

Anatomical patterns of pelvic venous reflux to the lower limbs

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ABSTRACT

Background: Pelvic venous insufficiency is an important but frequently overlooked cause of lower limb varicose veins and early recurrence after superficial venous interventions. Understanding the reflux patterns and distribution of lower limb varicose veins with pelvic origin is crucial for preventing recurrence and unsatisfactory outcomes, which may result from incomplete or inadequate investigation.

Methods: Data from 49 female patients (62 limbs) with pelvic reflux that connects to the lower limbs through pelvic escape points were analyzed. All patients were examined for reflux in the standing position using duplex ultrasound examination. Special attention was given to the reflux patterns, distribution, and connections to the saphenous veins, nerves, and lymph nodes.

Results: Most patients were classified as CEAP C2 (95%), and 70% reported leg pain. The most frequently observed patterns were varicose veins on the posterior surface of the thigh (19%), veins connected to the great saphenous vein (GSV) along the thigh and leg (29%), and veins running parallel to the GSV on the medial thigh (26%). Varicose veins confined exclusively to the perineal region were identified in 15% of patients. Less common patterns included varicose veins on the anterior thigh (8%), veins associated with the sciatic nerve (10%), and veins with lymph node connections (8%). Varicose veins connected to the small saphenous vein were the least frequent, accounting for 5% of cases.

Conclusions: Although the GSV is often involved in patients with pelvic venous insufficiency and escape points, non-saphenous varices appear to play a more prominent role in the reflux pattern. These findings support the concept that pelvic-origin reflux manifests as distinct patterns of lower limb varicose veins through defined pelvic escape points, underscoring the importance of thoroughly assessing the connection between pelvic and lower limb venous territories. A better understanding of the distribution of nonsaphenous reflux during venous mapping is essential for optimizing treatment strategies and reducing the risk of recurrence. (*J Vasc Surg Venous Lymphat Disord* 2026;14:102507.)

Keywords: Varicose veins; Pelvic veins; Venous insufficiency; Saphenous vein; Duplex ultrasound examination

Pelvic venous insufficiency remains a frequently under-diagnosed contributor to chronic venous disease, particularly in women presenting with atypical varicose veins or unexplained recurrence after standard superficial venous interventions. During routine venous mapping for varicose veins, reflux of pelvic origin is often overlooked, especially when attention is restricted to the saphenous system. Multicenter data suggest that, in a substantial proportion of patients, the origin of reflux is

unrelated to the saphenous system, instead arising from collateral pelvic pathways.¹⁻³ Initial studies by Labropoulos et al⁴ identified reflux in nonsaphenous superficial veins, suggesting a pelvic origin. Subsequently, Barros et al⁵ demonstrated a relevant prevalence of varicose veins of pelvic origin found in a sample of patients referred to a vascular laboratory for venous screening of the lower limbs. Although pelvic venous reflux underlies a spectrum of pelvic venous disorders and lower limb varicosities, its contribution to specific patterns of lower limb varicose veins remains insufficiently characterized, and it continues to be neglected in routine practice due to limited training and variability in diagnostic approaches among vascular specialists.⁶

The understanding of venous connections between the pelvis and the lower limbs has advanced significantly in recent decades, driven by studies that systematically mapped the so-called pelvic escape points. Franceschi initially described reflux pathways arising from pelvic escape points (perineal, inguinal, clitoral, gluteal, and obturator), which later formed the conceptual basis for correlating pelvic venous origin with varicose manifestations in the lower limbs.⁷ Subsequent works, such as those by Delfrate et al,⁸ refined this

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anatomical and functional description, integrating clinical, ultrasound, and phlebographic findings, and highlighting the importance of these communications both in the genesis of primary varicose veins and in recurrences after treatment. This detailed anatomical knowledge is essential for the accurate assessment of varicose vein distribution, enabling identification of their true origin and the connection pathways to the superficial network, with a direct impact on therapeutic decision-making.

Diagnosis demands imaging modalities capable of documenting dynamic reflux and unconventional venous routes. Standing-position duplex ultrasound examination remains the reference method,⁹ while complementary techniques, such as venography and magnetic resonance imaging, may be useful for complex pelvic anatomy.¹⁰ Not performing pelvic assessment has been linked to higher recurrence rates, as emphasized by Whiteley et al.¹¹ Despite this evidence, the anatomical distribution of pelvic-origin reflux within the lower limbs, including its nonsaphenous pathways and connections with neural and lymphatic structures, is still under-reported.

