Effectiveness of different endovascular treatments in management of chronic pelvic pain in women with pelvic congestion syndrome type I: a 12-month follow-up prospective cohort study

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Purpose
The study was designed to evaluate pelvic pain reduction during a 12-month follow-up period after different gonadal vein embolization modalities in women with pelvic congestion syndrome (PCS). We present our first report of prospective data collection for embolization of incompetent refluxing gonadal veins in women experiencing pelvic pain at Ain Shams University Hospitals with standard methods of venous reporting. In addition, we also evaluated the effectiveness of some embolic agents in treating pelvic venous insufficiency through close follow-up (12 months) using the visual analog scale (VAS).

Patients and methods
Data were collected from November 2019 and April 2021 from 24 female patients with (type I PCS) chronic pelvic pain, who were recruited prospectively from Ain Shams University Hospital. These patients were referred to our Department of Vascular Surgery from the Department of Gynecology. Their mean age was 34.25±4.33 years, and they were candidates for gonadal veins embolization. Inclusion criteria were women in childbearing period who had chronic pelvic pain for more than 6 months with more than 6-mm gonadal vein diameter by ultrasound with presence of venous reflux. Exclusion criteria were pregnancy, local gynecological diseases like endometriosis and fibroid, type II PCS (reflux secondary to obstructive pathology or external compression), postphelpitic iliac veins, or acute or chronic iliac veins thrombosis. Both gonadal veins were targeted for embolization, and pain level was assessed by VAS before and after treating these veins over 12 months. Clinical and technical success and complications were observed. New tools for symptoms, varices, and pathophysiology as well as lower limb clinical, etiology, anatomy, and pathophysiology tools were our venous standard reporting system that turned our sample into a homogenous cohort group.

Results
Clinical success was 100%, with significant improvement of symptoms and reduction in VAS (P<0.001) over the study period.

Conclusion
Gonadal vein embolization is an effective, feasible, and safe method for treating PCS and improves symptoms with a high clinical success rate and high degree of patient satisfaction.

Keywords:
chronic pelvic pain, direct venography, embolization, gonadal veins, pelvic congestion syndrome, pelvic venous insufficiency

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Introduction

Chronic pelvic pain is like a pelvic migraine that affects women in childbearing period and is defined as chronic noncyclic pelvi-abdominal pain of at least 6-month duration. According to Milka Greiner, pelvic congestion syndrome (PCS) is classified according to pathophysiology into three categories: type I: the most frequent etiology is reflux secondary to pelvic veins incompetence; type II: obstructing type due to outflow problem, for example, May-Turner syndrome, Nutcracker syndrome, left renal vein thrombosis, and other diseases; and type III: secondary to local extravenous phenomenon like endometriosis fibroids and posttraumatic lesions [1]. A new tool has been established recently by Meissner *et al.* [2]

for standardization of methods of reporting for cases with pelvic venous insufficiency (PVI). According to Bookwalter *et al.* [3], the criteria for diagnostic criteria that suggest PVI include the following:

Conventional venography showing the following:

(1) Dilated gonadal, uterine, and utero-ovarian arcade veins more than 5-mm in diameter.
(2) Retrograde caudal flow in the gonadal vein (unilateral or bilateral).
(3) Filling of the pelvic veins across the midline via the utero-ovarian arcade.
(4) Opacification of vulvo-vaginal and/or thigh varices.

Transvaginal ultrasound (US):

(1) Multiple dilated para-uterine varices.
(2) Diameter more than 4 mm.
(3) Slow flow less than or equal to 3 cm/s.
(4) Dilated arcuate vein in the myometrium, crossing the midline.

Transabdominal US:

(1) Retrograde flow in a dilated right or left gonadal vein.
(2) Dilated gonadal vein more than 5 mm.

MRI:

(1) Retrograde caudal flow of contrast material at time-resolved MR angiography.
(2) Dilated parauterine varices.
(3) Heterogeneous or T2-hyperintensity owing to slow flow.
(4) Presence of an arcuate vein crossing the midline, vulvar, and/or thigh varices.

Traditional therapy for the treatment of PCS includes both medical and surgical approaches. However, several studies have reported that endovascular minor invasive embolization of gonadal veins for PCS is relatively simple and safe with good therapeutic results [4].

The number of previous studies was relatively small in comparison to both burden of the diseases and number of real cases, and also most effective embolic materials and methods have not been established yet [2].

Some authors describe the presence of lower limb varicose veins secondary to PVI and correlate its recurrence with the pelvic leak points [5–7].

The purpose of our study was to evaluate the effectiveness of gonadal veins embolization using different embolic agents for treatment of chronic pelvic pain with follow-up of cases over a 12-month period.

Patients and methods

Data were prospectively collected from 24 female patients with chronic pelvic pain (reflux PCS type I) from November 2019 till April 2021 for treating their pelvic pain. A valid consent from patients and approval from the ethical committee were obtained. These women underwent high-quality US (transvaginal and transabdominal) and computed tomography (CT) venography as well before they were candidates for gonadal vein embolization.

Inclusion criteria

The following were the inclusion criteria:

(1) Married women in the childbearing period who have chronic pelvic pain for more than 6-month duration.
(2) Gonadal vein diameter by US more than 6-mm caliber with the presence of venous reflux.

