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Prevalence and Characteristics of Pelvic Congestion Syndrome in Infertile Women: A Cross-Sectional Study

Batuhan Üstün[1], Bilge Doğan Taymur[2], Emrullah Akay[3], Funda Dağıstanlı[4], Aziz İhsan Tavuz[5]

[1]Tekirdağ Namık Kemal University, Department of Gynaecology and Obstetrics, Tekirdağ, Turkey
[2]University of Health Sciences Turkey, Bursa City Hospital, Clinic of Gynaecology and Obstetrics, Bursa, Turkey
[3]University of Health Sciences Turkey, Başakşehir Çam and Sakura City Hospital, Clinic of Gynaecology and Obstetrics, İstanbul, Turkey
[4]Bolu Abant İzzet Baysal University, Department of Gynaecology and Obstetrics, Bolu, Turkey
[5]Momart IVF Center, İstanbul, Turkey

ABSTRACT

Purpose: Pelvic congestion syndrome (PCS) is a complex condition characterized by chronic pelvic pain (CPP) resulting from engorgement and dilatation of pelvic veins. Although PCS is primarily associated with CPP, recent research suggests a potential link between PCS and fertility problems. The aim of this cross-sectional study was to determine the prevalence of PCS in a large cohort of infertile women, and to identify and analyze associated demographic, clinical and ultrasound characteristics.

Methods: The study included 1,343 women presenting to a single infertility clinic. Participants underwent demographic interviews, gynecological examination, endocrinological workup, and transvaginal examination. Color Doppler identified veins, arteries and flow velocity during the val-salva maneuver. Patients with any ovarian vein with a diameter >5 mm, retrograde ovarian flow, >4 pelvic veins >4 mm diameter, or dilated arcuate veins communicating between bilateral pelvic varicose veins were diagnosed as PCS.

Results: Ultrasonographic evaluation identified a 5% prevalence (n=67) of PCS in this cohort. Women with PCS exhibited significantly lower rates of prior pregnancies (4.5% vs. 21.2%; $p=0.001$) and lower mean total antral follicle count (9.3+/-4.4 vs. 12.9+/-5.8; $p<0.001$) compared to infertile women without PCS. None of the women with PCS had polycystic ovary syndrome (PCOS) (0% vs. 17.3%; $p<0.001$). Symptoms such as CPP ($p<0.001$), hemorrhoids ($p<0.001$), dyspareunia ($p<0.001$), dysmenorrhea ($p<0.001$), lower extremity varices ($p=0.009$ for left; $p<0.001$ for right), vulvar varices ($p=0.002$) and hematuria ($p=0.01$) were significantly more prevalent in PCS group.

Conclusion: This large prospective cohort of 1,343 infertile women revealed a 5% prevalence of PCS using strict sonographic criteria. This finding is clinically significant, suggesting PCS as a previously omitted factor in 1 of 20 infertility cases. The findings found no evidence of PCS co-existence with PCOS and significant differences between groups in terms of frequency of a range of symptoms including CPP, dyspareunia, dysmenorrhea, and varices. These results suggest PCS may have a role in primary infertility and altered ovarian function.

Keywords: Pelvic pain, venous insufficiency, infertility, prevalence, ultrasonography

INTRODUCTION

Pelvic congestion syndrome (PCS) is a complex condition involving chronic pelvic pain (CPP) due to engorgement and dilation of the pelvic veins, particularly the ovarian and internal iliac veins. PCS generally results from valvular insufficiency, which is characterized by the failure of the one-way venous valves. This results in retrograde blood flow and accumulation. PCS may also result from venous obstruction.[1,2] The etiology of PCS is multifactorial, involving a combination of predisposing factors. Hormonal influences, such as elevated estrogen levels, are thought to contribute by weakening the walls of pelvic veins, making them more susceptible to dilation.[3]

