

# Pelvic veins ultrasound changes after surgical correction in patients with pelvic congestion syndrome

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## Key words:

pelvic congestion syndrome, pelvic venous disorders, ultrasonography, chronic pelvic pain, gonadal veins, ovarian veins, Nutcracker syndrome, May–Thurner syndrome.

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Pelvic congestion syndrome is a form of varicose disease, which is considered to be one of the main causes of chronic pelvic pain in women, which is associated with a violation of pelvic veins hemodynamics.

Pelvic venous disorders are invisible to clinicians due to the lack of pathognomonic symptoms and manual disease criteria, but it has significant consequences.

Today, one of the main diagnostic methods of pelvic venous disorders is a transvaginal US of pelvic veins, including gonadal veins (ovarian veins in women). Thanks to this non-invasive and simple diagnostic method that does not require specific preparation and has no contraindications, we have significant opportunities in diagnosis, as well as in the further evaluation of the postoperative results of surgical correction of pelvic congestion syndrome.

**The aim** of the study was to analyze changes of pelvic veins in patients with pelvic congestion syndrome before and after surgical intervention using the transvaginal US method.

**Materials and methods.** The study included 35 patients which underwent surgical treatment using open surgery and endovascular procedure between April 2019 and February 2022 with pelvic congestion syndrome. All patients underwent transvaginal ultrasound of the pelvic veins before surgery. A control examination was performed after surgical treatment in 4–6 months. The examination was performed on an expert-class ultrasound system “Toshiba Aplio 500” using all international standards for transvaginal examination of pelvic veins to evaluate the changes of iliac, paraovarian, parametrial and ovarian veins from the left side and from the right side in patients with pelvic venous disorders.

**Conclusions.** Transvaginal ultrasound of the pelvic veins can be considered one of the key diagnostic methods, with the help of which it is possible to investigate and evaluate hemodynamic disorders in the veins of the pelvis and pelvic organs in real time. Also, this method can be considered optimal for the control examination of patients who underwent surgical correction of pelvic congestion syndrome.

## Ключові слова:

синдром тазового венозного повнокров'я, варикозне розширення вен таза, ультразвукове дослідження, хронічний тазовий біль, гонадні вени, оваріальні вени, синдром Лускунчика, синдром Мея–Тернера.

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## Динаміка змін при ультразвуковому дослідженні вен таза в пацієнтів після хірургічної корекції синдрому тазового венозного повнокров'я

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Синдром тазового венозного повнокров'я – форма варикозної хвороби, яку вважають однією з основних причин хронічного тазового болю в жінок, що пов'язано з порушенням гемодинаміки вен таза.

Тазові венозні порушення є невидимі для клініцистів патологією через відсутність патогномічних симптомів, мануальних критеріїв захворювання та має складні наслідки.

Нині один з основних методів діагностики цієї патології – трансвагінальне дослідження вен таза, зокрема гонадних вен (оваріальні вени у жінок). Завдяки цьому неінвазивному та доволі простому методу діагностики, що не потребує спеціальної підготовки та не має протипоказань, істотно розширилися можливості діагностики й наступного оцінювання післяопераційних результатів корекції тазового венозного повнокров'я.

**Мета роботи** – оцінити зміни в тазових венах у пацієнтів із синдромом тазового венозного повнокров'я до та після хірургічного лікування за допомогою методу трансвагінального ультразвукового дослідження.

**Матеріали та методи.** У дослідження залучили 35 пацієнок із синдромом тазового венозного повнокров'я, котрі перебували на лікуванні в період з квітня 2019 року до лютого 2022 року. Хворим здійснили хірургічну корекцію відкритим та ендovasкулярним методами. Усім пацієнткам до операції виконали трансвагінальне УЗД вен таза. Контрольне дослідження здійснили після хірургічного лікування через 4–6 місяців. Дослідження виконали на ультразвуковій системі експертного класу «Toshiba Aplio 500» із дотриманням усіх міжнародних стандартів щодо трансвагінального дослідження вен таза для оцінювання стану клубових, параоваріальних, параметральних та оваріальних вен з обох боків.

**Висновки.** Трансвагінальне УЗД вен таза можна вважати одним із ключових методів діагностики, за допомогою якого в режимі реального часу можна дослідити й оцінити гемодинамічні порушення у венах таза й тазових органів. Цей метод можна вважати оптимальним і для контрольного обстеження пацієнтів, котрим здійснили хірургічну корекцію синдрому тазового венозного повнокров'я.

Pelvic congestion syndrome is a form of varicose disease, which is considered to be one of the main causes of chronic pelvic pain in women, which is associated with a violation of pelvic veins hemodynamics.

