevent detachment from the renal vein followed by part of vein excision.

Results

In the endovascular group, there was marked improvement concerning all of the preprocedural symptoms of PeVD s with obvious significant statistical difference. In the laparoscopic group, not all PeVD s showed significant postoperative improvement. Patients with menorrhagia, vulvar varicosities and urinary, or anal symptoms showed no significant statistical difference, with P value more than 0.05.

Conclusion

Endovascular and laparoscopic interventions are effective and safe in eliminating pathologic blood reflux along the gonadal veins; however, the laparoscopic intervention cannot improve the urinary symptoms or vulvar varicosities. Moreover, laparoscopy may be beneficial in exclusion of any gynecological pathology, but the endovascular procedure is more effective in all pelvic congestion symptoms, with satisfactory improvement, shorter duration, and less complications.

Keywords:

endovascular coiling, laparoscopic excision, ovarian vein reflux, pelvic venous disorder

Introduction

Pelvic venous disorders (PeVD) are a network of disease syndromes that cause chronic pelvic pain (CPP) and/or lower extremity symptoms in women [1].

Pelvic venous incompetence or pelvic congestion syndrome (PCS) (commonly referred to as PeVD) is increasingly diagnosed, especially in multiparous women [2].

Pelvic venous reflux (PVR) is considered to be the cause of recurrence of varicose veins following definitive treatment, in a substantial number of patients [3].

PVR also contributes to the etiology of vulval/labial varicose veins [4] and primary/recurrent lower limb atypical varicose veins arising on the buttocks or upper posteromedial thigh and extending to the vulval and perivulval regions [5].

In cases of recurrence, lower limb varicose veins can be attributed to PVR in 25% of women [3]. Venous disorders of the abdomen and pelvis are part of the spectrum of chronic venous disease and often play a role in lower extremity disease [6].

The clinical manifestations of PeVD may variously include CPP; pelvic origin extrapelvic lower extremity and genital varices; lower extremity pain and swelling; and left flank pain and hematuria [7].

Women affected by PCS most commonly present with pain, which may vary from being acute to chronic, unilateral to bilateral, or sharp to dull [8].

It was also found that 10% of healthy women had ovarian vein reflux and 60% of them had PeVD. True prevalence of PeVD is still uncertain; however, studies have shown that 30% of patients with CPP have PeVD as sole cause of their pain and an additional 15% have PeVD along with another pelvic pathology [9].

The exact etiology of PeVD is unknown. Multiple factors such as valvular incompetence, venous obstruction, and hormones may play an important role in congestion or slow drainage of utero-ovarian and salpingo-ovarian veins. The release of pain-triggering mediators owing to dilatation of veins, caused by venous stasis, is a possible cause of pain in PeVD [10].

On the contrary, hormonal changes (high levels of estrogen and progesterone) during pregnancy cause vasodilation of ovarian veins, resulting in a 60% increase in capacity of pelvic venous system. Reduction of symptoms after menopause indicates effect of hormones on PCS [11].

Gavrilov et al. [12], showed comparative analysis of the efficacy and safety of endovascular and endoscopic interventions on the gonadal veins in the treatment of PCS; however, the paucity of data comparing both procedures elaborated the worthiness of more studies to assess the contribution of such procedures in such disease.

Our study aims to compare the endovascular and laparoscopic interventions for symptomatic gonadal vein reflux assessing the technical feasibility, complications, and early clinical and radiographic outcomes from 6 weeks to 6 months.

Patients and methods
Study design
This is a prospective cohort study conducted in Fayoum and Cairo University hospitals, including 40 female patients presenting with suspected symptoms of PCS, namely, CPP, deep-seated pelvic heaviness, dyspareunia, dysmenorrhea, dysuria, unexplained vaginal discharge menorrhagia, vulvar varicosities, and even those having extra axial lower limb atypical varicosities presented to us between March 2020 and March 2021. They were subjected to detailed preoperative examination and investigations (lower limbs venous duplex and pelvic venous duplex showing refluxing and dilated ovarian vein more than 6 mm and parametrial varicosities) with exclusion of gynecological disorders.