Address for Correspondence: Batuhan Üstün, Tekirdağ Namık Kemal University, Department of Gynaecology and Obstetrics, Tekirdağ, Turkey
E-mail: bustun@nku.edu.tr **ORCID ID:** orcid.org/0000-0002-2113-1232
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Genetic predisposition and anatomical abnormalities, such as "nutcracker syndrome" which is the compression of the left renal vein or iliac vein, can also contribute to the development of PCS.[4] The reported prevalence of PCS varies across different populations. CPP is responsible for approximately 10% to 20% of gynecological visits, with its global prevalence estimated to be between 6% and 27%. PCS may account for CPP in up to 30% of women affected by this condition.[5-7]

While PCS is primarily recognized for its association with CPP, emerging research suggests a potential, though not yet fully elucidated, link between PCS and fertility impairment.[8,9] There are a few case series and reports of pregnancies after treatment in the literature that may suggest a possible link between PCS and infertility. However, this issue has not been proven etiologically, nor has causality been demonstrated in appropriately designed studies. Furthermore, there is a scarcity of large-scale studies specifically quantifying the prevalence of PCS within infertile populations and comprehensively characterizing the associated demographic, clinical, and sonographic features in this specific cohort.

The current study was undertaken to address this specific knowledge gap and provide a clearer understanding of the role of PCS in female infertility. The objective of this study was to determine the prevalence of PCS in a large cohort of infertile women presenting to a single infertility clinic and to identify and analyze the associated demographic, clinical, and ultrasound characteristics of these women compared to infertile women without PCS.

Diagnosing PCS can be challenging due to the non-specific and overlapping nature of its symptoms with numerous other gynecological and non-gynecological conditions. A thorough medical history and physical examination are essential initial steps, followed by imaging modalities such as venography as a gold standard.[5] Ultrasonography is a primary non-invasive tool for visualizing pelvic veins and identifying varicosities or abnormalities.[10] In the current study, PCS was diagnosed based on specific ultrasonographic criteria, consistent with established guidelines.[1]

METHODS

Ethics approval had been obtained from Tekirdağ Namık Kemal University Ethics Committee (approval number: 2024.52.03.16, date: 26.03.2024). Between May 2024 and May 2025, all consecutive women presenting to a single infertility clinic for evaluation were screened for eligibility. A total of 1,343 women who met the inclusion criteria and provided informed consent were prospectively enrolled in this prospectively collected cross-sectional study. All assessments were performed by a single in vitro fertilization specialist with more than 25 years of experience in gynecological ultrasonography. All menstruating women aged between 18 and 45 years and diagnosed with primary or secondary infertility were included in the study. The exclusion criteria were: being menopausal; being diagnosed with pelvic inflammatory disease during the examination; having a history of major pelvic surgery, including oophorectomy or deep endometriosis surgery; and being diagnosed with a gynecological malignancy. All women were interviewed for demographic variables, urogynecological and pelvic pain symptomatology. A through gynecological examination and endocrinological work up of patients was followed by transvaginal examination. Presence of any vulvar and lower extremity varices were recorded. A voluson E8 expert system with a 2-10 MHz transvaginal probe was used for gynecological ultrasound examination. If ovarian veins could not be identified during transvaginal examination, transabdominal pelvic ultrasonography using 2-8 MHz curved transducer was conducted with patient in 45 degrees supine position or in left or right lateral decubitus position, especially in obese women. Subsequently color doppler was used to identify the veins, arteries and flow velocity waveforms during the val-salva maneuver. PCS was diagnosed in the presence of one of the following criteria: ovarian vein diameter more than 5 mm; retrograde flow in an ovarian vein; more than four pelvic veins greater than 4 mm in diameter; and/or dilated arcuate veins in the myometrium communicating between bilateral pelvic varicose veins.[1] The normal diameter of pelvic veins was accepted to be less than or equal to 4 mm in diameter. The endometriosis group, one of the gynecologic pathologies investigated for co-existence with PCS in the study, was composed of patients with endometrioma observed by ultrasonography and patients who had undergone surgery and received this diagnosis. The hydrosalpinx group consisted of patients diagnosed by hysterosalpingography and the leiomyoma group consisted of patients diagnosed by ultrasonography. The Rotterdam criteria were used to diagnose polycystic ovarian syndrome (PCOS). Patients were identified as having PCOS if they presented with at least two of the following three features: (1) oligo and/or anovulation; (2) clinical and/or biochemical signs of hyperandrogenism; and (3) polycystic ovaries as seen on ultrasound, characterized by 12 or more follicles measuring 2-9 mm in diameter and/or an ovarian volume exceeding 10 cm^3.[11]