Exclusion criteria

The following were the exclusion criteria:

(1) Pregnancy.
(2) Local gynecological diseases like endometriosis and fibroid.
(3) Type II PCS (reflux due to proximal obstruction or due to external compression) detected by severe reflux by duplex even without valsalva and decline in respiratory phasicity in comparison with the other side and double checked by CT venography to exclude any reflux due to obstructive etiology.
(4) Patients with history of previous DVT or even findings detected by venous duplex (acute or chronic DVT) at iliac level.

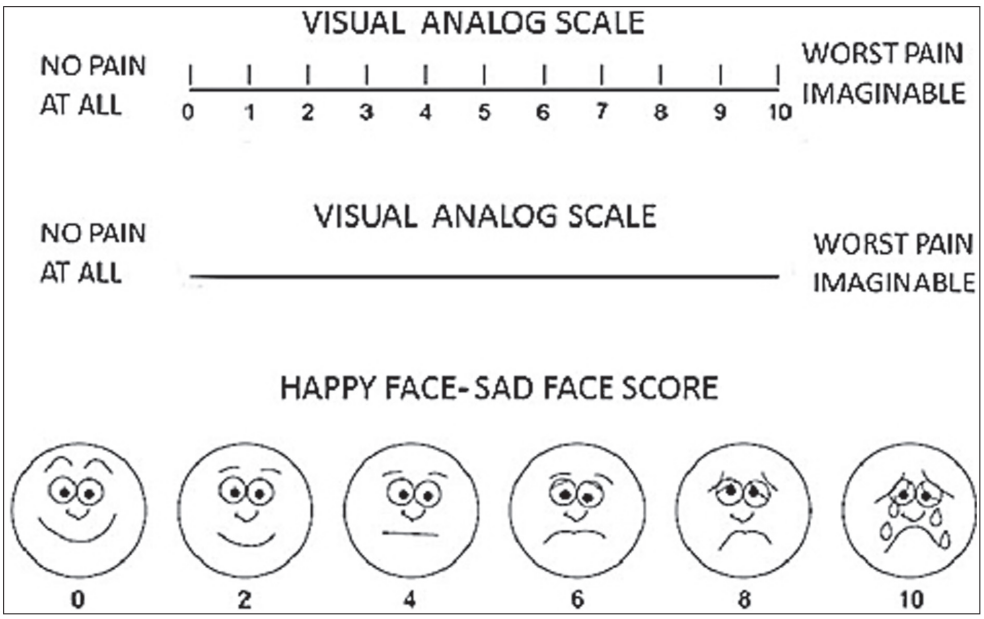
Pain level was assessed by visual analog scale (VAS) (a simple 10-point VAS and categorical VAS). This categorical VAS includes no symptoms group (VAS score 0 and 1), mild group (2, 3, and 4), moderate group (5, 6, and 7), and severe group (8, 9, and 10). The pain levels before and after embolization were subjectively assessed during the study period (0, 1, 3, 6, and 12 months) (Fig. 1). Marked improvement (significant) means decline from severe or moderate VAS down to mild or no group VAS, whereas insignificant improvement means decline of the scale from severe group to moderate group.

Clinical and technical success and complications were observed. New symptoms, varices, and pathophysiology (SVP) and clinical, etiology, anatomy, and pathophysiology (CEAP) tools were used for categorizing these patients and hence helped in standardization of venous reporting (Tables 1–3).

All patients underwent a comprehensive history and physical examination including pelviabdominal and gynecological examination. A simple screening questionnaire for PCS was used to establish which patient will undergo US examination to be included in our study.

Patients also were subjected to high-quality duplex (transabdominal, transperineal, and transvaginal) and CT venography and MRI to exclude obstructive etiology or nonvenous origin of pain. Afterward,

Figure 1



Visual analog scale employed to quantify the patients' pain: preintervention and follow-up postintervention, from a subjective point of view [5].

Table 1 Symptoms-varices-pathophysiology classification scoring sheet [2]

Symptoms (S)		Varices (V)		Anatomy/pathophysiology (P)				
						A	H	E
No pelvic symptoms	0	No pelvic varices	0			IVC	O	T
Renal	1	Renal	1					NT
Pelvic	2	Pelvic	2					C
Extrapelvic	3	Extrapelvic	3		L	RV	O	T
Genital	3_a	Genital	3_a					NT
Leg symptoms	3_b	Leg varices	3_b					C
Venous claudication	3_c				R	GV	O R	T
					L			NT
					B			C
					R	CIV	O R	T
					L			NT
					B			C
					R	IIV	O R	T
					L			NT
					B			C
					R	EIV	O R	T
					L			NT
					B			C
					R	PELV	O R	T
					L			NT
					B			C
S		V		Segment 1, H,E; segment 2,H,E				

Table 2 The 2020 revision of clinical, etiology, anatomy, and pathophysiology: summary of clinical, etiology, anatomy, and pathophysiology classifications

C class	Description
C0	No visible or palpable signs of venous disease
C1	Telangiectasias or reticular veins
C2	Varicose veins
C2r	Recurrent varicose veins
C3	Edema
C4	Changes in skin and subcutaneous tissue secondary to CVD
C4a	Pigmentation or eczema
C4b	Lipodermatosclerosis or atrophie blanche
C4c	Corona phlebectatica
C5	Healed
C6	Active venous ulcer
C6r	Recurrent active venous ulcer
E class	Description
Ep	Primary
Es	Secondary
Esi	Secondary intravenous
Ese	Secondary extravenous
Ec	Congenital
En	No cause identified
P class	Description
Pr	Reflux
Po	Obstruction
Pr,o	Reflux and obstruction
Pn	No pathophysiology identified