Written informed consent was obtained from the patients. The study was approved by the Department of Surgery, Faculty of Medicine, Cairo University. Approval from ethical committee in Fayoum University was taken before the beginning of the study. Patients were classified into two groups: the first group (20 patients) was laparoscopically treated by resection of part of the ovarian vein near to the site of connection with the left renal vein or inferior vena cava (according to the side of the refluxing vein), and the other group was treated by endovascular coiling and sclerotherapy of the refluxing gonadal vein.
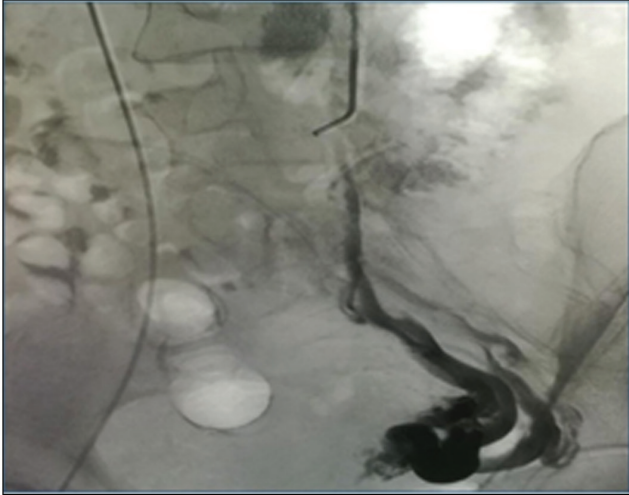
The inclusion criteria of our study were female patients presented with PCSs owing to ovarian vein reflux including abnormal distribution of varicosities (sciatic distribution and vulvo-perineal) or recurrent varicose veins, whereas the exclusion criteria were varicose veins with pregnancy, nutcracker syndrome, internal iliac vein reflux, patients with significant pelvic abnormalities (e.g. large uterine fibroids, endometriosis, adenomyosis, and ovarian mass), or past history of retroperitoneal surgery (marked fibrosis).

Technique of endovascular coiling
The procedure was carried out under local anesthesia with routine supine position via transfemoral vein approach with using 18 G needle and hydrophilic guidewire 0.035, 260 cm long. A vertebral catheter (5-Fr, 125 cm) was advanced and then IVC cavography was done to locate the renal and ovarian veins. After cannulation of the left renal vein and then the left ovarian vein, venography with Valsalva technique was done to detect reflux of the left ovarian vein assessing its diameter more than 6 mm as well as opacification of parametrial varicosities with possibility of crossing the midline (Figs 1, 2).
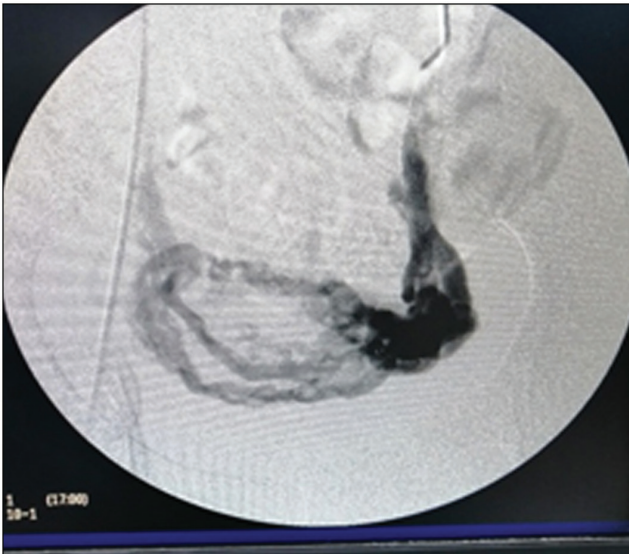
In all cases, foam sclerotherapy was used with a sclerosing agent aethoxysklerol in a 4: 1 mixture with air with a

Figure 1

Pelvic venous plexus.

Figure 2

Pelvic vein crossing midline.

Figure 3

Embolization of larger truncal draining tributaries.

Figure 4

Venography showing adequate closure.

