Endovascular Treatment of an Anatomically Complex Iliac Lesion and a Review of Variant Iliac Venous Anatomy

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ABSTRACT

The diagnosis and treatment of pelvic venous disease is complicated by a number of potential venous anatomic variants. Stent-assisted recanalization of a chronically occluded left external iliac vein draining directly into the inferior vena cava, with absence of the left common iliac vein, is described here. Variant iliac venous anatomy is reviewed in 3 categories: additional iliac vessels, absence/shortening of iliac vessels, and deviations in the drainage pattern of iliac vessels. Additionally, variations of the ascending lumbar and iliolumbar veins, the identification of which can aid in the treatment of pelvic venous disease, are described.

ABBREVIATIONS

ALV = ascending lumbar vein, CIV = common iliac vein, EIV = external iliac vein, GSV = greater saphenous vein, IIV = internal iliac vein, ILV = iliolumbar vein

Identification of iliac venous variants, reported in as many as 20%–27% of normal individuals, aids in the appropriate diagnosis and treatment of nonthrombotic iliac lesions, including what is historically referred to as May–Thurner syndrome, postthrombotic syndrome, and iliofemoral deep vein thrombosis (1–5). The purpose of the present report is to review various iliac venous variants as well as variations in the iliolumbar vein (ILV) and ascending lumbar vein (ALV). The described case illustrates the treatment of a nonthrombotic iliac lesion with variant iliac venous anatomy in which identification of the ALV and ILV proved useful.

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CASE REPORT

Institutional review board approval was not required for this report. A 35-year-old woman in whom postthrombotic syndrome developed after an acute iliofemoral deep vein thrombosis 3 years earlier (treated with anticoagulation) presented after imaging performed elsewhere revealed an occluded left external iliac vein (EIV) and subsequent venography failed to identify a vessel suitable for recanalization. The patient had mild postthrombotic syndrome on the Villalta scale (score = 7), with severe left lower-extremity pain with exercise. A second attempt at recanalization was deemed beneficial.

The patient was anticoagulated for 2 days (enoxaparin 1 mg/kg twice daily) before the procedure. Under general anesthesia, left greater saphenous vein (GSV) access was obtained. Initial venography revealed a patent IVC, patent right-sided iliac veins, patent left internal iliac vein (IIV), and multiple pelvic venous collateral vessels. No acute thrombus was present. Additional access was obtained via the right internal jugular vein, and multiplanar venography was performed from above and below the presumed left EIV occlusion. After several unsuccessful recanalization attempts, review of the venograms revealed 2 diminutive and minimally opacified vessels, possibly the ALV and occluded left EIV draining directly into the IVC (**Fig 1a**). The EIV was catheterized from the GSV access, and venography revealed a common ALV–ILV trunk joining the left EIV and confirmed direct drainage of the

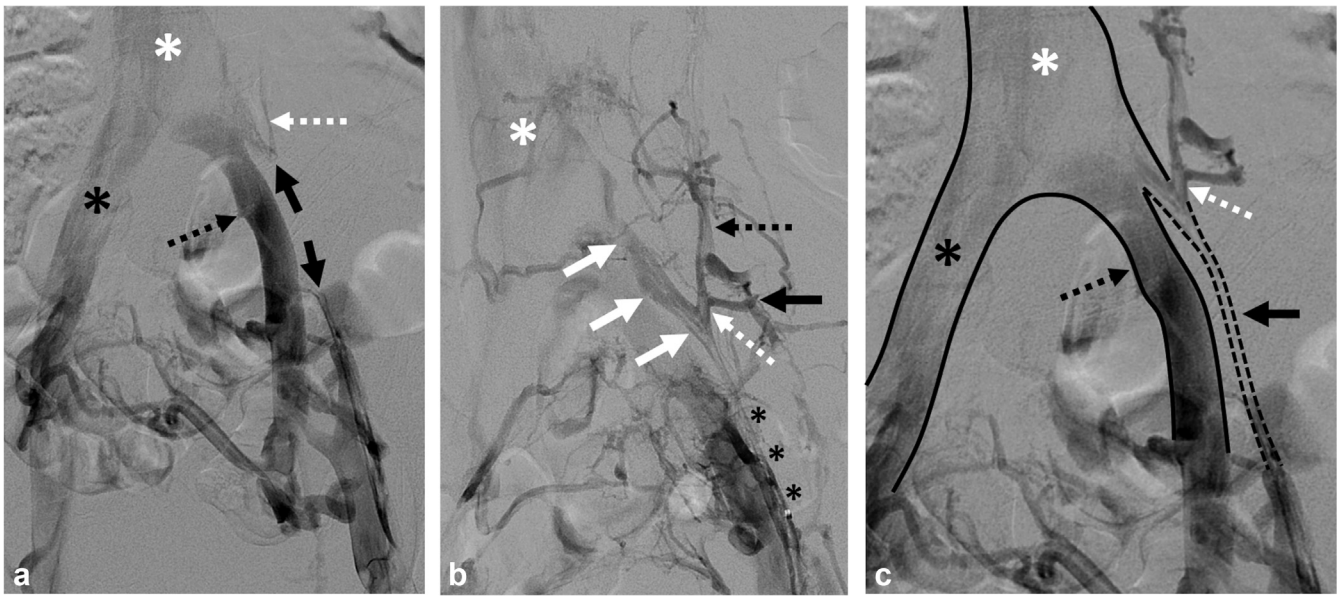


Figure 1. Intraprocedural venograms obtained via left GSV access. **(a)** Venogram obtained from the left common femoral vein shows the IVC (white asterisk), right CIV (black asterisk), presumed left CIV (black dotted arrow), partially visualized adjacent superior and inferior vessels (black solid arrows), and communicating vessel coursing superiorly (white dotted arrow). **(b)** Venogram obtained from what would later be identified as the left EIV (black asterisks) displays communication with the IVC (white asterisk), the ALV (black dotted arrow), and ILVs (black solid arrow), which form a common trunk (white dotted arrow) before joining the catheterized vessel (black asterisks), which was then identified as the EIV (white solid arrow). **(c)** A composite image of the venograms in **a** and **b** reveals the IVC (white asterisk), right CIV (black asterisk), ALV and adjoining ILVs (white dotted arrow), chronically occluded left EIV (black solid arrow), and left IIV (black dotted arrow). A trifurcation of the right common iliac vein, left IIV, and left EIV, with absence of the left CIV, is apparent.