The present study builds on our previously published work describing a comprehensive ultrasound protocol for confirming the pelvic origin of venous reflux.⁹ While that study focused on standardizing diagnostic methodology, the current analysis addresses a different research question. Specifically, this study aims to characterize the anatomical distribution patterns of lower limb varicose veins arising from pelvic-origin reflux, their relationship with defined pelvic escape points, and their connections with nonsaphenous pathways, including the lymphatic network and the sciatic nerve. We hypothesize that pelvic-origin venous reflux manifests as distinct, reproducible patterns of lower limb varicose veins that may be overlooked during routine venous mapping if pelvic reflux is not actively considered. The specific hypothesis of this study was that pelvic-origin venous reflux is associated with identifiable patterns of lower limb varicose vein distribution that can be systematically characterized using a standardized ultrasonographic protocol.

METHODS

This observational cross-sectional study included 49 female patients drawn from the cohort previously described by Barros et al.⁹ In total, 98 lower limbs were evaluated (both limbs in all subjects). Among them, 62 lower limbs presented varicose veins with ultrasonographically confirmed pelvic escape points extending into lower limb veins and were therefore included in the final analysis. All patients had documented pelvic venous reflux.

All patients underwent a comprehensive duplex ultrasound examination of the lower limb, abdominal, and pelvic venous systems following a standardized protocol,

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-center, observational cross-sectional study
- **Key Findings:** Among 49 women (62 limbs) with pelvic-origin reflux, nonsaphenous pathways predominated. Medial thigh patterns occurred in 26%, posterior thigh in 19%, great saphenous vein-related veins in 29%, isolated perineal varices in 15%, sciatic nerve-related veins in 10%, lymphatic connections in 8%, and small saphenous vein connections in 5%.
- **Take Home Message:** Distinct patterns of lower limb varicose veins can be used as a practical selection tool to identify patients in whom pelvic-origin venous reflux should be suspected, and a comprehensive pelvic investigation is warranted. These patterns reflect consistent anatomic distributions of pelvic reflux pathways, facilitating their recognition during routine venous mapping.

performed by the same examiner. On average, the complete examination lasted approximately 60 minutes per patient. Examinations were performed using a Philips EPIQ 5G (Philips Healthcare) ultrasound system with linear (3-12 MHz), convex PureWave (1-5 MHz), and endocavitary (3-10 MHz) transducers. Lower limb venous mapping was performed in the standing position, and reflux was assessed using color and spectral Doppler with systematic use of the Valsalva maneuver. All described pelvic escape points (perineal, inguinal, clitoral, gluteal, and obturator) were systematically investigated according to the standardized protocol; however, not all of them were identified in the present cohort. Although a complete pelvic assessment was performed in all patients, particular attention was directed to escape points located in proximity to the distribution patterns of lower limb varicose veins identified during initial mapping.

Inclusion criteria required a reflux duration of >0.5 seconds and demonstration of continuous venous flow from pelvic sources on duplex ultrasound examination performed in the standing position. Collected data comprised CEAP clinical classification, reported symptoms, and detailed duplex mapping of reflux pathways, with particular attention to connections involving the great saphenous vein (GSV), small saphenous vein, anterior saphenous vein, and adjacent neural and lymphatic structures.

During venous mapping, the sciatic nerve was systematically evaluated whenever varicose veins were identified on the posterior or lateral aspects of the leg or thigh. On duplex ultrasound examination, the sciatic nerve was identified as a hyperechoic structure with a characteristic honeycomb appearance, typically located anterior to the popliteal vein in the popliteal fossa and

followed proximally along its course. Venous structures were considered to be connected to the nerve when refluxing veins were seen coursing adjacent to or partially encasing the nerve, with demonstrable continuity toward a pelvic escape point.

Similarly, venous-lymphatic connections were delineated based on the anatomical relationship between refluxing veins and lymph node chains, particularly in the inguinal region. These connections were identified when varicose veins were seen in close proximity to lymph nodes, following known lymphatic pathways and demonstrating reflux continuity with pelvic escape points.

