The Heart Surgery Forum #2018-2053
21 (5), 2018 [Epub September 2018]
doi: 10.1532/hsf.2053 Online address: http://journal.hsforum.com

A New-Proposal Physical Examination Test for Unilateral Lower Extremity Edema

Fatih Ada, MD,[1] Volkan Emren, MD[2]

[1]Department of Cardiovascular Surgery, Cumhuriyet University School of Medicine, Sivas, Turkey; [2]Department of Cardiology, İzmir Katip Çelebi University School of Medicine, Izmir, Turkey

ABSTRACT

Objective: Patients with iliac vein compression syndrome (IVCS) usually present to the hospital with left-sided leg edema. We looked for an answer to the question: ‘’Can iliac vein compression syndrome (IVCS) be predicted with a reliable physical examination test in the differential diagnosis?”

Methods: We tested a new physical examination on patients with only left-sided lower extremity edema. In this physical examination the widest area of the calf point (just below tuberosity of the tibia) and medial malleolus was measured in both legs on the Trendelenburg position at 30°and repeated in standing position. Then the iliac venography was performed.

Results: The test was performed on 32 (N = 32) patients with left extremity edema. IVCS was observed on 18 (n = 18) (56%) patients. The test was found to have 88% sensitivity and 92% specificity in IVCS.

Conclusion: This new physical examination finding, which may be valuable in diagnosing IVCS, is proposed for use in patients with unilateral left-sided edema to preclude unnecessary use of expensive diagnostic imaging methods.

INTRODUCTION

The iliac vein compression syndrome (IVCS) is actually much more common than thought in the general population. According to the study of May and Thurner, which was conducted on cadavers 60 years ago, the rate of the left common iliac vein spur was 22% (May 1957). Many patients with IVCS are misdiagnosed with classic venous insufficiency and undergo operation. On the other hand, many patients, though having symptoms like unilateral extremity edema, continue to live without any treatment because venous insufficiency cannot be detected. IVCS can cause major complications such as deep vein thrombosis (DVT) and pulmonary thromboembolism (PTE) (Mousa 2013). Some of the patients were diagnosed with these complications, or these complications could be misdiagnosed without detecting the underlying IVCS. Therefore, a simple, practical diagnostic test is needed to easily diagnose IVCS before complications occur and eliminate further unnecessary use of expensive imaging tests. Nowadays, as in all disciplines in clinical practice, physical examination is neglected with the development and widespread use of imaging and laboratory technology in cardiovascular diseases (Mohammed 2016). Under these circumstances, in this study we aim to investigate the diagnostic accuracy of a new physical examination for IVCS (May-Thurner syndrome) in patients with unilateral left lower extremity edema.

METHODS

In this observational and cross-sectional study, we included 32 (N = 32) patients with left leg edema who applied to the cardiovascular surgery clinic of Sivas Numune Hospital between December 2016 and October 2017.A written consent form was obtained from all patients. We performed the physical examination by measuring leg circumference, just above the medial malleolus and on the tuberosity of the tibia at the neutral position in the standing position, and the test was repeated at the 30° Trendelenburg position. After physical examination, left iliac venography, which is the gold standard diagnostic method for IVCS, was performed on all patients. Venography results were compared with preintervention measurements.

Including Criteria

Patients were included if the difference in circumference in the left extremity relative to the right extremity is ≥1 cm on the medial malleolus or ≥2 on the tuberosity of the tibia (on the calf) (Bickley 2013).

Exclusion Criteria

Patients with bilateral lower extremity edema, known lymphedema, known DVT history, presence of acute, subacute, or chronic DVT in the Doppler ultrasound, splint edema in extremities due to limb fracture, congenital unilateral extremity hypertrophy, or atrophy were excluded.

Performing the Test

Following routine anamnesis and classical vascular examination, considering the symptoms of each patient, we measured both the widest part of the calf (just below the other tuberosity of the tibia) and just below the medial malleolus

Received March 30, 2018; accepted August 2, 2018.