Statistical Analysis

The data collected through the questionnaires and patient files were analyzed using IBM SPSS Statistics, version 25 (IBM Corp., Armonk, NY, USA). The categorical data are presented as numbers and percentages, and continuous variables are presented as mean and standard deviation. Independent samples t-test was used to compare continuous variables between patients with and without PCS. Chi-square test was used to compare categorical variables between the groups with and without PCS. Statistical significance was defined as $p<0.05$.

RESULTS

Among the 1,343 infertile women, 67 (5%) were diagnosed with PCS. The ultrasonographic evaluation of women diagnosed with PCS revealed several characteristic features (Table 1). The most common finding was the presence of >4 pelvic veins with a diameter exceeding 4 mm, observed in 43.3% of PCS cases. Dilation of the left ovarian vein (>5 mm) was present in 34.3% of cases, followed by dilation of the right ovarian vein (>5 mm) in 32.8%. Tortuous veins were noted in 31.3% of the PCS group. Retrograde flow, a key indicator of

venous insufficiency, was identified in the left ovarian vein in 14.9% of cases and in the right ovarian vein in 4.5% of cases.

Analysis of demographic and infertility-related variables (Table 2) revealed several significant distinctions between infertile women with and without PCS. Among the infertile cohort, significantly lower numbers of women were defined as secondary infertile (4.5% vs. 21.2% in controls, $p=0.001$) with a matching significant low gravida number compared to control group (0.07 vs 0.34 in controls, $p=0.007$). A particularly notable finding was the significantly lower mean total antral follicle count (AFC) in the PCS group (9.3) compared to the control group (12.9) ($p<0.001$). No statistically significant differences were observed in age, body mass index, duration of infertility, or follicle stimulating hormone levels between the two groups.

In terms of co-existing gynecological pathologies (Table 3), a significant difference was observed for the prevalence of PCOS, as none of the women with PCS (0%) had been diagnosed with it, whereas 17.3% of the control group had ($p<0.001$). No significant differences were found between PCS and endometriosis, hydrosalpinxes, or leiomyoma concurrence.

Table 1. Ultrasonographic findings of women with pelvic congestion syndrome

Ultrasound findings	Pelvic congestion syndrome (n=67) n, %
Left ovarian vein diameter >5 mm	23 (34.3)
Left ovarian vein retrograde flow	10 (14.9)
Right ovarian vein diameter >5 mm	22 (32.8)
Right ovarian vein retrograde flow	3 (4.5)
Tortious veins	21 (31.3)
>4 pelvic veins more than 4 mm in diameter	29 (43.3)

Table 2. Demographic variables of infertile women with and without pelvic congestion syndrome

	Pelvic congestion syndrome (n=67) n (%)	Controls (n=1276) n (%)	*p*
Secondary infertility	3 (4.5)	270 (21.2)	0.001*
Age (years)	32±5.1	32±5.2	0.9
Body mass index (kg/m²)	24.9±1.7	24.7±3.5	0.8
Infertility time (months)	113±60.3	102±59.3	0.1
Gravida	0.07±0.36	0.34±0.8	0.007
Follicle stimulating hormone	6.9±2.5	7.3±2.8	0.2
Total antral follicle count	9.3±4.4	12.9±5.8	<0.001**

*Chi-square test
**Independent samples t-test

Table 3. Gynecological pathologies in women with and without pelvic congestion syndrome

	Pelvic congestion syndrome (n=67) n (%)	Controls (n=1276) n (%)	*p*
Endometriosis	4 (6)	133 (10.4)	0.24
Hydrosalpinxes	4 (6)	70 (5.4)	0.8
Leiomyoma	10 (14.9)	211 (16.7)	0.7
Polycystic ovary syndrome	0	221 (17.3)	<0.001*