maximal volume of 10–12 ml foam to be injected in the Trendelenburg position (prepared according to Tessari's method) in the para-uterine varicosities. Embolization was typically performed using a 'sandwich' technique, which combines metallic devices (coils) with 2 or 3% aethoxysklerol foam (Figs 3, 4).
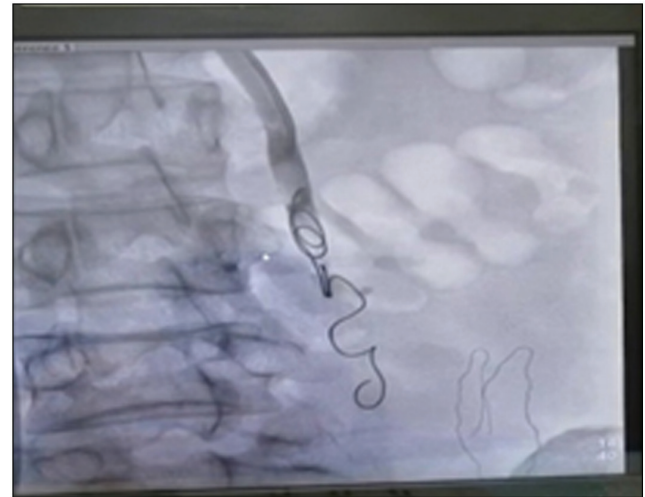
Laparoscopic technique

The procedure was carried out under general anesthesia with right lateral position for handling of the left gonadal (ovarian) vein and left lateral position for handling of the right gonadal vein. The peritoneum of posterior abdominal wall was incised just near and parallel to the inferior mesenteric vein. The inferior mesenteric vein is seen over aortic pulsation medially, the ureter laterally, and the left kidney and the left renal vein above. Endoscopic titanium clips were used for

occlusion of proximal end of the gonadal vein without traction to prevent detachment from the renal vein. Dissection started from above downward for excision of a long segment as possible with cauterization of tributaries of the gonadal vein to prevent recurrence. Precautions were taken to prevent injury of the ureter or the left colic branches (Figs 5–8).

Follow up

All the patients were asked to subjectively assess the level of CPP, postcoital pain, and lower limb pain, using the visual analog score (VAS). The VAS is rated from 0 to 10, where 0 represented 'no pain' and 10 represented 'worst pain possible.' Other clinical symptoms that were assessed included pain on standing, pain on lying down, menstrual pain, and increased urinary frequency. On physical examination, lower limb, vaginal, and

Figure 5

Sites of ports.

Figure 6
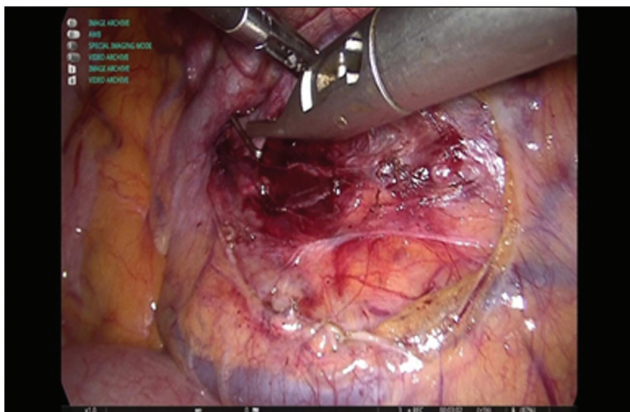
Closure of proximal end of left gonadal vein by titanium clips.

Figure 7

Duplicated ovarian vein.

Figure 8

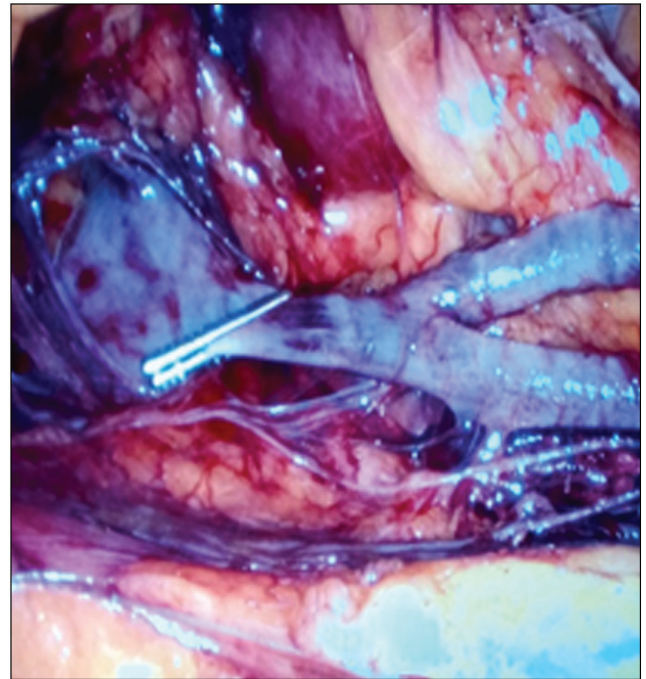
Excised duplicated ovarian vein.

vulvar varicosities were assessed. The VAS assessments were made before intervention and during the follow-up.