Table 3 The 2020 revision of clinical, etiology, anatomy, and pathophysiology: summary of anatomic (A) classification

A class	New	Description
A_s	Tel	Telangiectasia
	Ret	Reticular veins
	GSVa	Great saphenous vein above knee
	GSVb	Great saphenous vein below knee
	SSV	Small saphenous vein
	AASV	Anterior accessory saphenous vein
	NSV	Nonsaphenous vein
A_d	IVC	Inferior vena cava
	CIV	Common iliac vein
	IIV	Internal iliac vein
	EIV	External iliac vein
	PELV	Pelvic veins
	CFV	Common femoral vein
	DFV	Deep femoral vein
	FV	Femoral vein
	POPV	Popliteal vein
	TIBV Crural	(Tibial) vein
	PRV	Peroneal vein
	ATV	Anterior tibial vein
	PTV	Posterior tibial vein
	MUSV	Muscular veins
	GAV	Gastrocnemius vein
	SOV	Soleal vein
A_n	TPV	Thigh perforator vein
	CPV	Calf perforator vein

sonography was also done postoperatively at 0, 1, 3, 6, and 12 months searching for pelvic leaks or recurrence of reflux.

Two mainstay points are crucial in the study: first, the presence of lower limb varicosities may affect pelvic symptoms before and after intervention, and second, these pelvic varicosities may be confined into pelvis only, named as compressed uncompensated, or creeps beyond the pelvis into either genitalia or lower limb, hence named decompressed compensated; thus, patients were strictly categorized and reported using SVP and advanced CEAP tools.

The primary clinical end point of our study was to analyze pain improvement by VAS, which represents chronic pelvic pain and patient satisfaction after gonadal vein embolization, and compare these scores with the VAS scores before embolization. Clinical success (marked or significant) means decline in the VAS scale from severe or moderate group down to mild or no symptom group after embolization, whereas insignificant improvement means decline from severe group down to moderate group or no symptoms improvement.

Our secondary end points for pelvic vein embolization was symptom recurrence and complications related to procedures like pulmonary embolism, contrast reaction, vein perforation or dissection, coil migration, and pelvic pain decompensation during the study period.

Finally, we evaluated the correlation between the initial VAS and subsequently change after embolization during 12 months by applying the marginal homogeneity test studied and t test (P<0.001).

Techniques

All patients were counseled during the procedure and were alert, with no general anesthesia required. Some patients needed conscious light sedation. Patients were asked to evacuate their bladder just prior to venography.

All patients underwent selective venography through US-guided right IJV access using 6 F sheath by local anesthetic infiltration. Patients were also counseled for timing of valsalva or straining to visualize the venous lakes and dye stagnation into deep pelvic veins. Femoral vein access was used in some cases for better visualization of pelvi-abdominal veins.

To catheterize the left gonadal vein, we first accessed the left renal vein using a 4 F hydrophilic Cobra catheter (Terumo). Subsequently, we catheterized the left gonadal vein with a 4 F angiographic Bentson–Hanafee

hydrophilic catheter (Terumo). Catheterization of the right gonadal vein was performed using a 5 F visceral catheter (AngyoDynamics, New York, USA). To access the iliac internal veins, we used a 5 F visceral catheter and then we exchanged it for a 4 F Bentson–Hanafee hydrophilic catheter. After catheterization, DV was performed in all veins by hand injection and Valsalva maneuver using a Bentson–Hanafee 4 F hydrophilic catheter. In all vein segments in which IPV was confirmed, we performed embolization. We used metallic coils (Cook, Indiana, USA), which had a 0.035-in. caliber, 10–20-cm length, and 8–12-cm diameter in some cases. The diameter was selected according to the caliber and morphology of the vein segment. IVC and left renal vein pressure and left CIV pressure were not routinely measured, but obstructive etiology of each veins was carefully considered before and while performing the venography.

Indication of embolization include dilated refluxing gonadal veins, severe congestion of pelvic venous plexus, and significant stasis of contrast material into pelvic veins with crossing arcuate veins. Different embolic agents were used such as NBCA glue used in two (8.3%) cases, metallic coils, and polidocanol 2 and 3% sclerotizing agents whether used alone (by Tessari foaming) in 16 (66.7%) cases or mixture with coils used in six (25%) cases. After embolization, repeated venography was performed to confirm occlusion of targeted veins and concomitant parallel trunk obliteration. Finally, we evaluated the correlation between the initial VAS and subsequently change after embolization throughout 12 months (Figs 2–6).

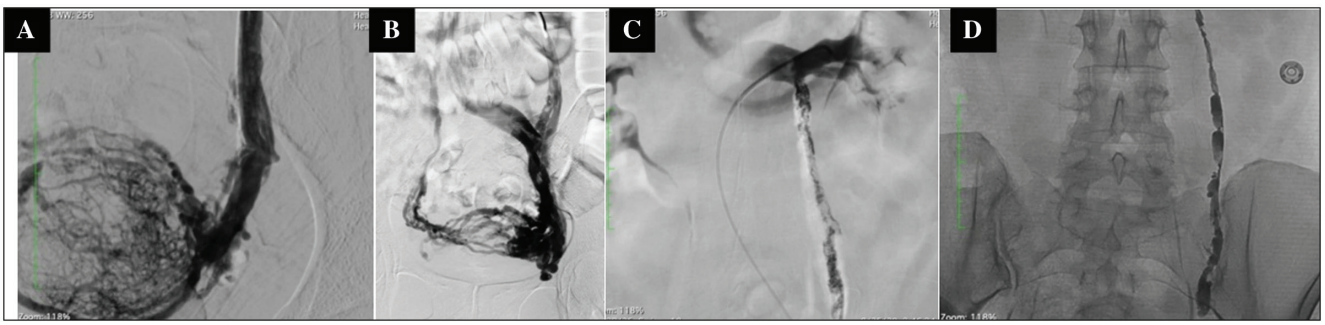
Results

A total of 24 cases were recruited, with a mean±SD age of 34.25 ± 4.33 years (range, 28–42 years). Overall, three patients had only one offspring, and 21 had two or more (Tables 4 and 5).

