# Role of CT Venography of Abdomen and Pelvis for Assessment of Females with Pelvic Congestion Syndrome.

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# Abstract

Background: Pelvic congestion syndrome (PCS) is one of the causes of persistent pelvic discomfort in females. It is believed to be caused by ovarian or pelvic vein venous insufficiency. Along with these and other symptoms, patients also exhibit vulva, gluteal, lower limb varicosities, dysuria, and dyspareunia. CT and MRI venography play a cornerstone role in diagnosis and even selection of an appropriate plan of management for the cases with PCS. In this study, we evaluate the role of computed tomography (CT) venography of abdomen and pelvis for evaluation of causes of pelvic venous insufficiency. Aim: To assess role of CT venography of abdomen and pelvis in diagnosis of pelvic congestion syndrome. Patients and Methods: cross sectional observational study was conducted at SCU hospitals, Ismailia city, Egypt. 50 Female Patients diagnosed with pelvic congestion syndrome. CT venography of abdomen and pelvis scans image readings was obtained to assess parametrial, pelvic and vulvuoperineal varicosity, gonadal vein dilatation and reflux, round ligament varicosity and vascular compression syndromes. Results: Chronic pelvic pain and Vaginal discharge and were the commonest symptoms (64% and 40% respectively). About half of participants 22 (44%) had secondary causes of pelvic congestion syndrome and 28 (56%) patients was diagnosed as nonobstructing primary pelvic congestion syndrome. Conclusion: CT venography of abdomen and pelvis is an initial investigation for female patients with pelvic congestion syndrome.

Keywords: Pelvic congestion syndrome, CT venography, chronic pelvic pain.

# Introduction

Chronic pelvic pain is defined as persistent pelvic discomfort lasting for at least six months without relief from medical treatment. Endometriosis is considered one of the most frequent causes. Among the more difficult-to-diagnose causes of chronic pelvic pain is female pelvic congestion syndrome (PCS) <sup>(1)</sup>. Pelvic congestion syndrome (PCS), which results from dysfunctional ovarian vein valves, is referred to as pelvic venous insufficiency <sup>(2)</sup>. Other structural factors contributing to pelvic

venous insufficiency include conditions such as posterior left renal vein, compression of the left renal vein (nutcracker syndrome), May-Turner syndrome, vascular malformations, inferior vena cava (IVC) obstruction or compression, or portal hypertension <sup>(3)</sup>. The gonadal veins empty into the inferior vena cava on the right and the left renal vein on the left. External compression of the IVC, left renal vein, or iliac veins may lead to pelvic venous hypertension, resulting in pelvic congestion, pelvic and inguinal varices and lower limb varicosities<sup>(4)</sup>. The primary imaging diagnostic method of pelvic venous insufficiency (PVI) is typically suggested through duplex ultrasound (US), but this imaging method has its limitations. It is an operator dependent method, does not easily visualize the gonadal veins and has limited sensitivity when it comes to detecting the structural causes of pelvic congestion syndrome <sup>(5)</sup>, Transvaginal ultrasound (TVUS) has various drawbacks in diagnosing pelvic congestion syndrome. It can cause discomfort, relies on the skill of the operator, cannot detect vascular abnormalities that typically lead to pelvic varices, and is not suitable for use with virgin females<sup>(6)</sup>.

Invasive venography is considered the gold standard for diagnosing and managing PCS. However, non-invasive techniques such as CT and MRI venography are crucial in diagnosing PCS and determining the appropriate management plan. The choice of treatment plan is based on radiological results, the extent of the condition, and the root causes of pelvic congestion syndrome <sup>(7)</sup>. The study aimed to assess the role of CT venography of abdomen and pelvis in evaluation of females with pelvic congestion syndrome.

#### **Patients and Methods**

A cross-sectional observational study was conducted at CT unit- Radiology department of Faculty of Medicine at Suez Canal University Hospital in Ismailia, Egypt. Patients with diagnosis of pelvic congestion syndrome who referred to CT unit at Radiology department of Suez Canal University Hospital from gynecology and obstetrics department as per the inclusion and exclusion criteria outlined below. Female patients who complain of pelvic

congestion syndrome were included.

#### **Exclusion criteria:**

- Patients with persistent pelvic pain of another diagnosis other than PCS.
- Patients with pelvic venous thrombosis.
- Patients with iliofemoral DVT.
- Patients with history of hysterectomy and oophorectomy.
- Patients with health concerns related to contrast media.