Correspondence: Fatih Ada, Assistant Professor, Cumhuriyet University School of Medicine, Department of Cardiovascular Surgery, Kayseri - Sivas Yolu, Cumhuriyet Üniversitesi, Postal Code: 58140, Merkez, Sivas, Turkey; +90-346-219-10-10; fax: +90-346-219-11-10 (e-mail: drfatihada@gmail.com).

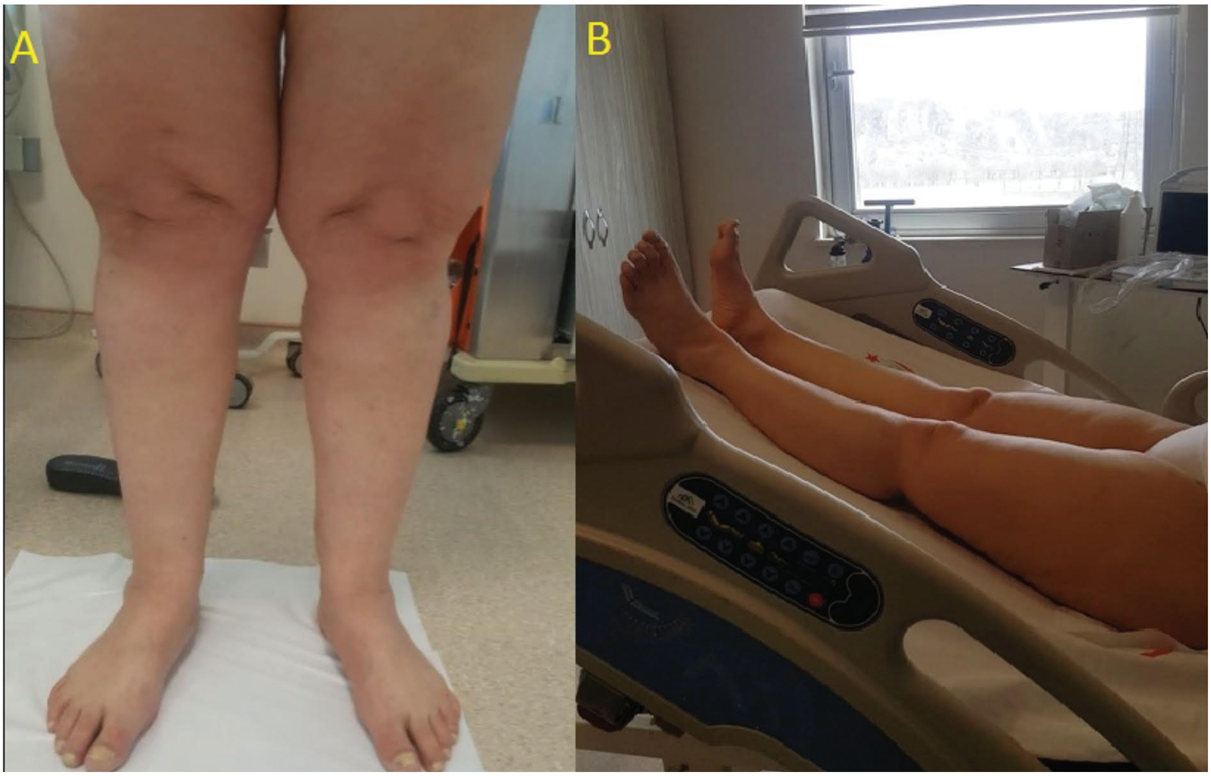

Figure 1. (A) Standing neutral position. (B) Trendelenburg position at 30°.

Figure 2.(A) Ankle circumference measurement on the standing neutral position. Note that the measurement is 27.5 cm. (B) Ankle circumference measurement on the Trendelenburg position at 30°. Note that the measurement is 24.8 cm.