Following the intervention, patients were followed up at our hospitals at 1, 3, and 6 months thereafter including clinical evaluation and symptoms assessment; patients were interrogated about pelvic pain, dyspareunia, dysmenorrhea, urinary urgency, vulvar varicosities, and lower limb pain. In the event of persistent pain within 6 months after the procedure, another venous pelvic duplex was carried out to reveal any PVR or other vein abnormalities. Plain chest and abdomen radiograph was planned to exclude any coil migration.

Statistical analysis

Data were collected and coded to facilitate data manipulation and double entered into Microsoft Access, and data analysis was performed using the Statistical Package of Social Science (SPSS) software, version 22 in Windows 7 (SPSS Inc., Chicago, Illinois, USA). Simple descriptive analysis was done in the form of numbers and percentages for qualitative data and arithmetic means as a central tendency measurement and SDs as a measure of dispersion for quantitative parametric data. The P value less than 0.05 was considered as statistical significance.

Results

A total of 40 patients were included in the analysis (20 patients for each procedure). The mean patient age was 33 years in the endovascular group A and 32.3 years in the laparoscopic group B (range, 24–40 years). The mean time of procedure was 39 min with group A and 91.5 min with group B, so there was a significant statistical shorter duration among the endovascular group, with *P* value less than 0.05, as shown in Table 1.

In the endovascular group, there was marked improvement concerning all the preprocedural symptoms of PeVDs with obvious significant statistical difference, as shown in Table 2.

In the laparoscopic group, not all PeVDs showed significant postoperative improvement. Patients with menorrhagia, vulvar varicosities, and urinary or anal symptoms showed no significant statistical difference, with *P* value more than 0.05, as shown in Table 3. Urinary symptoms got worst postlaparoscopically, as shown in Table 4. However, patients with CPP, dyspareunia, and lower limb pain showed significant statistical difference, with *P* values of 0.01, 0.004, and 0.009, respectively, as shown in Table 3.

It was found that the number of patients who improved postoperatively concerning their CPP, lower limb pain, dyspareunia, vulvar varicosities menorrhagia, and urinary symptoms was greater with endovascular procedure than with laparoscopic procedure, as shown in Table 4. Statistical significance was not tested or analyzed concerning the comparison between two groups owing to the limited numbers of the different varieties among the symptoms of PeVD. NB: stationary asymptomatic means the patient was asymptomatic preprocedurally and still asymptomatic postprocedurally.

Table 1 Comparisons of age, duration of procedure, and ovarian diameter in different study groups

Variables	Endovascular (*N*=20)		Laparoscopic (*N*=20)		*P* value	Significance
	Mean	SD	Mean	SD		
Age (years)	33	5	32.3	5.8	0.7	NS
Duration of procedure (min)	39	8.8	91.5	12.8	<0.001	HS
Ovarian diameter (mm)	9.30	1.3	9.65	1.3	0.4	NS

Table 2 Comparisons of preprocedural and postprocedural symptoms in the endovascular group

Variables	Preprocedure [*n* (%)]	Postprocedure [*n* (%)]	*P* value	Significance
Chronic pelvic pain				
No pain	0	9 (45)	<0.001	HS
Mild	3 (15)	10 (50)		
Moderate	9 (45)	1 (5)		
Severe	8 (40)	0		
Dyspareunia				
No pain	0	11 (55)	<0.001	HS
Mild	3 (15)	7 (35)		
Moderate	6 (30)	2 (10)		
Severe	11 (55)	0		
Menorrhagia				
Asymptomatic	6 (30)	14 (70)	0.009	HS
Mild	2 (10)	4 (20)		
Moderate	6 (30)	1 (5)		
Severe	6 (30)	1 (5)		
Lower limb pain				
No pain	0	11 (55)	<0.001	HS
Mild	2 (10)	7 (35)		
Moderate	7 (35)	1 (5)		
Severe	11 (55)	1 (5)		
Vulvar varicosities				
No	4 (20)	13 (65)	0.01	S
Yes	16 (80)	7 (35)		
Urinary or anal symptoms (strangury)				
Asymptomatic	11 (55)	18 (90)	0.01	S
Urinary	8 (40)	2 (10)		
Anal	1 (5)	0		