Gonadal veins were the targeted veins. Pain reduction was correlated after embolization of these veins whether isolated right or left or both with or without pelvic leak point embolization.

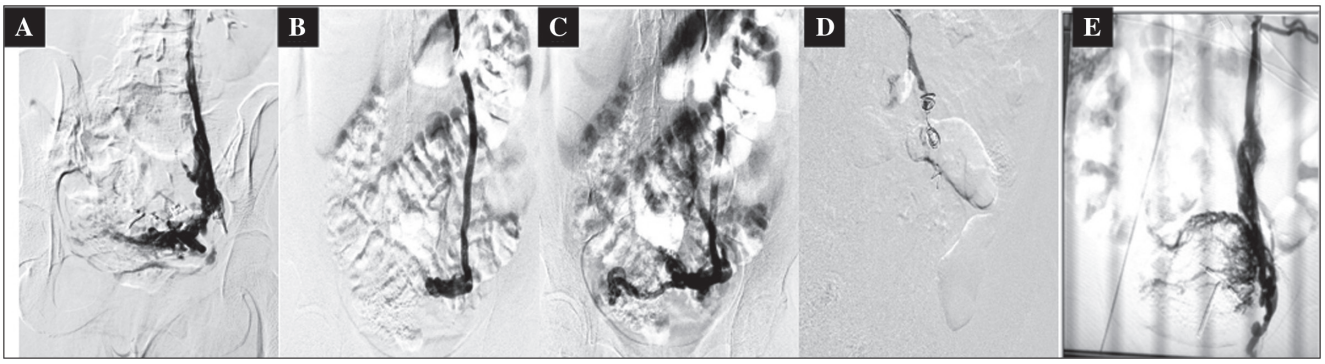
Both gonadal veins were embolized in four (16.7%) cases, isolated left gonadal vein was embolized in 18 (75%) cases, and right gonadal vein was embolized in two (8.3%) cases (Table 6).

Figure 2



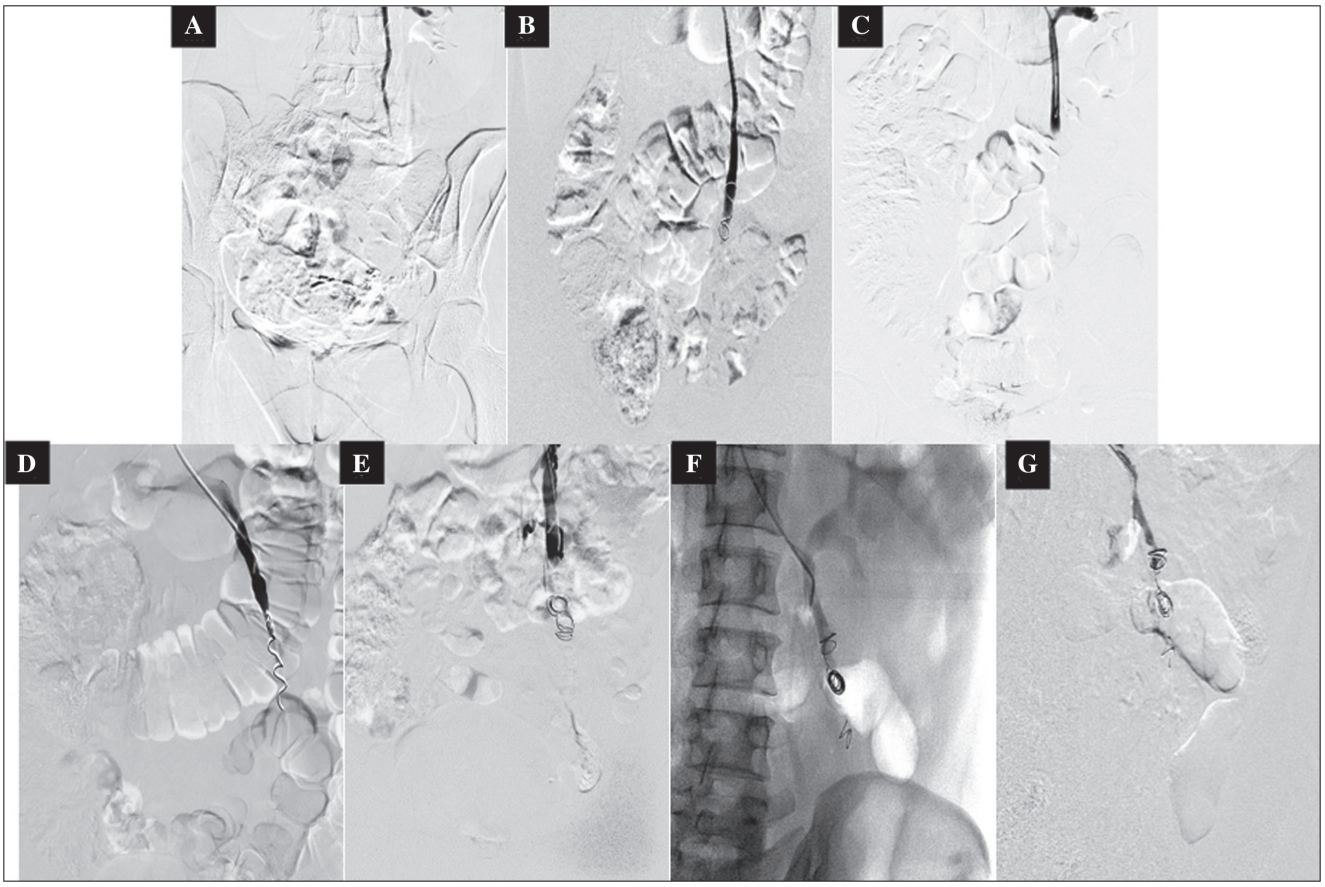
The above shown venography demonstrates dilated left gonadal veins with complete arcauting and siphoning with dilated parauterine veins prior embolization (a, b) and after NBCA injection (c, d).