Table 1. Measurement Data of the Test

	Type of Measurement	Location of Measurement	Right (cm)	Left (cm)	Difference of Circumference (cm)	Result	Intervention
Case 1	Standing	Ankle	21	22	1	May-Thurner syndrome	Balloon angioplasty
		Calf of the leg	34	35	1	May-Thurner syndrome	Balloon angioplasty
	Trendelenburg (30°)	Ankle	20	20	0	May-Thurner syndrome	Balloon angioplasty
		Calf of the leg	33	33	0	May-Thurner syndrome	Balloon angioplasty
Case 2	Standing	Ankle	24	26.5	1.5	May-Thurner syndrome	Balloon angioplasty
		Calf of the leg	35	38	3	May-Thurner syndrome	Balloon angioplasty
	Trendelenburg (30°)	Ankle	23	24	1	May-Thurner syndrome	Balloon angioplasty
		Calf of the leg	34	35	1	May-Thurner syndrome	Balloon angioplasty
Case 3	Standing	Ankle	22	24	2	Normal venous anatomy	No
		Calf of the leg	48	49	1	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	21	23	2	Normal venous anatomy	No
		Calf of the leg	47	48.5	1.5	Normal venous anatomy	No
Case 4	Standing	Ankle	22	23	1	May-Thurner syndrome	No
		Calf of the leg	38	39.5	1.5	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	22	22	0	May-Thurner syndrome	No
		Calf of the leg	37	37.5	0.5	May-Thurner syndrome	No
Case 5	Standing	Ankle	22.5	24	1.5	Normal venous anatomy	No
		Calf of the leg	41	42	1	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	22	23.5	1.5	Normal venous anatomy	No
		Calf of the leg	41	42	1	Normal venous anatomy	No
Case 6	Standing	Ankle	24	27	3	Normal venous anatomy	No
		Calf of the leg	38	42	4	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	23	26	3	Normal venous anatomy	No
		Calf of the leg	37.5	40	2.5	Normal venous anatomy	No
Case 7	Standing	Ankle	23	24	1	May-Thurner syndrome	No
		Calf of the leg	36	36.5	0.5	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	21	21	0	May-Thurner syndrome	No
		Calf of the leg	35.5	35.5	0	May-Thurner syndrome	No
Case 8	Standing	Ankle	23	24.5	1.5	Normal venous anatomy	No
		Calf of the leg	39	41	2	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	23	22	1	Normal venous anatomy	No
		Calf of the leg	38	39.5	1.5	Normal venous anatomy	No
Case 9	Standing	Ankle	23	24	1	May-Thurner syndrome	No
		Calf of the leg	35	36	1	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	21	21	0	May-Thurner syndrome	No
		Calf of the leg	32.5	32.5	0	May-Thurner syndrome	No
Case 10	Standing	Ankle	29	32	3	May-Thurner syndrome	No
		Calf of the leg	45	47	2	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	27	27.5	0.5	May-Thurner syndrome	No
		Calf of the leg	42	42.5	0.5	May-Thurner syndrome	No
Case 11	Standing	Ankle	22	23	1	Normal venous anatomy	No

Table 1. Measurement Data of the Test (continued)