#### **Study Procedure:**

Fifty participants who fulfilled the study criteria were assessed as follows:

Baseline clinical and demographic data ;Patient history including age, parental history and symptoms (Chronic pelvic pain, vaginal discharge, dysmenorrhea, dysuria), Verbal consent were considered including procedure description and benefits. Serum creatinine level were assessed for all patients. **Imaging procedure** 

Contrast-enhanced CT was performed to all cases using 16 slice scanner, Activion 16 model TSX-031A-2012 (Toshiba Medical Systems).The parameters of the volume CT scanning was as follows: tube voltage = 120 kV; tube current = 200–250 mAs; slice thickness = 5 mm; and the scan matrix is 512 × 512 matrices. Both plain CT scans and contrast enhanced CT scans were performed for all patients. Via a power injector, 100 mL of Omnipaque 300 mg l/ml, inject intravenous (IV) at a rate of 4 mL/s as the contrast agent. A workstation was used for the post-processing of the images.

#### **Imagine analysis**

Two experienced radiologists examined the images. Arterial phase images were utilized to evaluate potential reflux into the gonadal veins. The examination of the ovarian veins involved measuring their diameters and determining their drainage location and excluding vascular compression syndromes.

#### Statistical analysis

The data were entered into a computer and analyzed using IBM SPSS software package version 20.0 (Armonk, NY: IBM Corp). Qualitative data were presented using frequencies and percentages. The Kolmogorov-Smirnov test was applied to assess the normality of the data distribution. Quantitative data were described using the range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The significance of the results was determined at the 5% level.

The statistical tests used were Chi-square test for categorical variables, to compare differences between groups. Fisher's Exact or Monte Carlo correction was Applied to adjust the chi-square test when more than 20% of the cells have an expected count of less than 5. Student's ttest was used for normally distributed quantitative variables to compare between two groups.

#### Results

The mean age of the studied sample is  $(36.48 \pm 8.77 \text{ years})$ , ranged from 16 to 55 years. The mean body mass index (BMI) of the studied sample is  $(27.03 \pm 3.48 \text{ Kg/m}^2)$ , ranged from  $20.9 - 35.20 (\text{Kg/m}^2)$ . (Table 1). About two thirds of the patients had chronic pelvic pain, 40% complaint of vaginal discharge and 30% of them had dysmenorrhea. One patient had history of vaginal bleeding and hematuria (Table 2).

CT venography revealed that 28 (56 %) of cases had primary non obstructing pelvic congestion syndrome, while 22 (44%) of cases had other diagnoses causing secondary pelvic congestion by CT study. 21 (42%) had CT features of vascular compression syndromes, (26%) had nutcracker syndrome, (6%) had May-Thurner syndrome and (10%) had combined multiple vascular compression syndromes and one patient was proved to have refluxive internal pudendal vein. (Table 3).

There is statistically significant difference in CT findings with regard to age and body mass index of the studied sample, it was found significant higher percentage of vascular compression syndromes in participants with younger age and lower body mass index with p value (<0.05). (Table 4). Bilateral ovarian veins dilatation was noted in 20 (45%) of participants, left gonadal vein dilatation in 14 (28%) with mean diameter (6.88 ± 2.15) mm and right gonadal vein dilation was noted in 7 (14 %) of participants with mean diameter (6.10  $\pm$  2.01) mm. Refluxing bilateral ovarian veins was seen in 8 (16%) participants, left gonadal vein was seen in 15 (30%) while reflux in right gonadal vein was seen only in 3 (6%). (Table 5).

Table (1): Distribution of the studied cases according to demographic data (n = 86)			
	No.	%	
Age (years)			
<36	25	50	
≥36	25	50	
Min. – Max.	55.0–16.0		
Mean ± SD.	8.77±36.48		
BMI (kg/m <sup>2</sup> )			
Min. – Max.	35.20–20.90		
Mean ± SD.	3.48±27.03		
Smoking			
Negative	49	98	
Positive	1	2	
IOD below exceptible menutes			

IQR: Inter quartile range

SD: Standard deviation

Table (2): Distribution of the studied cases according to main presenting symptoms (n = 50)			
	No.	%	
Chronic pelvic pain	32	64	
Vaginal discharge	20	40	
Dysmenorrhea	15	30	
Vaginal bleeding	1	2	
Hematuria	1	2	

Table (3): Distribution of the studied cases according to CT final Diagnosis (n = 50)			
CT final Diagnosis	No.	%	
A- Vascular compression syndromes	21	42	
1- Nutcracker syndrome	13	26	
a- Anterior nutcracker syndrome	10	20	
b- Posterior nutcracker syndrome	3	6	
2- May-Thurner syndrome	3	6	
<b>3-</b> Combined vascular compression syndromes	5	10	
B- Non vascular compression	29	58	
1- 1ry pelvic congestion	28	56	
2- Refluxive internal pudendal vein	1	2	