Figure 3



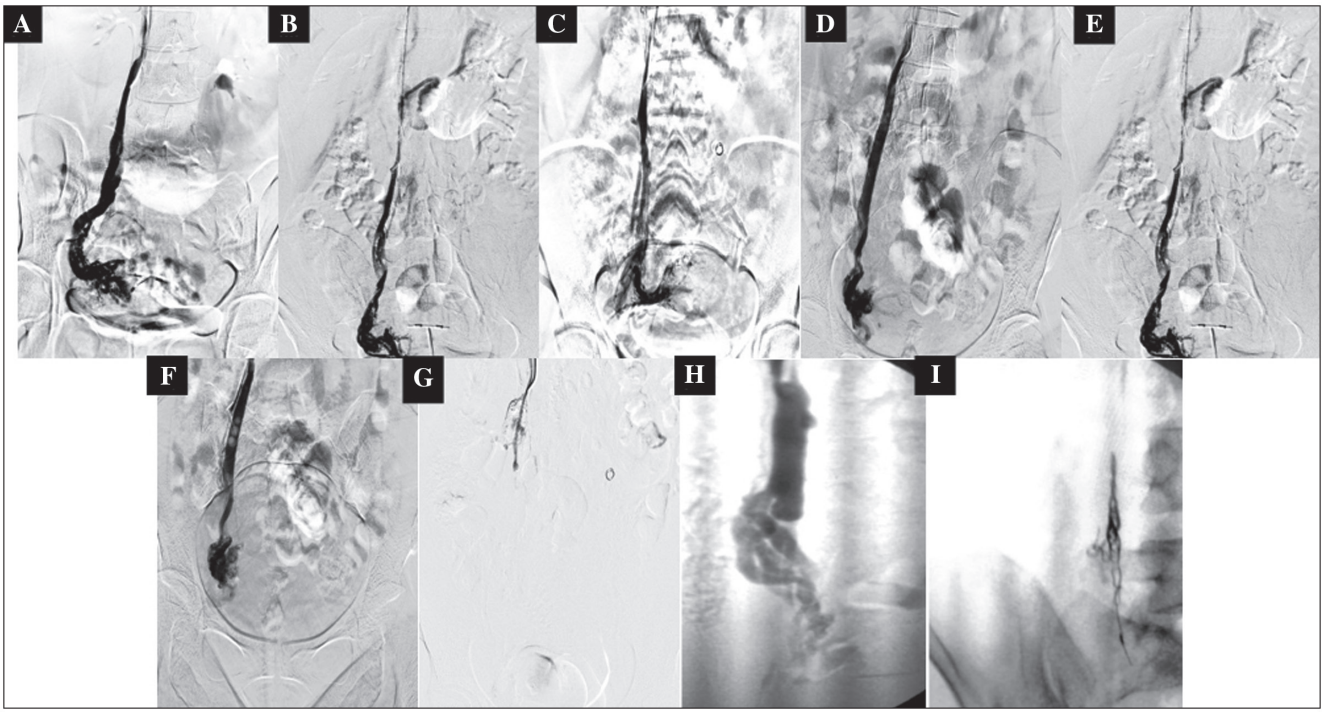
Venograghy in different cases that show left ovarian vein varices with dilated arcuate veins with stagnation of the dye into the pelvis with crossing veins (a), prior coiling (b), right G point (c), postcoiling (d), with parauterine varicosities and left G point (e).