	Type of Measurement	Location of Measurement	Right (cm)	Left (cm)	Difference of Circumference (cm)	Result	Intervention
		Calf of the leg	34	36	2	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	21	22.5	1.5	Normal venous anatomy	No
		Calf of the leg	34	36	2	Normal venous anatomy	No
Case 12	Standing	Ankle	24.5	26	1.5	Normal venous anatomy	No
		Calf of the leg	42	45.5	3.5	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	24	25.5	1.5	Normal venous anatomy	No
		Calf of the leg	41	44	3	Normal venous anatomy	No
Case 13	Standing	Ankle	23	24	1	Normal venous anatomy	No
		Calf of the leg	37	38.5	1.5	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	22	23.5	1.5	Normal venous anatomy	No
		Calf of the leg	36	37.5	1.5	Normal venous anatomy	No
Case 14	Standing	Ankle	24.8	26.1	1.3	Normal venous anatomy	No
		Calf of the leg	41.2	43.3	2.1	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	24.5	25.6	1.1	Normal venous anatomy	No
		Calf of the leg	40.8	43	2.2	Normal venous anatomy	No
Case 15	Standing	Ankle	24.5	27	2.5	Normal venous anatomy	No
		Calf of the leg	39	41	2	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	24	26	2	Normal venous anatomy	No
		Calf of the leg	38	40	2	Normal venous anatomy	No
Case 16	Standing	Ankle	24	24.5	0.5	Normal venous anatomy	No
		Calf of the leg	37.5	39	1.5	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	23	24.1	1.1	Normal venous anatomy	No
		Calf of the leg	36.5	38.6	2.1	Normal venous anatomy	No
Case 17	Standing	Ankle	24	25	1	May-Thurner syndrome	No
		Calf of the leg	42	43	1	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	23	23	0	May-Thurner syndrome	No
		Calf of the leg	41	41	0	May-Thurner syndrome	No
Case 18	Standing	Ankle	25	29.5	4.5	May-Thurner syndrome	Balloon angioplasty + venous stent
		Calf of the leg	41	44	3	May-Thurner syndrome	Balloon angioplasty + venous stent
	Trendelenburg (30°)	Ankle	24.5	25.5	1	May-Thurner syndrome	Balloon angioplasty + venous stent
		Calf of the leg	40.5	41.5	1	May-Thurner syndrome	Balloon angioplasty + venous stent
Case 19	Standing	Ankle	25.5	27	1.5	May-Thurner syndrome	No
		Calf of the leg	43	44.5	1.5	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	24.8	26.1	1.3	May-Thurner syndrome	No
		Calf of the leg	42	44	2	May-Thurner syndrome	No
Case 20	Standing	Ankle	23.5	24.5	1	May-Thurner syndrome	No
		Calf of the leg	41	42	1	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	23	23	0	May-Thurner syndrome	No

Table 1. Measurement Data of the Test (continued)

	Type of Measurement	Location of Measurement	Right (cm)	Left (cm)	Difference of Circumference (cm)	Result	Intervention
		Calf of the leg	40	40	0	May-Thurner syndrome	No
Case 21	Standing	Ankle	25.5	26.5	1	May-Thurner syndrome	No
		Calf of the leg	46.5	47.5	1	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	24	24	0	May-Thurner syndrome	No
		Calf of the leg	45.5	45.5	0	May-Thurner syndrome	No
Case 22	Standing	Ankle	26.1	27.5	1.4	May-Thurner syndrome	Venous stent
		Calf of the leg	44	45	1	May-Thurner syndrome	Venous stent
	Trendelenburg (30°)	Ankle	24.5	24.8	0.3	May-Thurner syndrome	Venous stent
		Calf of the leg	43.5	44	0.5	May-Thurner syndrome	Venous stent
Case 23	Standing	Ankle	23.3	24.3	1	Normal venous anatomy	No
		Calf of the leg	39.9	40.7	0.8	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	23	23	0	Normal venous anatomy	No
		Calf of the leg	38	38.5	0.5	Normal venous anatomy	No
Case 24	Standing	Ankle	21.5	22.6	1.1	May-Thurner syndrome	Venous stent
		Calf of the leg	34.5	35.5	1	May-Thurner syndrome	Venous stent
	Trendelenburg (30°)	Ankle	20.9	21.3	0.4	May-Thurner syndrome	Venous stent
		Calf of the leg	33.2	33.5	0.3	May-Thurner syndrome	Venous stent
Case 25	Standing	Ankle	22.6	23.7	1.1	May-Thurner syndrome	Venous stent
		Calf of the leg	34	34.6	0.6	May-Thurner syndrome	Venous stent
	Trendelenburg (30°)	Ankle	22	22.8	0.8	May-Thurner syndrome	Venous stent
		Calf of the leg	33	33	0	May-Thurner syndrome	Venous stent
Case 26	Standing	Ankle	23.3	26.2	2.9	May-Thurner syndrome	No
		Calf of the leg	37	41	4	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	23	24.6	1.6	May-Thurner syndrome	No
		Calf of the leg	36.5	38.6	2.1	May-Thurner syndrome	No
Case 27	Standing	Ankle	21	22.1	1.1	May-Thurner syndrome	No
		Calf of the leg	33	35	2	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	20.5	20.8	0.3	May-Thurner syndrome	No
		Calf of the leg	32	33.2	1.2	May-Thurner syndrome	No
Case 28	Standing	Ankle	23.3	25.5	2.2	Normal venous anatomy	No
		Calf of the leg	37.5	40.2	2.7	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	22.5	24	1.5	Normal venous anatomy	No
		Calf of the leg	36	38.5	2.5	Normal venous anatomy	No
Case 29	Standing	Ankle	26.5	27.8	1.3	Normal venous anatomy	No
		Calf of the leg	36.3	38.6	2.3	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	24.5	26.9	2.4	Normal venous anatomy	No
		Calf of the leg	35.1	37.1	2	Normal venous anatomy	No
Case 30	Standing	Ankle	25.5	28.5	3	Normal venous anatomy	No
		Calf of the leg	42	44.2	2.2	Normal venous anatomy	No
	Trendelenburg (30°)	Ankle	24.5	27.9	3.4	Normal venous anatomy	No
		Calf of the leg	40.2	42.2	2	Normal venous anatomy	No