Pelvic congestion syndrome (PCS) is one of the existing causes of chronic pelvic pain (CPP) in women, which consists of dilation and stasis of the pelvic venous plexus. CPP is defined as a noncyclical pain in the hypogastric, lumbosacral, or perineal area, which lasts 6 months or longer. It is quite an important health problem that causes up to 40% of referrals for gynecology units [1,2].

The common causes of chronic pelvic pain include ovarian varicoceles, endometriosis, pelvic adhesions, atypical menstrual pain, urologic disorders, irritable bowel syndrome, and psychosocial issues. Pelvic varicoceles are found in approximately half of the women with chronic pelvic pain [3].

Currently, the diagnosis of PCS remains a challenge, given that there are not universally accepted criteria for enlarged pelvic venous vessels. In recent years, the Symptoms – Varices – Pathology (SVP) classification has been published for pelvic venous disorders, encompassing three domains: symptoms, varices, and pathophysiology, while also including the anatomy of abdominal and pelvic veins associated with hemodynamic anomalies and etiology. This instrument, once validated, could help to obtain homogeneous study groups with unified diagnostic criteria [4].

In comparison with other techniques, transvaginal ultrasound (US) is an easily accessible, nonionizing, and minimally invasive technique. It allows for the measurement of pelvic veins and blood flow identification in real time [5].

## Aim

The aim of the study was to analyze changes of pelvic veins in patients with pelvic congestion syndrome before and after surgical intervention using the transvaginal US method.

## Materials and methods

The study included 35 patients which underwent surgical treatment using open surgery and endovascular procedure between April 2019 and February 2022 with pelvic congestion syndrome.

Inclusion criteria: female, age 18 years or more, symptomatic pelvic venous disorders, and chronic pelvic pain more than 6 month, indications for surgical correction, no significant comorbidities or contraindications for surgery intervention.

Exclusion criteria: male, age under 18 years, asymptomatic pelvic venous disorders, significant comorbide pathology, active oncopathology, contraindications for surgical intervention.

All patients are women. The mean age of the patients was  $43.5 \pm 9.0$  years (from 27 to 55 years). The body mass index (BMI) was  $20.0 \pm 3.1$ . Pain manifestations before surgery according to the visual analogue scale (VAS) were 5 (from 4 to 8) points. The pain syndrome had the following manifestations: abdominal pain was

in 60 %, lumbar pain was in 18 %, pain in the left upper quadrant – 40 %, pain in the left flank – 25 %, pelvic pain was observed in almost all patients and was 80%, which usually increased after physical activity (Table 1).

To confirm the diagnosis of pelvic congestion syndrome, all patients underwent a standard diagnostic algorithm: multispiral computer tomography (Toshiba Activion TSX-031A), transabdominal ultrasound of the pelvic and retroperitoneal veins (General Electric VIVID 7). All patients underwent transvaginal ultrasound of the pelvic veins before surgery. A control examination was performed after surgical treatment in 4–6 months.

The examination was performed on an expert-class ultrasound system “Toshiba Aplio 500” using all international standards for transvaginal examination of pelvic veins to evaluate the changes of iliac, paraovarian, parametrial and ovarian veins from the left and from the right in patients with pelvic venous disorders.

Patients were placed in the gynecological position right after urinating in order to perform the assessment with an empty bladder, as is usual procedure for gynecological ultrasonography assessment [6].

Pain was subjectively assessed based on a visual analog scale (VAS) before surgical treatment and in 4–6 month after the intervention.

All 35 patients (100 %) underwent surgical treatment: ligation of left ovarian vein using open access in 17 (49 %) cases, endovascular embolization of left ovarian vein combined with sclerotherapy of pelvic veins in 18 (51 %) cases.

## Results

The diagnosis of pelvic congestion syndrome was made on the basis of clinical features and findings on computer tomography angiography. With transvaginal US we examined all patients who underwent surgical treatment and were clinically suspected with diagnosis of pelvic congestion syndrome on the basis of complains and physical examination. All patients had a history of chronic pelvic pain for more than 6 months.

The diagnosis of pelvic congestion syndrome was confirmed in all patients (100 %) during examination with transvaginal ultrasound. Performing transvaginal US, we evaluated such parameters as: the diameter of the iliac veins, the diameter of the veins of the paraovarian plexus, the diameter of the veins of the parametric plexus, as well as the diameter of the ovarian veins. Also, we evaluated flow direction (reflux) of the following veins with color Doppler sonography.

We used diagnostic measurements of pelvic veins which were dilatated and varicose changed more than 5–6 mm in diameter around the ovary and uterus (Table 2).