Figure 4



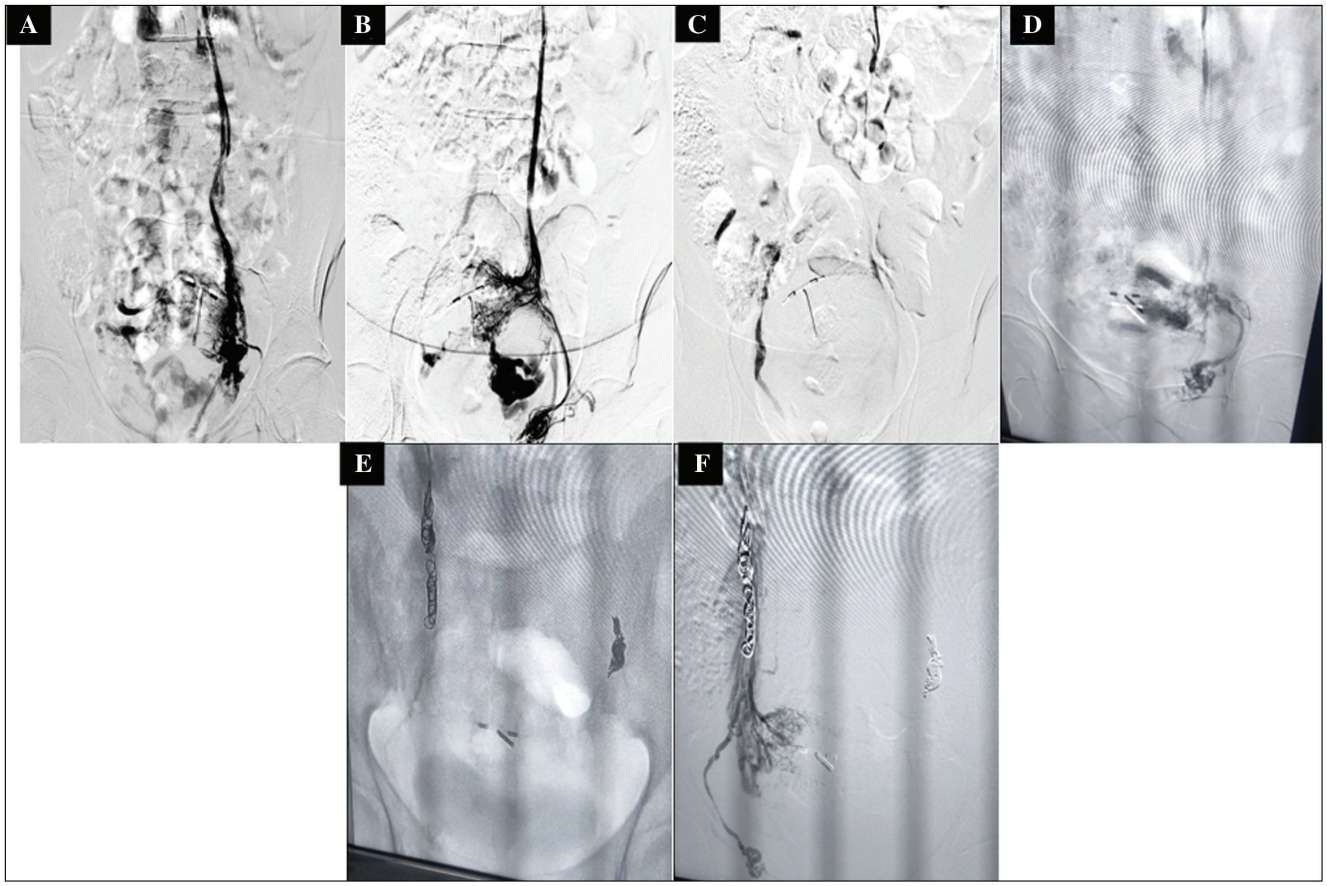
Different venograms show complete obliteration of previously dilated left gonadal vein after being embolized by polidocanol 3% using Tessari method (a, c), coiling (b, d, e, f, g).

Figure 5



Venograms of right ovarian veins prior embolization (a, b, c, d, e, f), with left gonadal vein coil seen packed (c), after complete obliteration (g), dilated right gonadal vein prior coiling (h), and after embolization (i).

Figure 6



Venograms show uterine varicosities with vaginal and bilaterally vulvar escape points (a), pelvic and extrapelvic varices seen with O and G points noticed prior and after embolization (b, c), incomplete obliteration of left GV (d), and bilateral GV coiling by detachable metallic coils (e, f).

Table 4 Demographic data including age for the study group

	Mean±SD	Range
Age	34.25 ± 4.33	28–42

Table 5 Demographic data including parity for the study group

	Offspring	*n* (%)
Parity	1	3 (12.5)
	>1	21 (87.5)

Table 6 Targeted gonadal veins that have been embolized

	n (%)
Target	
LGV	18 (75.0)
RGV	2 (8.3)
BGV	4 (16.7)

BGV, both gonadal vein; LGV, left gonadal vein; RGV, right gonadal vein.

Some of these patients were embolized through their pelvic leak points: gluteal point (G), two (8.3%) cases, one (4.2%) case with obturator point (O), vulvar point in three (12.5%) cases, and four (16.7%) cases were embolized through more than one pelvic leak points (Table 7).

Table 7 Pelvic escape points that have been embolized

	n (%)
Leak points	
No	14 (58.3)
Gluteal	2 (8.3)
Obturator	1 (4.2)
Vulvar	3 (12.5)
More than one	4 (16.7)

Table 8 Gonadal veins diameter (mm)

	Mean±SD	Range
RGV diameter (mm)	5.88 ± 1.73	3–10
LGV diameter (mm)	8.07 ± 1.07	5–10

LGV, left gonadal vein; RGV, right gonadal vein.

The mean diameters of right and left gonadal veins were 5.88 ± 1.73 and 8.07 ± 1.07 mm, respectively (Table 8).

Only foam sclerotherapy without coiling of these veins was embolized through 16 (66.7%) cases, whereas foam sclerotherapy and coiling were used in six (25%) cases and only glue was used in two (8.3%) cases (Table 9).