Table 1. Measurement Data of the Test (continued)

	Type of Measurement	Location of Measurement	Right (cm)	Left (cm)	Difference of Circumference (cm)	Result	Intervention
Case 31	Standing	Ankle	24.6	25.8	1.2	May-Thurner syndrome	No
		Calf of the leg	36.1	37.4	1.3	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	24.1	24.3	0.2	May-Thurner syndrome	No
		Calf of the leg	35.8	36.4	0.6	May-Thurner syndrome	No
Case 32	Standing	Ankle	23.8	25.1	1.3	May-Thurner syndrome	No
		Calf of the leg	35	36.4	1.4	May-Thurner syndrome	No
	Trendelenburg (30°)	Ankle	23	23.2	0.2	May-Thurner syndrome	No
		Calf of the leg	34.5	34.8	0.3	May-Thurner syndrome	No

with a plastic, nonstretch, flexible, disposable tape. A total of 4 points on both legs were measured. We performed the test if there was a difference of 1 cm or more on the medial malleolus or 2 cm or more on the tuberosity of the tibia at the first measurement.

The barefoot patient was kept in an upright standing position for 10 minutes, faced across the room, and only wore underwear; and the distance between the legs was sufficient for measurement. Medial malleolus and the tuberosity of the tibia were identified and the circumference of both legs was measured (Figure 1). Subsequently, the patient was taken to the examination stretcher for 10 minutes, waiting with no motion and facing the ceiling, and with his/her feet up (at 30°in the Trendelenburg position), the measurements were taken and noted again (Figure 2).

As we mentioned above, the difference in circumference in the left extremity relative to the right extremity ≥1 cm on the medial malleolus or ≥2 cm on the tuberosity of the tibia (on the calf) was considered to be significant. The test was followed by positioning at the Trendelenburg position; if the difference in leg circumferences was ≤1 cm on the medial malleolus or ≤2 cm on the calf, the test was considered positive. However, the test was considered negative, if the difference was >1 cm on the medial malleolus and >2 cm on the calf or if the difference in the first measurement or the second measurement was considered to be the same or greater.

Statistical Analyses

All analyses were performed by using IBM SPSS Statistics for Windows, Version 19.0. (IBM Corp., Armonk, NY, USA). Numerical variables are presented as mean ± standard deviation and nominals as percentages. All variables were subjected to Kolmogorov-Smirnov testing to determine whether they were normally distributed. Nonparametric values were compared by using the Mann-Whitney U test. The chi-square and Fischer exact tests were used to compare categorical data. We also calculated the sensitivity and specificity, the positive and negative predictive values of physical examination for the determining of IVCS. A *P* value <.05 was considered significant.

RESULTS

The test was conducted on 32 patients who met the appropriate criteria. IVCS syndrome was seen in 18 (56%) of the patients. Twelve patients (66.7%) were female and 6 (33.3%) were male. Two patients had a negative test but were diagnosed with IVCS syndrome (Table 1). The test was positive in one patient and was not diagnosed with IVCS.