The comprehensive pelvic ultrasound protocol, including transabdominal, transperineal, and transvaginal approaches, was previously described in detail and constituted the primary focus of our earlier publication.⁹ The present study applies this validated protocol to analyze the anatomical distribution patterns of pelvic-origin reflux in the lower limbs. Descriptive statistics were used to characterize the distribution of reflux patterns. In addition, the association between pelvic escape points and lower limb varicose vein distribution patterns was evaluated using the χ^2 test for categorical variables. This study was approved by the local Research Ethics Committee under approval number 5.931.954, and all participants provided written informed consent before inclusion.

RESULTS

Most patients (95%) were classified as CEAP C2, and 69% reported lower limb pain. The mean age was 42 years (standard deviation ± 9), with a median gravidity of 2 pregnancies (range 0-7) and a median of 2 children (range 0-5). Body mass index ranged from 19 to 31 kg/m² (mean 23 kg/m²). In the study population, leg pain was reported by 69% of patients, whereas 31% did not report leg pain despite the presence of lower limb varicose veins. Pelvic pain was reported by 31% of patients and dyspareunia by 29%. When venous mapping suggested a possible pelvic origin of reflux, through veins connected to pelvic escape points, patients were referred for comprehensive pelvic ultrasound evaluation to confirm pelvic venous insufficiency. Baseline characteristics are presented in Table I, and the distribution of pelvic escape points is shown in Table II.

Although an association between specific pelvic escape points and lower limb varicose vein distribution patterns was observed, the association was not uniform, likely due to the extensive venous anastomotic network within the pelvis. The most frequent distribution pattern, varicose veins along the medial aspect of the thigh, with or without connection to the GSV, was more commonly associated with the perineal escape point. In contrast, varicose veins on the posterior aspect of the thigh were more frequently associated with the gluteal

Table I. Baseline characteristics of the study population

Variable	Statistics
Age, years, mean $\pm$ SD	42 $\pm$ 9
BMI, kg/m ² , mean $\pm$ SD	23 $\pm$ 3
Pregnancies, No., median (range)	2 (0-7)
Children, No., median (range)	2 (0-5)
CEAP C2, No. (%)	58 limbs (95)
Dyspareunia, No. (%)	14 (29)
Leg pain, No. (%)	34 (69)
Pelvic pain, No. (%)	15 (31)
BMI, Body mass index; SD, standard deviation.	

escape point, although this pattern was also observed in cases related to the perineal escape point. Inguinal escape points were mainly related to anterior thigh varicose veins and recurrence after prior saphenectomy, frequently with reflux detected at the level of the saphenofemoral junction in veins located deep to the GSV. Gluteal escape points correlated with posterior thigh varicose veins and, in selected cases, with reflux involving the inferior gluteal veins and connections adjacent to the sciatic nerve (Fig 1 and Table III).

Venous connections involving adjacent neural and lymphatic structures were identified in a subset of patients. Involvement of the sciatic nerve was observed in 10% of cases and was predominantly associated with varicose veins distributed along the posterior and lateral aspects of the thigh, frequently extending from the leg into the thigh in close anatomical relationship with the nerve. This pattern was more commonly related to the gluteal escape point, although similar distributions were also observed in cases associated with the perineal escape point, reflecting the complexity of pelvic venous interconnections. The clinical relevance of this pelvic-origin reflux pattern lies in alerting clinicians to pursue a more detailed investigation in patients presenting with varicose veins located below the popliteal crease and lateral to the small saphenous vein and may be associated with sciatic-type pain radiating from the popliteal region toward the gluteal area. This clinical presentation may be easily misinterpreted as spinal or musculoskeletal pathology. On duplex ultrasound examination, diagnosis

Table II. Prevalence of pelvic leak points (n = 62 limbs)

Pelvic leak points	No. (%)
Gluteal (G)	7 (11)
Inguinal (I)	11 (18)
Combined I + G	2 (3)
Perineal (P)	40 (65)
P right/I left	1 (2)
P + Obturator (O)	1 (2)