Table 3 Comparisons of preoperative and postoperative symptoms in the laparoscopic group

Variables	Preoperative [n (%)]	Postoperative [n (%)]	P value	Significance
Chronic pelvic pain				
No pain	0	7 (35)	0.01	S
Mild	0	7 (35)		
Moderate	5 (25)	3 (15)		
Severe	15 (75)	3 (15)		
Dyspareunia				
No pain	1 (5)	6 (30)	0.004	HS
Mild	2 (10)	8 (40)		
Moderate	4 (20)	2 (10)		
Severe	13 (65)	4 (20)		
Menorrhagia				
Asymptomatic	7 (35)	8 (40)	0.06	NS
Mild	0	5 (25)		
Moderate	4 (20)	2 (10)		
Severe	9 (45)	5 (25)		
Lower limb pain				
No pain	1 (5)	6 (30)	0.009	HS
Mild	1 (5)	6 (30)		
Moderate	5 (25)	3 (15)		
Severe	13 (65)	5 (25)		
Vulvar varicosities				
No	7 (35)	8 (40)	0.9	NS
Yes	13 (65)	12 (60)		
Urinary or anal symptoms (strangury)				
Asymptomatic	17 (85)	11 (55)	0.2	NS
Urinary	3 (15)	9 (45)		

Table 4 Comparisons of postoperative symptoms in different study groups

Variables	Endovascular (N=20) [n (%)]	Laparoscopic (N=20) [n (%)]
Chronic pelvic pain		
Improved	19 (95)	14 (70)
Not improved	1 (5)	6 (30)
Stationary asymptomatic	–	–
Dyspareunia		
Improved	18 (90)	13 (65)
Not improved	2 (10)	6 (30)
Stationary asymptomatic	–	1 (5)
Menorrhagia		
Improved	12 (60)	6 (30)
Not improved	2 (10)	7 (35)
Stationary asymptomatic	6 (30)	7 (35)
Lower limb pain		
Improved	18 (90)	11 (55)
Not improved	2 (10)	8 (40)
Stationary asymptomatic	–	1 (5)
Vulvar varicosities		
Improved	9 (45)	1 (5)
Not improved	7 (35)	12 (60)
Stationary asymptomatic	4 (20)	7 (35)
Urinary or anal symptoms (strangury)		
Improved	7 (35)	–
Not improved	2 (10)	9 (45)
Stationary asymptomatic	11 (55)	11 (55)

Regarding complications, there was significant bleeding in one patient in the laparoscopic group owing to detachment of left ovarian vein from left renal vein, which mandated midline exploration to control bleeding and the patient ran a smooth postoperative status; however, there was no improvement concerning her PeVDs. However, with endovascular group, there were no significant complications, as shown in Table 5, especially coil migration, which was assessed by chest and abdomen plain radiograph through 6-month duration.

Follow-up venous duplex of five patients (postlaparoscopic intervention within the same period) revealed para-uterine venous plexus, and pelvi-abdominal ultrasound was also done for these patients to exclude any new gynecological pathology, and then they underwent foam sclerotherapy of the venous plexus.

Discussion

PeVD is characterized by pelvic varicosities and CPP, defined as noncyclic pelvic pain that persists for more than 6 months. Pain and discomfort related to PeVD typically worsen with upright positioning and occur more frequently in multiparous and premenopausal women [13].

Table 5 Comparisons of postoperative complications in different study groups

Complications	Endovascular (N=20) [n (%)]	Laparoscopic (N=20) [n (%)]	P value	Significance
No	20 (100)	19 (95)	0.9	NS
Yes	0	1 (5)		

The underlying cause of this disease is pelvic venous insufficiency, which is indicated by dilation and dysfunction of the ovarian or internal iliac veins with characteristic slow flow and reflux [14].

In England, it was reported that up to 38 of 1000 women annually present in primary care with intermittent or constant pain in the lower abdomen or pelvis [15].

The attractiveness of using the endovascular procedure with coils is explained not only by the pathogenetic effect of this method but also by the associated low injury and high cosmetic effect, the possibility of performing an intervention under local anesthesia, and on an outpatient basis [16].

At the same time, negative aspects of using this approach include the need for implanting intravascular metal devices (that make expensive procedure), radiation exposure to the doctor and patient, risk of migration, or protrusion of coils [17].