Table 9 Embolic agents used in the study

	n (%)
Embolic agents	
Polidocanol foam	16 (66.7)
Polidocanol foam and coil	6 (25.0)
NBCA glue	2 (8.3)

Table 10 Complications occurring during the study

	n (%)
Complication	
No	19 (79.2)
PE	1 (4.2)
Vein penetration	2 (8.3)
Recurrence	1 (4.2)
More than one	1 (4.2)

Table 11 Categorical groups of visual analog scale preembolization and postembolization

	Pre [*n* (%)]	Post [*n* (%)]	Marginal homogeneity test		
			Mean MH	*P* value	Significance
VAS					
0	0	4 (16.7)			
1	0	20 (83.3)	43	<0.001	S
2	6 (25.0)	0			
3	18 (75.0)	0			

VAS, visual analog scale.

Initial technical success rates of percutaneous transcatheter embolization were 100%, and occlusion of these veins was confirmed by postembolization venography.

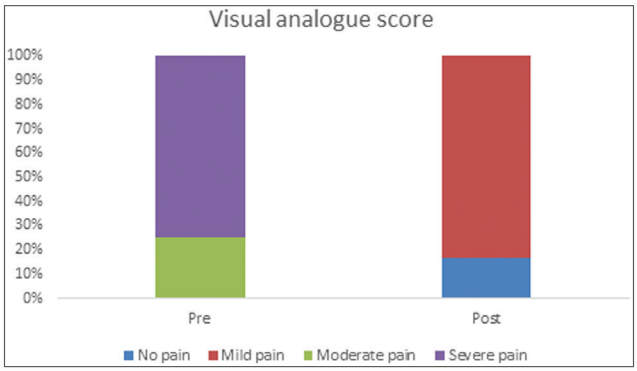
One (4.2%) patient developed minor pulmonary embolism that was self-limiting; two (8.5%) segments of these veins were perforated and dissected. One (4.2%) patient developed recurrence (Table 10).

A total of 23 (95.8%) cases did not receive any re-intervention nor had any recurrence of symptoms throughout the study period.

VAS scores were severe in 18 (75%) cases before embolization and decreased to mild or no pain, whereas six (25%) cases had moderately high VAS and decreased to no or mild pain; these decreases were both clinically and statistically significant (P <0.001) using the marginal homogeneity test. This decrease was the same and fixed during the follow-up period (Table 11) (Fig. 7).

VAS was measured both categorically and numerically for future data processing, and there were marked decreases in numerical VAS postoperatively compared with before embolization using Student t test, with a mean±SD of 8.187 ± 0.844, which turned to 2.25 ± 0.79 (Table 12 and Fig. 8).

Figure 7



Bar chart that shows VAS prior and after embolization (categorical). VAS was measured both categorical and numerical for future data processing and there were marked drop in numerical VAS postoperatively compared to prior embolization using Student t test men was (8.187) and turned (2.25), while SD were (0.844) and turned (0.79) (Table 12 and Fig. 8). VAS, visual analog scale.

Table 12 Categorical groups of visual analog scale preembolization and postembolization (numerical)

	Mean	SD	Paired *t* test		
			t	*P* value	Significance
VAS pre	8.1875	0.84458	24.99	<0.001	S
VAS post	2.2500	0.79400			

VAS, visual analog scale.

Figure 8

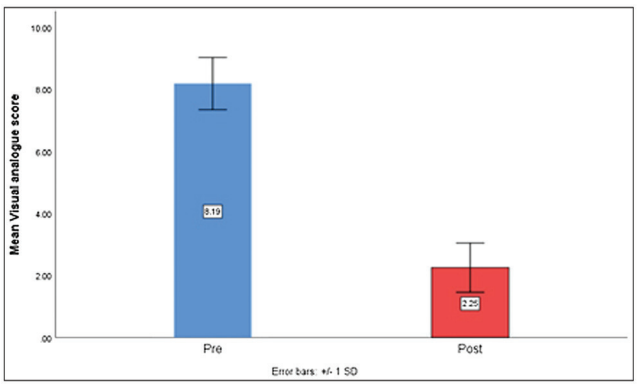


Chart that shows VAS prior and after embolization (numerical). VAS, visual analog scale.

A total of 20 (83.3%) cases complained of lower limb varicosities, whereas five (20.8%) cases were recurrent varicose veins. Moreover, six (25%) cases had extra-axial varicosities, and lastly, six (25%) cases had compensated decompressed pelvic symptoms, whereas three (12.5%) cases had their symptoms uncompensated compressed within the pelvis (Table 13).

Discussion

Chronic pelvic pain significantly improved for those women who underwent gonadal vein embolization

Table 13 Symptoms, varices, pathophysiology and clinical, etiology, anatomy, and pathophysiology of the study group

	n (%)
Chronic pelvic pain of venous origin	
No	0
Yes	24 (100.0)
Localized symptoms with veins of external genitalia	
No	4 (16.7)
Yes	20 (83.3)
Localized symptoms with pelvic origin	
No	4 (16.7)
Yes	20 (83.3)
Pelvic varices	
No	0
Yes	24 (100.0)
Genital varices	
No	4 (16.7)
Yes	20 (83.3)
Lower limb varices	
No	4 (16.7)
Yes	20 (83.3)
Pathology	
Reflux	24 (100.0)
Pathology	
Nonthrombotic	24 (100.0)
C	
No sign	11 (45.8)
Varicose veins	8 (33.3)
Recurrent varicosed veins	5 (20.8)
E	
0	9 (37.5)
1	15 (62.5)
a.s	
No	10 (41.7)
GSVa	6 (25.0)
GSVb	2 (8.3)
NSV	6 (25.0)
a.d	
No	10 (41.7)
Pelvic veins	14 (58.3)
P	
No	10 (41.7)
Reflux	14 (58.3)
Compensated decompressed decompensated uncompressed	
0	15 (62.5)
1	6 (25.0)
2	3 (12.5)

(P<0.001) with little or no major complication as addressed in our study with relatively small number of recurrence within 1 year of follow-up period (4.2%).