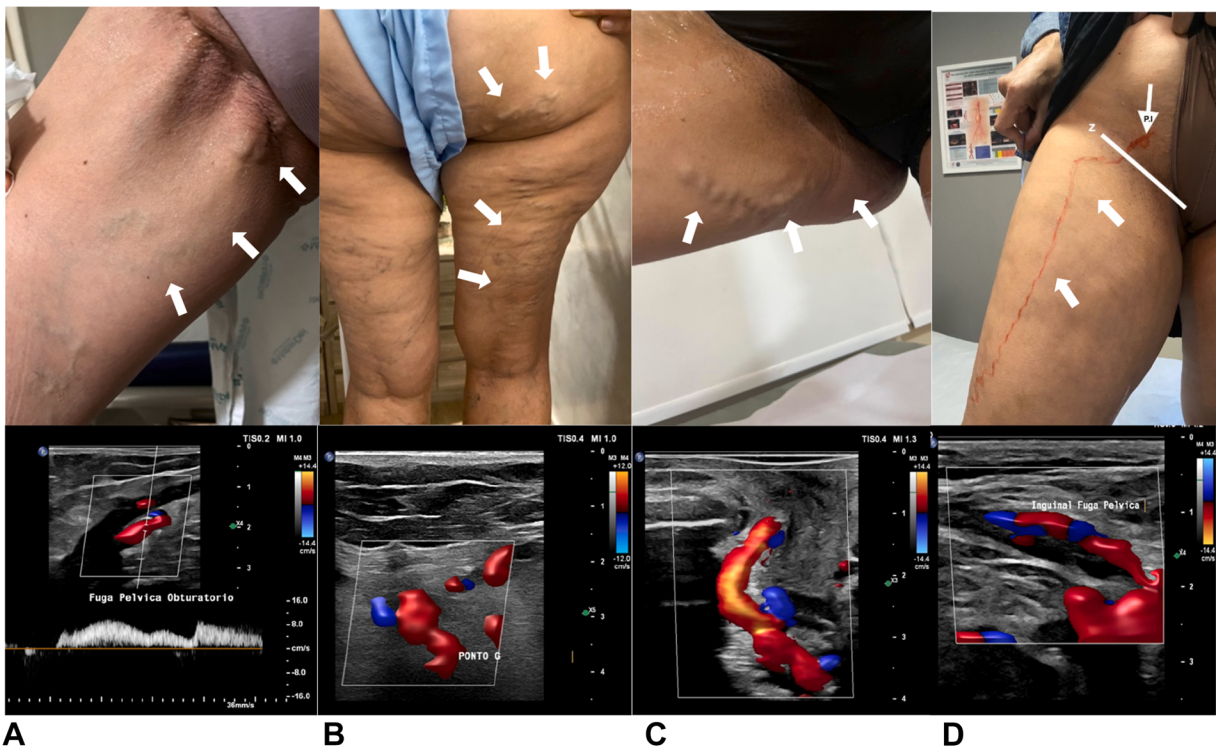
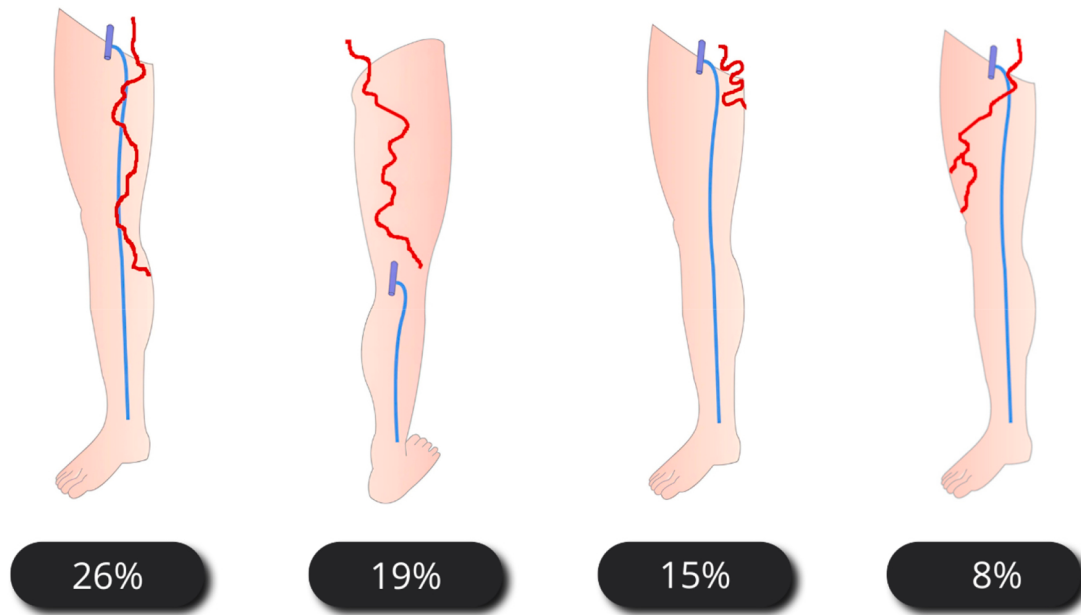