The advantage of using a laparoscope with PeVD is exclusion of other causes of PCS such as pelvic inflammatory disease, ovarian cysts, pelvic adhesions, and endometriosis for which laparoscopy is the 'gold standard.' Laparoscopy remains the most trusted technique for the diagnosis of endometriosis and adhesions [18].

In contrast, laparoscopic interventions on the gonadal veins are associated with general anesthesia and significant postoperative pain [19].

Different studies [20–23] addressed the different aspects of PeVDs, namely, lower limb pain, CPP, dyspareunia, dysmenorrhea, vulvar varicosities, and voiding disturbances, which are almost the same aspects addressed in our study.

Sutanto *et al.* [21], detected 970 patients undergoing isolated ovarian vein or mixed veins embolization from 20 studies. Pooled analysis revealed mean improvements on the VAS. Common symptoms such as urinary urgency and dyspareunia reported significant improvements of 78–100% and 60–89.5%, respectively.

However, Abdelsalam [20] reported 100% procedural success rate, where five patients had unilateral left ovarian vein embolization and six had bilateral ovarian vein embolization. Postembolization pelvic pain relief and relief of vulval varices were encountered in seven (70%) of 10 patients by 3 months after the procedure. Improvement of thigh varicosities was reported in four (66.7%) of six patients.

Our study reported significant improvement concerning CPP with endovascular procedure and laparoscopic intervention (95 and 70%, respectively). There was 90% improvement in dyspareunia after endovascular procedure, whereas the improvement after laparoscopic intervention was 65%, but there was a high difference between the two groups concerning urinary symptoms, where they got worst postlaparoscopically, whereas improvement was 35% with endovascular procedure.

A study by Gavrilov *et al.* [12] showed comparative analysis of the efficacy and safety of endovascular and endoscopic interventions on the gonadal veins in the treatment of PCS; this could be correlated to our study, which assessed the laparoscopic and endovascular management of PeVDs, where Gavrilov *et al.* [12] reported that endovascular and endoscopic interventions on the gonadal veins are highly effective and safe in eliminating pathologic blood reflux along the gonadal veins and in the pelvic venous pain relief in PCS. However, it was observed that there was complete elimination of pelvic venous pain at 1 month after intervention in 52 (77.6%) patients (from 67 patients totally) after endovascular procedure and 25 (89.3%) patients (from 28 patients totally) after laparoscopic intervention (P>0.05), which are contradictory to our study, which showed a higher percentage of improvement with endovascular intervention (95%) than laparoscopic intervention (70%).

Gargiulo *et al.* [24] used almost the same inclusion criteria in our study, mainly, age more than 18 years, presence of chronic abdominal or pelvic pain for more than 6 months, more than 6 mm pelvic venous caliber measured by transvaginal ultrasound, and presence of venous reflux or communicating veins by transvaginal Doppler ultrasound. The same criteria were used for exclusion, which were gynecologic or pelvic pathologies such as endometriosis, pelvic inflammatory disease, postoperative adhesions, adenomyosis, or leiomyoma; glomerular filtration rate less than 60 ml/min; history of contrast agent reaction; and patients not able to be followed for at least 1 year.

In our study, the mean patient age was 33 years in the endovascular group and 32.3 years in the laparoscopic group (range, 24–40 years).

This is intimately related to the same age groups in the two studies conducted by *De Gregorio et al.* [25] and Gavrilov *et al.* [12], where the mean age was 43.2 and 32.3 years, respectively.

It was clearly obvious in our series that the mean time was 39 min with endovascular procedure and 91.5 min with laparoscopic intervention, which is similar to Gavrilov *et al.* [12], concerning the endovascular time (32.7 min); however, it was greatly different concerning the laparoscopic time (31.3 min). Longer duration with laparoscopic intervention was explained by the time taken for excision of whole left gonadal vein by pulling the vein from underneath left colic vessels with great caution to avoid their injury, and cauterization of the pelvic leaking veins.

In a study by Gargiulo *et al.* [24], the mean operating time was 110 min (range, 90–140 min) in group A (10 women, the left ovarian vein was reached through the sigmoid and left colon which were mobilized and reflected medially to expose the retro peritoneum) and 89 min (range, 45–140 min) in group B (13 women, the left ovarian vein was reached by incising the posterior peritoneum covering the abdominal aorta 2 cm below the inferior duodenal fold). After the plateau of the learning curve for the procedure was reached, a marked reduction in operating time was observed in group B, with an average duration of 61 min (range, 45–90 min) in the last six women versus 113 min (range, 90–140 min) in the first seven.