There was no saphenofemoral or deep venous insufficiency on the left lower extremity with venous Doppler ultrasonography in 8 (44.5%) patients with IVCS, and 3 (16.6%) patients had left lower extremity varicose vein surgery history. No varicose veins were observed on physical examination in 10 (55.6%) patients diagnosed with IVCS. The demographic data of the patients are shown in Table 2. Data on the reliability of the test are shown in Table 3.

Six patients (33.3%) diagnosed with IVCS underwent interventional treatment. Balloon-only angioplasty was performed in 2 (11.1%) patients, balloon angioplasty with venous stent was performed in 1 (5.5%) patient, and direct venous stent treatment was performed in 3 (16.6%)patients. The other 12 (66.7%) patients were treated with a venotonic agent, antiplatelet drugs, and compression stockings. These patients were followed up with medicine because they did not accept balloon angioplasty or venous stent after diagnosis (Table 4).

DISCUSSION

IVCS is a mechanical compression of the left common iliac vein between the right main iliac artery and the lumbar corpus vertebrae. Internal luminal intimal hyperplasia developed as a secondary to mechanical compression, and arterial pulsation leads to "spur" development in the obstructed area. These pathophysiologic factors ultimately result in varicose enlargement and pelvic collateral development in the proximal part of the obstruction (May 1956). The tendency to develop venous thrombosis is increased. Previous studies showed that the left iliac DVT is 2 times diagnosed more than the right iliac DVT (Boyd 2004).

Our physical examination is developed according to the

Table 2. The Demographic Data of the Patients*

	Sex	Height (cm)	Weight (kg)	BMI (kg/m^2)	Varicose Veins	Previous Operation	Venous Doppler USG	Diagnosis	Test Result
Case 1	Female	164	60	22.3	No	No	No DVI or SFI	IVCS	Positive
Case 2	Male	174	78	25.8	Yes	No	Grade 4 SFI, no DVI	IVCS	Positive
Case 3	Female	162	98	37.3	No	No	Grade 4 SFI, no DVI	NVA	Negative
Case 4	Female	150	74	32.9	No	No	Grade 2 SFI, no DVI	IVCS	Positive
Case 5	Female	161	71	27.4	No	No	No DVI or SFI	NVA	Negative
Case 6	Female	158	89	35.7	No	No	Grade 4 SFI, no DVI	NVA	Negative
Case 7	Male	170	73	25.3	Yes	No	Grade 2 SFI, no DVI	IVCS	Positive
Case 8	Female	157	90	36.5	No	No	Grade 2 SFI, no DVI	NVA	Negative
Case 9	Female	158	69	27.6	No	No	Grade 2 DVI, no SFI	IVCS	Positive
Case 10	Female	163	78	29.4	No	No	Grade 3 SFI and grade 3 DVI	IVCS	Positive
Case 11	Male	166	75	27.2	No	No	Grade 4 SFI and grade 3 DVI	NVA	Negative
Case 12	Male	187	102	29.2	Yes	No	Grade 3 SFI and grade 2 DVI	NVA	Negative
Case 13	Female	160	74	28.9	Yes	No	Grade 2 SFI, no DVI	NVA	Negative
Case 14	Female	170	90	31.1	Yes	No	Grade 1 SFI, no DVI	NVA	Negative
Case 15	Female	160	85	33.2	No	No	No DVI or SFI	NVA	Negative
Case 16	Male	187	96	27.5	Yes	Yes	Grade 3 SFI, no DVI	NVA	Negative
Case 17	Male	165	89	32.7	Yes	No	No DVI or SFI	IVCS	Positive
Case 18	Female	160	85	33.2	No	No	Grade 2 SFI, no DVI	IVCS	Positive
Case 19	Female	162	86	32.8	No	No	No DVI or SFI	IVCS	Negative
Case 20	Female	152	70	30.3	No	Yes	No saphenous vein and no DVI	IVCS	Positive
Case 21	Female	162	95	36.2	No	No	No DVI or SFI	IVCS	Positive
Case 22	Female	174	99	32.7	Yes	Yes	Grade 2 DVI, no saphenous vein	IVCS	Positive
Case 23	Female	160	105	41	Yes	No	Grade 3 SFI and grade 2 DVI	NVA	Positive
Case 24	Male	171	70	23.9	Yes	No	No DVI or SFI	IVCS	Positive
Case 25	Female	163	62	23.3	No	No	Grade 2 SFI, no DVI	IVCS	Positive
Case 26	Female	162	80	30.5	Yes	No	No DVI or SFI	IVCS	Negative
Case 27	Male	182	60	18.1	Yes	Yes	Grade 3 DVI, no saphenous vein	IVCS	Positive
Case 28	Male	178	95	30	Yes	No	Grade 3 SFI and grade 2 DVI	NVA	Negative
Case 29	Female	160	78	30.5	Yes	No	Grade 3 DVI, no SFI	NVA	Negative
Case 30	Female	178	91	28.7	Yes	Yes	Grade 3 DVI, no saphenous vein	NVA	Negative
Case 31	Female	162	58	22.1	No	No	No DVI or SFI	IVCS	Positive
Case 32	Male	174	74	24.4	Yes	No	Grade 1 SFI, no DVI	IVCS	Positive