Fig 1. Schematic representation of the anatomical distribution of varicose veins of pelvic origin, accompanied by representative clinical images and color Doppler ultrasound images illustrating the associated reflux patterns and their corresponding pelvic escape points during the Valsalva maneuver. **(A)** Varicose veins running parallel to the axis of the great saphenous vein on the medial thigh, arising from the obturator escape point, with reflux at the level of the saphenofemoral junction in veins located deep to the great saphenous vein and originating from the obturator foramen. **(B)** Varicose veins on the posterior thigh arising from the gluteal escape point, associated with reflux in the inferior gluteal veins. **(C)** Varicose veins confined to the perineal region arising from the perineal escape point, associated with reflux in the perineal vein anatomically located between the urethra and the ischial bone. **(D)** Varicose veins on the anterior thigh (red line) arising from the inguinal escape point, associated with the presence of varicose veins along the inguinal canal.

Table III. Results of the reflux patterns found in lower limb varicose veins

Reflux pattern	No. of limbs (n = 62) (%)
Connection with the great saphenous vein (thigh/leg)	18 (29)
Medial thigh course parallel to the GSV	16 (26)
Varicose veins on the posterior thigh surface	12 (19)
Varicose veins only in the perineal region	9 (15)
Connection with the sciatic nerve	6 (10)
Varicose veins on the anterior thigh surface	5 (8)
Varicose veins related to lymph nodes	5 (8)
Connection with the small saphenous vein	3 (5)

GSV, Great saphenous vein.

was based on B-mode visualization of small-caliber veins (2-4 mm) with a spiral course dissecting the fibers of the sciatic nerve, which typically demonstrated a thickened hyperechoic sheath (Fig 2). Spectral Doppler analysis revealed long-duration reflux (>1 second) elicited during distal compression maneuvers.

Venous connections involving the lymphatic network were identified in 8% of patients and were more frequently associated with the inguinal escape point. On duplex ultrasound examination, venous-lymphatic connections were identified in the inguinal region by the presence of tortuous anechoic channels within the lymph node hilum that emptied with transducer compression and demonstrated slow-flow signals modulated by respiration or the Valsalva maneuver, as illustrated in the anterior thigh pattern (Fig 2).

These findings were predominantly observed in patients with recurrent varicose veins, particularly when recurrence involved the anterior saphenous vein of the thigh, with varicose veins most commonly following an anterior thigh distribution pattern and suggesting a pelvic connection through the superficial epigastric vein.

DISCUSSION

This study builds on, but is distinct from, the comprehensive ultrasound evaluation previously reported by our group.⁹ While that prior study focused on standardizing a complete diagnostic protocol to confirm the pelvic origin of venous reflux, the present analysis provides a pattern-based morphologic characterization of lower limb varicose veins resulting from pelvic-origin reflux. By identifying specific and reproducible reflux patterns, this study aims to support the selection of patients who require a comprehensive pelvic venous investigation, rather than advocating universal pelvic screening. It highlights the continuum of venous disease spanning pelvic and extrapelvic regions through defined escape points and underscores the predominance of nonsaphenous reflux, which challenges the

adequacy of conventional saphenous vein-focused assessments.^{4,5,8}

Jaworucka-Kaczorowska et al¹² described atypical reflux frequently associated with neuropathic or lymphatic symptoms, highlighting the diagnostic importance of detecting these connections and emphasizing that varicosities of pelvic origin are anatomically and functionally distinct from typical saphenous vein incompetence. Our findings expand on these observations by demonstrating how such atypical connections translate into consistent anatomic patterns in the lower limbs, facilitating their recognition during routine venous mapping. Given the anatomical boundary between the pelvic cavity and the lower extremities by muscles and skeletal structures, only a limited number of venous routes, such as perineal, gluteal, inguinal, and obturator pathways, can transmit pelvic reflux to extrapelvic regions. Recognizing these specific conduits and their corresponding lower limb varicose patterns is critical for differentiating pelvic-origin varices from primary limb disease, particularly in cases of recurrence after standard superficial interventions.