The diameter of the iliac veins on the right was  $11.3 \pm 1.6$  mm, on the left –  $11.4 \pm 1.6$  mm, the diameter of the paraovarian veins on the right was  $5.9 \pm 1.6$  mm, on the left –  $7.6 \pm 1.6$  mm. The diameter of the parametrial veins was  $5.4 \pm 1.6$  mm on the right,  $7.0 \pm 1.8$  mm on the left. The diameter of the right ovarian vein was  $5.9 \pm 1.6$  mm, the diameter of the left ovarian vein was  $8.4 \pm 1.8$  mm with significant reflux in all cases (100 %). After performing a diagnostic protocol which include CT,

**Table 1.** VAS specification

Parameter	%	VAS(m)	VASmin	VASmax
Abdominal pain	60	5	4	8
Upper left quadrant pain	40	5	0	6
Lumbar pain	18	5	2	8
Pelvic pain	80	5	0	7

**Table 2.** Veins measurements (before surgery)

Parameter	Right, mm	Reflux	Left, mm	Reflux
Iliac veins	11.3 ± 1.6	–	11.4 ± 1.6	+
Paraovarian plexus	5.9 ± 1.6	+	7.6 ± 1.6	+
Parametral plexus	5.4 ± 1.6	+	7.0 ± 1.8	+
Gonadal veins	5.9 ± 1.6	+	8.4 ± 1.8	+

**Table 3.** Veins measurements (after surgery)

Parameter	Right, mm	Reflux	Left, mm	Reflux
Iliac veins	11.1 ± 1.6	–	11.4 ± 1.0	–
Paraovarian plexus	5.2 ± 1.2	–	5.7 ± 1.4	–
Parametral plexus	5.4 ± 1.3	–	4.6 ± 1.8	–
Gonadal veins	5.6 ± 1.0	–	Not visualized	–

**Table 4.** Comparison of vein sizes (before and after surgery)

Parameter	Before intervention		After intervention		p
	Right, mm	Left, mm	Right, mm	Left, mm	
Paraovarian plexus	5.9 ± 1.6	7.6 ± 1.6	5.2 ± 1.2	5.7 ± 1.4	<0.05
Parametral plexus	5.4 ± 1.6	7.0 ± 1.8	5.4 ± 1.3	4.6 ± 1.8	<0.05
Ovarian veins	5.9 ± 1.6	8.4 ± 1.8	5.6 ± 1.0	Not visualized	<0.05

**Table 5.** Comparison of vein sizes in 2 groups (open and endovascular surgery)

Parameter	Open surgery		Endovascular surgery	
	Right, mm	Left, mm	Right, mm	Left, mm
Paraovarian plexus	5.25 ± 1.17	5.75 ± 1.40	5.05 ± 0.86	5.80 ± 0.84
Parametral plexus	5.40 ± 1.03	4.63 ± 1.84	4.94 ± 1.08	4.89 ± 1.20
Gonadal veins	5.68 ± 1.06	Not visualized	6.03 ± 0.91	Not visualized

transabdominal and transvaginal ultrasound, all patients (n = 35) underwent surgery intervention.

49 % (n = 17) patients underwent open surgical treatment in the volume of the ligation of the left ovarian vein combined with sclerotherapy of pelvic veins. We used an oblique-transverse retroperitoneal approach on the left side of the abdomen after which the lower third of ovarian vein was dissected in order to ligate all its inflows to avoid recurrence of the disease. After that we performed ligation of the ovarian vein with 2 ligatures – proximal and distal using a Prolene 5/0. A 3 % – 2 ml solution of ethoxysclerol was injected into the distal end of the vein which was prepared according to the standard method.

51 % (n = 18) of the patients underwent endovascular procedure for correction of pelvic congestive syndrome. We performed the intervention via right common femoral vein under local anesthesia, with using a 5-Fr introducer. Catheterization of the left ovarian vein was accomplished with a 5-Fr Cobra catheter (Terumo Europe). After cath-

eterization of left renal vein retrograde venography was performed using Valsalva's maneuver. We used embolization coils (Tornado type in 11 cases, Nestor type in 7 cases) and installed them at the lower third of the ovarian vein. After performing control venography we injected 3 % – 2 ml solution of ethoxysclerol during Valsalva's maneuver. At the end of the procedure a control venography is necessary.

A follow-up examination of all patients was performed in 4–6 months after the intervention, including CT and transvaginal US of the pelvic veins. The following results were obtained during transvaginal sonography of the pelvic and ovarian veins (Table 3).

The diameter of the right iliac vein was 11.1 ± 1.6 mm, on the left – 11.4 ± 1.0 mm. The diameter of the paraovarian veins on the right was 5.2 ± 1.2 mm; on the left – 5.7 ± 1.4 mm. The diameter of the parametral veins on the right was 5.4 ± 1.3 mm; on the left – 4.6 ± 1.8 mm. The diameter of the right ovarian vein was 5.6 ± 1.0 mm; the left ovarian vein was not visualized due to its obliteration. Reflux through the veins of the pelvis was not defined in all patients after the intervention.