This was close to our learning curve time, which was reduced in the last five patients, where the laparoscopic time reached around 60 min.

Regarding PeVDs, in our study, the degree of preoperative symptoms [dyspareunia, menorrhagia, lower limb pain, vulvar varicosities, and urinary or anal symptoms (strangury)] was almost the same concerning both groups, with no significant statistical difference.

In addition, the number of patients who improved postoperatively concerning their CPP, lower limb pain, dyspareunia, vulvar varicosities, menorrhagia, and urinary symptoms was greater with endovascular procedure than with laparoscopic procedure. This could be explained owing to absence of additive foam sclerotherapy in the laparoscopic group, hence the parametrial varicosities still needed sufficient time to get involuted, which could not be shown in the early follow-up.

Regarding the endovascular group, our study stated the number of patients improved postprocedurally from CPP was 19 (95%) patients, nine patients with no pain, 10 patients with mild pelvic pain, only one patient (not improved) with moderate pain and no cases reported with severe pelvic pain. In addition, postprocedurally there were 18 (90%) patients improved from dyspareunia, 11 patients with no pain, seven patients with mild pelvic pain, only two patients (not improved) with moderate pain, and no cases reported with severe pain. On the contrary, postprocedurally there were 12 (60%) patients who improved from menorrhagia and two (10%) patients were still complaining. Regarding lower limb pain, our study reported that postprocedurally, 18 (90%) patients improved. Besides, nine (45%) patients showed disappearance of vulvar varicosities. Concerning urinary or anal symptoms, six (30%) patients got improved with urinary symptoms and only one patient got improved with her anal hemorrhoids.

Gavrilov *et al.* [12] showed CPP relief in 77.6% of patients. Kim *et al.* [26] reported a decrease in CPP in 83%, which is almost the same with the studies by Kwon *et al.* [27] and Bachar *et al.* [28], who showed pelvic pain relief to be 82 and 83.3%, respectively.

CPP relief after endovascular procedure was stated by Laborda *et al.* [29] in 92% of patients and by Edo Prades *et al.* [30] in 61% of patients with PCS.

Sutanto *et al.* [21] detected significant improvements in urinary urgency and dyspareunia of 78–100% and 60–89.5%, respectively.

Guirola *et al.* [31] showed improvement in dyspareunia (83.3%) and urinary urgency (92.8%).

In a study by Abdelsalam [20], postembolization relief of vulval varices was encountered in seven (70%) of 10 patients by 3 months after the procedure, and another study by Castenmiller *et al.* [32] found that coil embolization was successful in eliminating vulval varices in 21 (88%) of 24 patients, whereas Van der Vleuten *et al.* [33] showed significant improvement of hemorrhoids after embolization, with *P* value of 0.047.

Van der Vleuten *et al.* [33] explained this improvement by the fact that hemorrhoids are varicosities of the hemorrhoidal plexus (rectal venous plexus). This plexus communicates with the uterovaginal plexus and drains, via the rectal veins, into the internal pudendal vein and internal iliac vein. After embolization, the varicose vein is closed and no reflux is left. Consequently, reflux in the hemorrhoidal plexus decreases, making the

hemorrhoids diminish or disappear – consistent with the significant improvement in hemorrhoids.

Regarding the laparoscopic group, our study stated that the number of patients improved postoperatively from CPP was 14 (70%) patients, seven patients with no pain, seven patients with mild pain, and six patients with moderate and severe pain (not improved). In addition, postoperatively, there were 13 (65%) patients who improved from dyspareunia. On the contrary, it was obvious in our study that six (30%) patients improved from menorrhagia and seven (35%) patients were still complaining. Our study reported 11 (55%) patients improved from lower limb pain. One (5%) patient showed disappearance of vulvar varicosities, but there were three patients with urinary symptoms that got worse postlaparoscopically. There are fewer studies on laparoscopic intervention including a small number of patients. Gargiulo *et al.* [24] documented a beneficial effect of bilateral endoscopic gonadal vein ligation in 18 (78%) patients.

Rogers *et al.* [34] reported elimination of the PCS in a female patient after laparoscopic ligation of the left gonadal vein.