*Fisher's exact test

Table 4. Clinical symptoms in cases with respect to pelvic congestion syndrome

	Pelvic congestion syndrome (n=67) n (%)	Controls (n=1276) n (%)	*p*
Chronic pelvic pain	11(16.4)	39 (3.1)	<0.001*
Hemorrhoids	12 (17.9)	10 (0.8)	<0.001*
Dyspareunia	10 (14.9)	39 (3.1)	<0.001*
Dysmenorrhea	14 (20.9)	72 (5.6)	<0.001*
Menorrhagia	2 (3)	25 (2)	0.56
Left Lower extremity varices	6 (9)	39 (3.1)	0.009*
Right lower extremity varices	8 (11.9)	39 (3.1)	<0.001*
Vulvar varices	2 (3)	-	0.002**
Hematuria	2 (3)	2 (0.2)	0.01**

*Chi square, **Fisher's exact test

Finally, the analysis of clinical symptoms (Table 4) demonstrated significant differences between PCS and control group regarding a range of classical symptoms. CPP was reported by 16.4% of women with PCS, compared to only 3.1% in the control group ($p<0.001$). Dyspareunia (14.9% vs. 3.1%, $p<0.001$) and dysmenorrhea (20.9% vs. 5.6%, $p<0.001$) were also significantly more prevalent in the PCS group. Excluding symptoms of pain, hemorrhoids (17.9% vs. 0.8%, $p<0.001$), left lower extremity varices (9% vs. 3.1%, $p=0.009$), right lower extremity varices (11.9% vs. 3.1%, $p<0.001$), vulvar varices (3% vs. 0%, $p=0.002$) and hematuria (3% vs. 0.2%, $p=0.01$) symptoms were significantly more common in the PCS group. Menorrhagia was not found to be significantly more common in women with PCS compared to those without PCS in this cohort.

DISCUSSION

This large cross-sectional study of 1,343 infertile women found a 5% prevalence of PCS using strict sonographic criteria. This finding is clinically significant, suggesting PCS may be a previously underrecognized factor in as much as 1 in 20 of female infertility cases. Previous studies have shown that the overall prevalence of PCS in the general female population ranges from 6% to 27%. Among cohorts with CPP, PCS accounts for 15% to 30% of cases. The 5% prevalence observed in this study, which involved an infertile population, is at the lower end of this spectrum, and significantly lower than that of cohorts specifically selected for CPP. The reason for this difference may be that the studies conducted to determine the prevalence of PCS in the literature are calculated by retrospectively examining pelvic computerized tomographs and magnetic resonance images taken for different reasons, unlike the methodology used in this study. Infertile patients are expected to have fewer pregnancies on average compared to the general population, which supports the augmenting effect of having a pregnancy in the etiology of PCS.[12] In addition, the average age of the infertile patient group is lower than the average age at which PCS is first diagnosed in the general population, which is at 36 years old. This may also explain the lower prevalence.[13]

An unexpected finding was that women with PCS in this study had a significantly lower number of prior births (Table 2). This observation stands in contrast to the established understanding that PCS primarily affects multiparous women and often develops or worsens with subsequent pregnancies due to increased intravascular volume and venous distension.[6,12,14] This apparent contradiction suggests a potential selection bias in an infertility clinic setting. Women presenting for infertility treatment may have primary infertility or secondary infertility due to reasons other than PCS. The data implies that PCS, when identified in an infertile population, might be linked to mechanisms of primary infertility rather than being solely a consequence of multiple pregnancies. This finding challenges the traditional view of PCS as exclusively a "multiparous woman's disease" and encourages future research for investigating its role in primary infertility, potentially through direct impact on ovarian function or anatomical integrity from an early stage, independent of the physiological stresses of prior pregnancies.[9]