*BMI, Body mass index; USG, ultrasonography; DVI, deep venous insufficiency; SFI, saphenofemoral insufficiency; IVCS, iliac vein compression syndrome; NVA, normal venous anatomy.

same hypothesis including the nonvalvular collateral veins that develop secondary to iliac veins' compression from the outside, spurs formation inside, and the Bernoulli principle. Venous obstruction in the iliac vein and backflow from the collateral veins cause venous hypertension in the left leg when the patient is standing, and venous structures dilated in years. When the patient raises his or her feet upward, the flow velocity and hence the flow rates of these collaterals due to the gravity effect are increased, and the venous hypertension in the lower limbs is reduced. Based on the above-mentioned theory, equal circumference or convergence between the right and left lower extremity veins in the Trendelenburg position can be explained provided that fibrin accumulation does not occur because of chronic

Table 3. The Diagnostic Value Results of the Physical Examination Test*†

	Results		
	Disease Present	Disease Absent	Totals
Results of diagnostic physical examination test			
Test positive	16	1	17
Test negative	2	13	15
Totals	18	14	32

*All data are n or N (N = 32).
†Sensitivity = 0.88; specificity = 0.92; positive predictive value = 0.94; negative predictive value = 0.86; Pretest probability (prevalence) = 0.56; accuracy = 0.90; likelihood ratio for a positive test result = 11; likelihood ratio for a negative test result = 0.02.

Table 4. The Demographic Data of the Patients and Test Results*

	IVCS (n = 18)†	NVA (n = 14)†	*P*
Age, mean ± SD (range)	36.83 ± 8.26 (25-51)	42.5 ± 11.69 (30-67)	.165
Sex			
Male	6 (33.3%)	4 (28.5%)	.773
Female	12 (66.7%)	10 (71.5%)	.773
Hypertension	2 (11.1%)	5 (35.7%)	.195
Diabetes	2 (11.1%)	2 (14.2%)	1
Smoking	8 (44.4%)	4 (28.5%)	.358
BMI, kg/m^2 ± SD	28.02 ± 5.05	31.72 ± 4.32	.095
Varicose veins	8 (44.4%)	8 (57.1%)	.476
Previous varicose vein surgery	3 (16.6%)	2 (14.2%)	1
Previous medical treatment	16 (88.8%)	13 (92.8%)	1
Previous compression stocking treatment	15 (83.3%)	13 (92.8%)	.613
Venous insufficiency in Doppler ultrasonography	10 (55.5%)	12 (85.7%)	.124
Physical examination test			
Positive	16 (88.9%)	Positive, 1 (7.1%)	<.001
Negative	2 (11.1%)	Negative, 13 (92.8%)	<.001
Venous stent implantation	4 (22.2%)	0	—
Venous angioplasty	3 (16.6%)	0	—

*IVCS, iliac vein compression syndrome; NVA, normal venous anatomy; BMI, Body mass index.
†Data aregiven as n(%) except for age and BMI, for which the information is in the left column.

venous insufficiency.