SVP tool is a mainstay in categorizing patients during treatment being dynamic and new way of venous reporting standard tool that was recently published but still needs to be refined. It is also a disease-specific tool that measures the outcomes and identifies homogenous patient populations for clinical trial recruitment [2].

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 [4].

De Gregorio and colleagues published a retrospective study conducted from January 2000 to June 2017 in 617 patients diagnosed with pelvic congestion, with a mean age of 43 ± 7.2 years old. It had a large number of patients, who were reviewed through medical records, but there was lack in the homogeneity of the study population as all types of pelvic venous diseases were included, even women with gynecological diseases. This restricts their conclusion that embolization of pelvic veins was safe and effective [8].

Refining of CEAP tool through a recent publication that was brought to light in 2020 helped us in making our sample more homogenous and look alike, taking into consideration females with lower limb-derived pelvic varicosities and extrapelvic varices. A total of 20 (83.3%) patients in our study had both genital and lower limb-derived pelvic varices [9].

The study by Chung and Huh demonstrates a significant decrease in the VAS after ovarian vein embolization (7.8–3.2; P<0.05) with better results than more invasive surgical treatment. It also puts into consideration the psychological status of the patient, but it lacks disease-specific tool in making the sample homogenous and more representative [10].

Daniels and colleagues conducted a systematic review encompassing various terms of pelvic congestion, and 17 bibliographic databases were included. Early relief of pain was observed in ~75% of women undergoing embolization and generally increased over time and was sustained. Significant pain reduction following treatment was observed in all studies that measured pain by VAS, like in our study. There were few data on the effect on menstruation, follicular ovarian reserve, and fertility. Moreover, they concluded that embolization appeared to provide symptomatic relief of CPP in the majority of women and was safe, but the quality of evidence was low [11].

In our observation, the technique used did not include hypogastric vein embolization. However, Laborda and colleagues included in their study hypogastric vein embolization using coils, yet clinical success results by VAS were the same, which questions the value of internal iliac vein embolization for improvement of these symptoms. This was a prospective study that was conducted on a cohort of 202 patients who were followed for a longer period (5 years), but the

patients were recruited as they were complaining of lower limb varicosities without being referred from a Gynecological Department. Moreover, the study focused on both ovarian and hypogastric vein reflux; hence, embolization was done using metallic coils in all cases, and the technical success and clinical success rates were 100%. Moreover, VAS was the subjective symptomatic tool that was used, with a score of 7.34 ± 0.7 preprocedurally versus 0.78 ± 1.2 at the end of follow-up ($P<0.0001$). They concluded that coil embolization for PCS is effective and safe, with very high technical rate and degree of satisfaction [5].

Kwon and colleagues conducted a cohort study reviewing data retrospectively before embolization through medical records. A total of 67 patients with PCS were recruited, and the pain level was assessed before and after embolization. They used coil as the only embolic material without focusing on pelvic leak point injection, and the follow-up period was 12 months. The results showed that 55 cases (82%) experienced pain reduction after coil embolization, and 12 (18%) cases responded that their pain level had not been changed or became more severe at the end. They reported similar results to our study, but this study lacked the leak point reflux theory [4].

In Meneses and colleagues, 10 women were recruited complaining of both PCS symptoms and recurrent lower limb varicose veins. They used both VAS and VCSS as tools of reporting for the 6-month study period. The results showed that 15 vein segments in 10 women were suitable for embolization, and there were significant reduction in both VCSS and VAS ($P<0.01$), with no recurrence detected. This study focused on lower limb varicosities and also included a small sample size, but they reported symptomatic improvement from PCS symptoms, with less risk of lower limb VV recurrence [12].

Edwards *et al.* [13] 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.* [14] reported six 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 six cases, and the benefit was sustained during a follow-up period ranging from 1 to 4 years. Capasso *et al.* [15] 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 (56%) of 19 patients, partial in three (16%), and absent in five (26%). Cordts *et al.* [16] described a study of nine women, eight (89%) of whom 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.* [17] described a series of 41 patients who underwent ovarian vein embolization using a mixture of enbucrilate and lipiodized oil or minicoils.

Kim *et al.* [18] 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 in at 1-year follow-up. Moreover, Kim *et al.* [18] performed secondary internal iliac vein embolotherapy in 108 (85%) of 127 patients 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 end point 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. At last, we did not consider assessment of technical success in this study design, as it is not always immediately detected and needs longer period of follow-up.

Conclusion

Embolization of gonadal veins is considered to be both effective and safe, with high clinical success rate and reduction in the degree of pain score in VAS. A large prevalence study of concurrent pelvic and lower limb varices should be prospectively randomized through prolonged follow-up period for those women who experience PVI.

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Conflicts of interest

There are no conflicts of interest.

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