Regarding complications, in our endovascular procedure study, migrations of coils to the left renal vein and inferior vena cava were not detected in any of our patients. No hematoma was reported at the puncture site. No complications were reported related to hypersensitivity to the dye or extravasation. No patients were reported with postoperative DVT. This was nearly the same as the studies conducted by Abdelsalam [20] and Bachar *et al.* [28], which reported no significant complications in the study group regarding coil migration, contrast extravasation, or puncture site hematoma.

Another study by Gavrilov *et al.* [12] reported 6% of patients with hematoma and 4.5% of patients (three cases) with coil protrusions. Hematoma formation is caused by suboptimal compression after the intervention, whereas the protrusion of coils is related to the peculiarities of the endovascular technique, which includes the use of coils with dimensions exceeding the diameter of the gonadal vein by at least 20%.

Another study by Laborda *et al.* [29] reported groin hematoma in 3% of cases after pelvic vein embolization via femoral access, whereas Kwon *et al.* [27] reported 3% coil migration.

Tu *et al.* [35] described many complications in the literature from the procedure, the most common

of which is vein perforation and extravasation, thrombophlebitis of the treated vein, and hematoma in the puncture site, and this occurs in about 4% of cases in the literature.

The study by Kim *et al.* [26] stated that proximal migration is dangerous, and it was mentioned to occur in 2% of patients treated with the procedure.

In our laparoscopic intervention study, bleeding occurred with one patient owing to detachment of left ovarian vein from left renal vein, so midline exploration was done to control bleeding. The use of laparoscopic intervention required general anesthesia and muscle relaxants, but there were no complications detected in any of our cases. Transperitoneal technique is associated with paralytic ileus and colonic or ureteric injury, which were not reported in our study.

There were no cases of wound complications. The same was encountered by Gargiulo *et al.* [24] and Rogers *et al.* [34] in their studied groups.

Gavrilov *et al.* [12] reported paralytic ileus in two (7.1%) patients after bilateral gonadal vein ligation, which spontaneously resolved at 2–3 days after the procedure. There were no cases of bleeding or infectious wound complication.

Our study has some limitations: first, the limited numbers of the different varieties among the symptoms of PeVD, so significance cannot be obtained concerning the comparison between two groups, and second, we did not test for long-term recurrence of symptoms, which may be done in a later long-term study.

Abd Elkhalek *et al.* [36] had the same limitations; they included only 10 female patients and performed a short-term study.

Gavrilov *et al.* [12] had limitations owing to retrospective, nonrandomized nature and different number of patients in the study groups.

Kwon *et al.* [27] had limitations owing to grading systems for pain both preprocedurally and postprocedurally, which were controversial and necessarily subjective.

Guirola *et al.* [31] had limitations concerning short time of follow-up (6 months to 1 year) in addition to cost calculation.

Regarding follow-up, in our study, patients were followed up at our hospital at 1, 3, and 6 months, which included symptom assessment and clinical evaluation.

All of the patients were asked to subjectively assess the level of CPP, postcoital pain, and lower limb pain, by using the VAS. The VAS is rated from 0 to 10, where 0 represented 'no pain' and 10 represented 'worst pain possible.'

Other clinical symptoms that were assessed included pain on standing, pain on lying down, menstrual pain, and increased urinary frequency. At physical examination, lower limb, vaginal, and vulvar varicosities were assessed. The VAS assessments were made before intervention and during the follow-up.

In the event of persistent pain in the 6 months after the procedure, another venous pelvic duplex was carried out to reveal any PVR or other vein abnormalities. For these patients with recurrent symptoms, exclusion of new gynecological pathology was done by new pelvi-abdominal ultrasound and post-laparoscopic recurrence, foam sclerotherapy of pelvic plexus was done.

Almost the same mean follow-up period was reported with Abd Elkhalek *et al.* [36] *and* Bachar *et al.* [28], where patients were followed up within 3 and 7 months, respectively.

However, the studies by Kwon *et al.* [27] *and* Abdelsalam [20] reported a mean follow-up period of 28.1 and 39.4 months, respectively.

Conclusion
Endovascular and laparoscopic interventions are effective and safe in eliminating pathologic blood reflux along the gonadal veins; however, the laparoscopic intervention cannot improve the urinary symptoms or vulvar varicosities. Moreover, laparoscopy may be beneficial in exclusion of any gynecological pathology, but the endovascular procedure is more effective in all PCSs with satisfactory improvement, shorter duration, and less complication.

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Conflicts of interest
No conflict of interest.

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