Another significant finding was the lower mean total AFC in the PCS group (Table 2). AFC is a widely accepted marker of ovarian reserve, and a lower count indicates diminished ovarian reserve, a crucial factor in female infertility.[15] The significantly lower AFC in women with PCS suggests a direct, fundamental impact of the condition on ovarian health and function, rather than solely mechanical or flow-related issues with fallopian tubes or the uterus.[16] The venous congestion, altered hemodynamics, and increased pressure in the pelvic veins associated with PCS could potentially compromise the microcirculation to the ovaries.[17] This could lead to chronic hypoxia, impaired nutrient delivery, or the accumulation of metabolic waste products within the ovarian microenvironment.[18] Such adverse conditions might accelerate follicular atresia or impair follicular development, thereby reducing the functional ovarian reserve.[19] This finding proposes a novel mechanism by which PCS could contribute to infertility, particularly primary infertility, warranting further mechanistic studies into the ovarian microenvironment in the presence of venous congestion.

None of the patients with PCS in the study cohort had PCOS, although the rate in the infertile women was around 17%. PCOS is a common endocrine disorder and a leading cause of anovulatory infertility.[20] PCS, in contrast, is primarily a vascular disorder. The observation that these two common causes of infertility appear to be mutually exclusive in this cohort suggests that the underlying pathophysiological mechanisms or predisposing factors for PCS and PCOS may be distinct. However, some other published studies report that the ovaries of PCS patients have a predominantly polycystic appearance due to venous congestion.[21-23] Although these studies do not place the appearance in a definitive category as polycystic ovary syndrome, it is clear that studies targeting this should be designed to clarify whether a morphologically similar antral follicle distribution pattern is causally related to pelvic congestion. In addition, PCOS, by its mechanism, creates a hyperandrogenenic microenvironment, whereas the mechanism of PCS is through the effect of the estrogenic microenvironment on the vessels.[24] Therefore, whether having PCOS is preventive for PCS is a separate research topic although the findings of this study support this hypothesis.

The absence of significant differences between PCS and our control group regarding the other gynecological pathologies, such as endometriosis, hydrosalpinxes, or leiomyoma, further indicates that PCS operates independently of these common gynecological conditions in this particular cohort.

The study strongly reinforces the well-documented clinical presentation of PCS by demonstrating significant differences between PCS and the control group in terms of a range of classic symptoms. These include CPP, dyspareunia, and dysmenorrhea, which are consistent with the established literature on PCS.[1,5,6]

Higher prevalence of hemorrhoids and lower extremity varices reinforces the understanding that PCS is often part of a broader

systemic venous insufficiency.[8] Increased pelvic venous pressure can affect other venous drainage systems, leading to varicose veins in the legs, vulva, and perianal region.[25,26] The significant presence of vulvar varices and both left and right lower extremity varices further supports this systemic venous component.[27,28]

An interesting and potentially novel symptom concurrence identified was with hematuria, present in 3% of PCS cases compared to 0.2% in controls. This finding suggests potential involvement of peri-vesical venous plexuses in PCS, where venous congestion around the bladder could lead to microscopic or macroscopic blood in the urine.[29,30]

The observed strong concurrences between PCS and these specific symptoms mean that these indicators, even if not the primary reason for seeking fertility treatment, should serve as important "red flags" for fertility specialists. In an infertility clinic, patients might not primarily complain of pain, or their pain might be dismissed as secondary to other infertility causes. Therefore, a comprehensive symptom history, specifically inquiring about these associated symptoms, should be mandatory during the initial workup of infertile women. This approach could lead to earlier suspicion and targeted diagnostic evaluation for PCS, uncovering an otherwise overlooked cause of infertility and guiding appropriate management.

The study's findings provide empirical support for the hypothetical links between PCS and impaired fertility. The significantly lower AFC in the PCS group strongly supports the hypothesis of direct ovulatory dysfunction or diminished ovarian reserve due to chronic venous congestion. Furthermore, the lower gravida and secondary infertility rates observed in this study suggest that PCS might be contributing to primary infertility, potentially through these direct ovarian effects, rather than being a consequence of multiple pregnancies. While this study is cross-sectional and cannot establish causality, its data reinforces the probability of PCS affecting fertility through mechanisms impacting ovarian function, fallopian tube integrity, and uterine receptivity.