Table (4): Relation between CT and demographic data (n = 49)					
	СТ				
	VCS (n = 21)		Primary PCS		n value
			(n = 28)		praiae
	No.	%	No.	%	
Age (years)					
<36	14	66.7	9	32.1	
≥36	7	33.3	19	67.9	0.0127*
Min. – Max.	22.0 - 53.0 22.0 - 55		- 55.0		
Mean ± SD.	33.67 ± 6.53		39.32 ± 8.74		
Smoking					
Negative	21	100	27	96.43	<sup>FE</sup> p=1
Positive	0	0	1	3.57	
BMI (kg/m <sup>2</sup> )					
Min. – Max.	20.90 - 31.60		22.40 - 35.20		0.0032*
Mean ± SD.	24.65 ± 2.73		28.45 ± 3.06		

VCS: vascular compression syndrome, PCS: pelvic congestion syndrome

SD: Standard deviation FE: Fisher Exact, P: p value for Relation between CT and demographic data, \*: Statistically significant at  $p \le 0.05$ 

Table (5): Ovarian veins diameter, reflux and pelvic varices findings according to CT			
venography			
CT venography findings	No.	%	
Gonadal vein dilatation ( >5.5 mm)			
Negative	9	18	
Left ovarian vein	14	28	
Right ovarian vein	7	14	
Bilateral ovarian veins	20	40	
Left gonadal vein diameter (mm)			
Min. – Max.	3 - 11.5		
Mean ± SD.	6.88 ± 2.15		
Right gonadal vein diameter (mm)			
Min. – Max.		3.0 – 11.0	
Mean ± SD.	6.10 ± 2.01		
Pelvic varices diameter (mm)			
Mean ± SD.	6.97 ± 2.34		
Min. – Max.	4.5 - 16		
Gonadal vein reflux			
Negative	24	48	
Left ovarian vein	15	30	
Right ovarian vein	3	6	
Bilateral ovarian veins	8	16	

#### Discussion

Chronic pelvic pain is a common complaint of females with approximate incidence of 3.8% in the adult female population. Pelvic congestion syndrome (PCS) is among the potential causes of chronic pelvic pain. <sup>(8)</sup>. PCS is a challenging condition for diagnosis, requiring several studies for assessment of possible structural causes that can lead to pelvic venous hypertension in order to construct proper plan of management and therefor, lower the patient's rate of and recurrence incidence. morbidity This study was carried out to assess the diagnostic performance of CT venography of abdomen and pelvis in assessment of pelvic venous insufficiency in females by conducting a cross sectional observational study including 50 participants diagnosed with pelvic congestion syndrome. Concerning to CT venography findings, about half of cases (44 %) had a structural cause resulting in secondary pelvic venous insufficiency. This highlights the role of CT venography of abdomen and pelvis as one of the important investigations for females with pelvic congestion symptoms; however one study using CT reported that dilated and incompetent ovarian veins are commonly observed in asymptomatic women who have given birth<sup>(9)</sup>. We found that (42%) of our studied sample had vascular compression syndromes, the most frequent vascular compression syndrome seen was anterior nutcracker syndrome seen in (26 %), This is quite close to Scultetus et al 2001 who found nutcracker syndrome in 17.9% of patients with PCS <sup>(10)</sup> and Osman et al. 2021 who evaluated the

role of CT and MRI in female pelvic congestion syndrome, they found vascular compression syndrome in (28 %) of  $cases^{(1)}$ . while in Whiteley et al 2015 study observed the nutcracker syndrome in only 2% of patients <sup>(11)</sup>. We observed bilateral ovarian vein dilatation in 20 (40%) of our studied sample, left ovarian vein dilatation in 14 (28 %) patients and right ovarian vein dilation in 7 (14 %) patients while non dilated ovarian veins was found only in 9 (18 %) patients, considering ovarian vein dilatation of diameter more than 5.5 mm (12). This was consistent with Szaflarski et al. 2019, Using computed tomography in adults, the researchers assessed how often ovarian venous hypertension occurred and how severe it was, of 143 positive CT study, they found left ovarian vein dilation in (20.3%), right ovarian vein dilation in (12.6%) and bilateral ovarian vein dilation in  $(67.1\%)^{(13)}$ , while this was contrasted with Awad et al. 2020; a comparative study carried on 200 patients complaining of persistent pelvic discomfort to assess the role of CT venography in chronic pelvic pain patients, they found higher incidence of ovarian vein dilation was on the left side in (40%), followed by dilation in the right side in (33.3%) and only (26.7%) with bilateral ovarian vein dilatation <sup>(12)</sup>. However each individual study considered a different cut point for ovarian vein dilation. Regarding ovarian venous reflux, we found left ovarian vein reflux in 15 (30%) of the in our studied sample, this matches the findings of Hiromura et al. 2004, a study was conducted to characterize the CT findings associated with ovarian vein reflux in asymptomatic women. They reported left ovarian vein reflux in 50 (33.1%) of the 151 study patients <sup>(14)</sup>.

## Conclusion

We can consider that CT venography of abdomen and pelvis serves as a fast, easy, and noninvasive method for the assessment of females with chronic pelvic pain and a diagnostic method for detection of structural causes of pelvic venous insufficiency that can determine the plan of management.

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