The role of pelvic venous reflux in varicose vein recurrence has been quantitatively demonstrated by Whiteley et al,¹¹ who identified pelvic reflux as a major contributory factor in 25.6% of recurrent varicose vein cases. This prevalence rises to 31.5% among multiparous women and reached 40.9% in those without prior hysterectomy. These data reinforce the clinical relevance of accurately identifying pelvic-origin reflux; however, indiscriminate pelvic screening is impractical. The pattern-based approach proposed in this study provides a practical framework to guide targeted pelvic investigation during routine venous mapping, potentially reducing incomplete treatment and subsequent relapse.

The identification of reflux pathways involving neural and lymphatic structures further advances the understanding of pelvic venous disorders and their diverse symptomatology.¹³⁻¹⁵ In this study, varicose veins with connections to the sciatic nerve and the lymphatic network were consistently associated with pelvic escape points, supporting their pelvic origin. Duplex ultrasound examination in the standing position, performed during a Valsalva maneuver, remains the gold standard for dynamic mapping of these reflux routes. Applying the described pattern-recognition approach during venous mapping may reduce false-negative examinations for pelvic reflux and improve diagnostic efficiency for vascular sonographers and specialists.

This study has limitations, mainly the relatively small single-center sample and the fact that the cohort was derived from a previously published case-control study, which may introduce selection bias. Social determinants of health were not specifically analyzed, as the primary focus of this study was the anatomical characterization of pelvic-origin reflux patterns.

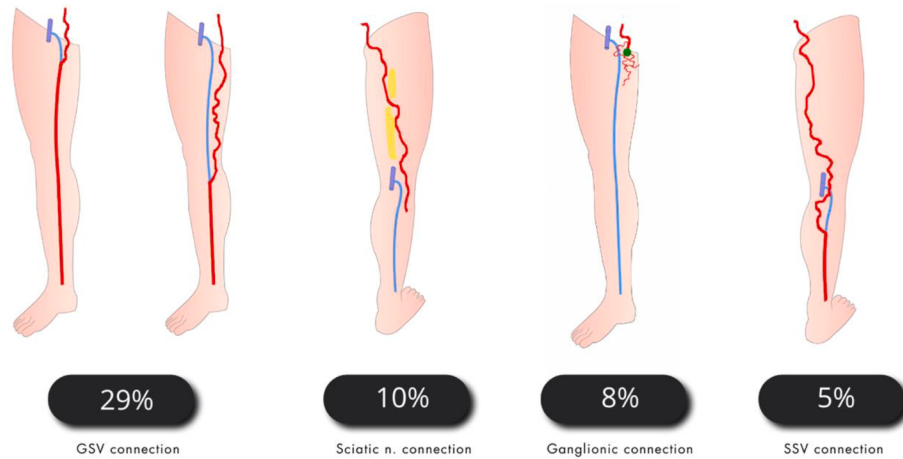


Fig 2. Illustrative diagram highlighting the anatomical connections of pelvic-origin varicose veins, with corresponding clinical presentation and ultrasound findings. **(A)** Varicose veins involving the sciatic nerve, originating from the gluteal escape point and ultrasound findings showing small-caliber veins with a spiral course dissecting the fibers of the sciatic nerve on B-mode imaging, associated with a thickened hyperechogenic nerve sheath. **(B)** Patient with prior saphenectomy presenting with recurrence through the inguinal escape point, with connection to the ganglionic network identified as tortuous anechoic channels within the lymph node hilum. GSV, Great saphenous vein; SSV, small saphenous vein.

CONCLUSIONS

Pelvic escape points are critical anatomical sources of lower limb reflux patterns, often involving nonsaphenous pathways. Recognizing how pelvic-origin reflux distributes along the leg is essential so that venous mapping can actively search for these patterns and prompt consideration of a pelvic connection. Incorporating detailed ultrasonographic assessment of these routes into a comprehensive pelvic-lower limb evaluation supports tailored interventions. This study supports an anatomy-driven perspective on chronic venous disease, highlighting pelvic venous insufficiency as a key consideration in clinical decision-making and reflecting the evolution of research over the past three decades.

AUTHOR CONTRIBUTIONS

Conception and design: JS, NO

Analysis and interpretation: JS, FB

Data collection: JS, FB

Writing the article: JS, FB, NO

Critical revision of the article: JS, FB, NO

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DISCLOSURES

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