Comparing the size of the veins (paraovarian, parametral, ovarian veins) before and after the surgical intervention, we obtained a statistically significant result, which is shown below (Table 4).

All patients (n = 35) were interviewed according to the VAS in the postoperative period. All patients were given a choice on a scale from 0 to 10 (where 0 – pain was absent, 10 – intolerable pain, which was relieved only by analgesics). VAS was 1 point average (from 0 points to 2 points) in 4–6 months after surgical treatment.

We also compared the results of transvaginal ultrasound in different groups: group 1 – patients who underwent open surgical treatment (ligation of the left ovarian vein), group 2 – endovascular embolization. In both groups, pelvic vein sclerotherapy was performed. It can be noted that in the early postoperative period in patients after open surgical treatment, a higher pain syndrome was observed, which was decreased by small doses of analgesics, which was associated with an external incision of the skin (5–7 cm). Also, one of the advantages of endovascular treatment was local anesthesia (2 % solution of lidocaine), despite the fact that open correction requires general anesthesia with mechanical ventilation, as well as a longer hospitalization at the surgical department. But our study showed that in the long-term follow-up period, there was no difference in the advantages of one or the other method of surgical treatment (Table 5).

## Discussion

The causes of ovarian varicoceles are probably multifactorial, involving both mechanical and hormonal factors. During pregnancy, the vascular capacity of the ovarian veins may increase up to 60 times the normal value and remain this way for months after delivery [7]. Although an association between pelvic congestion syndrome and pelvic varicosities has been known for many years, uncertainty regarding its cause results in different therapeutic approaches, producing variable results. Longterm clinical studies revealed that coil embolization of patients with

pelvic congestion syndrome had provided symptomatic relief in 68–74 % of patients [8,9].

However, the proper diagnosis is often missed because women lie down for a pelvic examination. In this position, the ovarian veins will not fill enough with blood to reveal the vascular changes. It should be remembered that a standard transvaginal US will not reveal vascular changes and is reliable only when duplex Doppler modality is implemented [10].

Also, to confirm the diagnosis of pelvic venous disorders, diagnostic laparoscopy is often used. Laparoscopy is the most used diagnostic technique in women with chronic pelvic pain. This direct visualization is an excellent tool to exclude other pelvic pathologic conditions such as extragenital endometriosis. It is, however, not useful for varicose vein diagnosis because it requires women to lie down for the procedure and involves insufflations of carbon dioxide that conceals pathological vessels and, as a rule, has unsatisfactory results [10]. Based on our experience, we also believe that laparoscopy cannot be considered the golden diagnostic method due to the reasons described above. Also, diagnostic laparoscopy is a serious invasive intervention that can be avoided using the diagnostic algorithm, including CT and transvaginal US.

Transvaginal US may be the preferred first-line test to investigate for other pathologies with a high probability of visualizing the peri-uterine veins [11]. Whiteley M. S. et al. evaluated the use of transvaginal US in the diagnosis of pelvic congestion syndrome and proposed this to be the new gold standard, however this diagnostic imaging modality is limited by the inability to demonstrate the course of the ovarian veins and potential higher obstructions that may include the Nutcracker phenomenon or May–Thurner syndrome [12].

It is also noninvasive, widely available, cost-effective, and lacks the radiation or the use of contrast as compared to other imaging modalities. The greatest benefit of this modality is the dynamic feature where patients are able to change position, as well, as perform the Valsalva maneuver [11].

The current literature is lacking any prospective, randomized controlled trials addressing the optimal imaging diagnostic modality for pelvic congestion syndrome. There are many case reports and small case series that utilize various imaging modalities including ultrasound [11].

More recently, authors suggested that transvaginal US could replace venography as the criterion standard screening imaging method [13,14]. Unlike CT and MRI, ultrasound may be performed in a semiupright position and with provocative maneuvers (Valsalva maneuver) to best simulate anatomic conditions and accentuate venous reflux for visualization [15].

## Conclusions

1. Transvaginal US examination of the pelvic veins is one of the key methods in the diagnosis of pelvic congestion syndrome.

2. Transvaginal US is noninvasive, cost-effective, widely available diagnostic method which can be performed in a semiupright position with provocative

maneuvers and position changes with all benefits of position changes.

3. Transvaginal US of the pelvic veins must be combined with other diagnostic methods such as CT and ultrasound of the retroperitoneal veins to determine the cause of the pelvic varicosities, which allow to plan the correct treatment tactic and surgical intervention.

4. Transvaginal US of the pelvic veins can be considered the optimal method in patients for follow-up examination after surgery intervention in 4–6 months.

5. Transvaginal US in our study in patients after surgical treatment shows a regression of the manifestations of varicose veins, as well as the presence of caudal blood flow through the venous plexuses of the pelvis.

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