Leg-circumference differences in chronic venous insufficiency are explained by chronic fibrin and collagen accumulation (Eberhardt 2005). Collagen accumulation and fibrin cause a difference in leg circumference if there is a unilateral venous insufficiency. However, because collagen accumulation and fibrin cannot theoretically displace the position, we do not expect the test to be positive in these patients. In addition, this test loses validity in patients with both IVCS and chronic venous insufficiency coexisting with molecular changes. It is obvious that the test will be negative in these patients.

In this instance, confirming the diagnosis with MR angiography or CT angiography or venography is directly related to the experience and clinical suppositions of the physician. In patients with IVCS, if concomitant chronic venous insufficiency does not occur, or occurs without affecting a large area, the test will be expected to be positive. We did not perform venous computed tomography or magnetic resonance angiography in patients with IVCS because of the diagnostic uncertainty and expensiveness of those tests. In addition, venography as a gold standard diagnostic test for IVCS makes a diagnosis clear at a point that there is no room for doubt (Hurst 2001).

In general, the complaints of the patients were pain and swelling of the left leg; and ,interestingly, pain mainly occurs at the heel. All of the patients were seen in many different centers and followed by many different doctors from varied disciplines. Patients who were misdiagnosed with chronic venous insufficiency were treated with both medical treatment and compression stockings; some of them were operated on for venous insufficiency. Doppler ultrasonography showed no saphenofemoral insufficiency or deep venous insufficiency in some of the patients.

The physical examination test used in this study is based on very simple methods. In addition to the circumference of the leg, there are many techniques that measure leg volume (Guex 2000). Methods such as water displacement, perometer, disc method, and frustum method can be applied to this test.

The diagnostic accuracy of this physical examination is not 100%; many other physical examination tests also do not have 100% accuracy. However, the feasibility of this test suggests that the results of the patients to whom the test was applied can be used in clinical practice.

Parameters such as test-related measurement locations, measurement format, and duration will be optimized with studies with large populations.

CONCLUSION

The new physical examination test is practical, easy, feasible, and cost-effective for the differential diagnosis of IVCS. Thus, many patients will be diagnosed and treated without delayed diagnosis and without complications. However, prospective studies with large populations are needed to able to confirm the specificity and sensitivity of the test.

ACKNOWLEDGMENTS

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The authors declare no conflict of interest in preparing this article.

REFERENCES

Bickley LS, Szilagyi PG. Bates' guide to physical examination and history-taking. 11th ed. Philadelphia: Wolters Kluwer Health/Lippincott Williams & Wilkins; c2013.

Boyd DA. 2004. Unilateral lower extremity edema in May-Thurner syndrome. Mil Med 169(12):968-71.

Eberhardt RT, Raffetto JD. 2005. Chronic venous insufficiency. Circulation 111(18):2398-409.

Guex JJ, Perrin M. 2000. Edema and leg volume: methods of assessment. Angiology 51(1): 9-12.

Hurst DR, Forauer AR, Blooem JR, Greenfield LJ, Wakefield TW, Williams DM. 2001. Diagnosis and endovascular treatment of iliocaval compression syndrome. J Vasc Surg 34(1):106-13.

May R, Thurner J. 1956. [A vascular spur in the vena iliaca communis sinistra as a cause of predominantly left-sided thrombosis of the pelvic veins]. Z Kreislaufforsch 45(23-24):912-22. German.

May R, Thurner J. 1957. The cause of the predominantly sinistral occurrence of thrombosis of the pelvic veins. Angiology 8(5):419-27.

Mohammed KA. 2016. Clinical examination nowadays. Lancet 388(10044):559-60.

Mousa AY, AbuRahma AF. 2013. May–Thurner syndrome: update and review. Ann Vasc Surg 27(7):984-95.