This study reiterates the importance of increased awareness among fertility specialists regarding PCS as a potential contributing factor to female infertility. The findings suggest systematic screening, particularly with ultrasonography, for PCS in infertile women. This is especially relevant for those presenting with unexplained infertility, lower AFC, or any of the significantly associated symptoms identified in this study, such as CPP, dyspareunia, dysmenorrhea, hemorrhoids or external varices.

Addressing PCS through medical management or minimally invasive procedures, like pelvic vein embolization may not only alleviate pain but also potentially improve fertility outcomes. While existing studies on fertility improvement post-embolization are limited, they offer encouraging results.

The current study possesses several notable strengths. Its substantial sample size of 1,343 infertile women provides important statistical power for identifying associations and lends credibility to the observed prevalence and characteristic profiles. The prospective nature of the study and the use of a single, highly experienced in vitro fertilization specialist for all ultrasonographic examinations significantly reduced inter-observer variability, thereby enhancing the consistency and reliability of the diagnostic data. Furthermore, the thorough collection of demographic variables, urogynecological and pelvic pain symptomatology, and detailed ultrasound findings allowed for a comprehensive characterization of the study participants.

Despite its strengths, the study has inherent limitations. As a cross-sectional observational study, it can establish associations and prevalence but cannot definitively determine causality. The study cannot conclude that PCS causes infertility or the observed demographic or symptomatic differences; it only shows co-occurrence at a single point in time. The single-center design, conducted at one infertility clinic, may limit the generalizability of the findings to other populations or healthcare settings, as patient demographics, referral patterns, and diagnostic practices can vary between centers. In addition, as the study cohort was pre-selected for infertility, the findings may not be representative of PCS prevalence or characteristics in the general female population or in women with PCS who do not present with infertility.

Ultrasonography, particularly in a supine position, may not always fully capture the complete extent of pelvic varicosities, which can be more evident with upright positioning or more advanced imaging techniques, such as venography, computed tomography or magnetic resonance imaging. However, the study's inclusion of the val-salva maneuver and positional changes during examination eliminates some of these limitations. Finally, our study design does not include follow-up data on fertility outcomes after PCS diagnosis or potential treatment, which prevents conclusions about the impact of PCS management on reproductive success.

Based on the findings of this study, several suggestions can be made for future research. Prospective longitudinal studies will be important to investigate a causal relationship between PCS and infertility, tracking fertility outcomes over time in women diagnosed with PCS. Randomized controlled trials are needed to evaluate the efficacy of PCS treatments, such as embolization, specifically on fertility outcomes. Further research should be conducted to understand the ways PCS might affect ovarian reserve, potentially through studies on ovarian microcirculation or hormonal regulation in PCS patients, and to explore the reasons behind the observed negative association with PCOS. Larger multicenter studies are also encouraged to validate the prevalence and associated features of PCS in diverse infertile populations, improving generalizability. Finally, the development and validation of standardized diagnostic protocols for PCS within infertile groups would be highly beneficial.

CONCLUSION

This study identified a 5% prevalence of PCS in infertile women and its key features, which included dilated pelvic and ovarian veins, fewer prior pregnancies, and diminished ovarian reserve shown by lower AFC. The findings revealed a negative co-existence with PCOS and significant differences between groups in terms of symptoms including CPP, dyspareunia,

dysmenorrhea, and varices. These results suggest PCS may have a role in primary infertility and altered ovarian function. The study highlights the importance for reproductive medicine practitioners to consider PCS during infertility workups and the value of diagnostic efforts towards PCS to reveal treatable infertility causes and improve reproductive outcomes.

Ethics

Ethics Committee Approval: Ethics approval had been obtained from Tekirdag Namik Kemal University Ethics Committee (approval number: 2024.52.03.16, date: 26.03.2024).

Informed Consent: Informed consent was obtained from all participants.

Authorship Contributions

Surgical and Medical Practices: E.A., Concept: B.Ü., B.D.T., A.İ.T., Design: B.Ü., B.D.T., F.D., Data Collection or Processing: E.A., F.D., A.İ.T., Analysis or Interpretation: B.Ü., B.D.T., A.İ.T., Literature Search: B.Ü., E.A., F.D., Writing: B.Ü.

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