EIV into the IVC (Fig 1b,c). A stiff guide wire was passed through the EIV into the IVC via the GSV access. Serial balloon dilation was performed using 8-, 14-, and 16-mm balloons. Venography after angioplasty demonstrated parallel drainage of the IIV and EIV into the IVC with absence of the common iliac vein (CIV; Fig 2a). Intravascular ultrasound (Volcano, San Diego, California) identified focal compression of the left EIV by the overlying right common iliac artery and determined the exact position of the EIV–IVC confluence. An 18 × 90-mm Wallstent and an 16 × 90-mm Wallstent (Boston Scientific, Marlborough, Massachusetts) were then placed in tandem from the IVC to the distal left EIV and balloon-expanded with a 16-mm angioplasty balloon. Completion venography showed a patent reconstructed left EIV with robust transit of contrast medium without demonstration of the previously seen venous collateral vessels (Fig 2b).

The patient was discharged the following day without complication and was prescribed continued enoxaparin for 30 days. The patient reported significant improvement in symptoms 3 days after the procedure and had complete resolution of symptoms within 14 days. One-month follow-up computed tomographic (CT) venography revealed a patent stent (Fig 3), and the patient's symptoms remained resolved at 2-year follow-up.

VARIANT ILIAC VENOUS ANATOMY

Classic iliac venous anatomy is present in approximately 73%–81% of individuals (Fig 4h) (2–5). Cases of variant iliac venous anatomy can be organized into 3 distinct categories: category 1 includes those with an extra iliac vessel(s), category 2 includes those with a normally occurring vessel deviating from its typical drainage pattern, and category 3 includes those with shortening or absence of the CIV.

Category 1

The most frequently encountered extra iliac vein is an extra unilateral IIV that drains ipsilaterally (Fig 4a), resulting in 2 parallel IIVs draining into the ipsilateral CIV. This has been reported in 6%–27% of individuals (2,6). Similarly, an extra unilateral IIV may drain contralaterally, resulting in 2 ipsilateral IIVs draining into opposite CIVs (Fig 4b). Morita et al (6) reported this finding in 11% of a normal patient population. The presence of bilateral extra iliac veins that form a common trunk before draining into a single CIV has been observed, albeit infrequently (Fig 4c) (6,7). An extra iliac vein communicating between 2 normally occurring iliac veins has also been reported under titles such as "accessory iliac vein," "ilioiliac anastomosis," "iliac fenestration," "iliac channel," and "interiliac vein" (Fig 4d). This variant was present, with various drainage patterns, in 10% of individuals studied by Vidal et al (2), on 8%

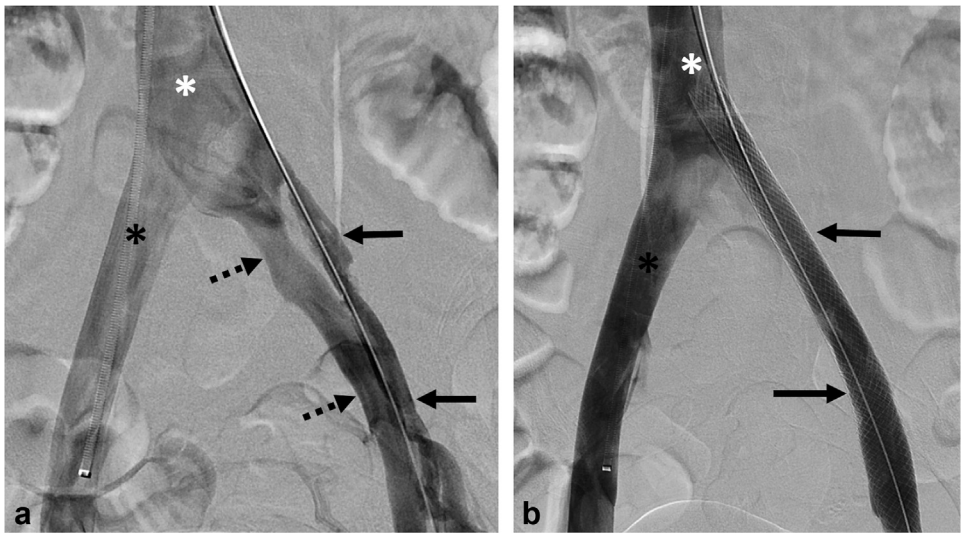


Figure 2. Venograms after **(a)** angioplasty and **(b)** stent placement. **(a)** Venogram shows the IVC (white asterisk), postangioplasty left EIV with significant residual stenosis (black solid arrowheads), left EIV (black dotted arrows), and right CIV (black asterisk). The trifurcation of the right common iliac vein, left IIV, and left EIV is again noted. **(b)** Completion venogram shows the IVC (white asterisk), a reconstituted left EIV after stent placement (black arrows), and the right CIV (black asterisk). Note that the left IIV and previously seen collateral vessels do not opacify.

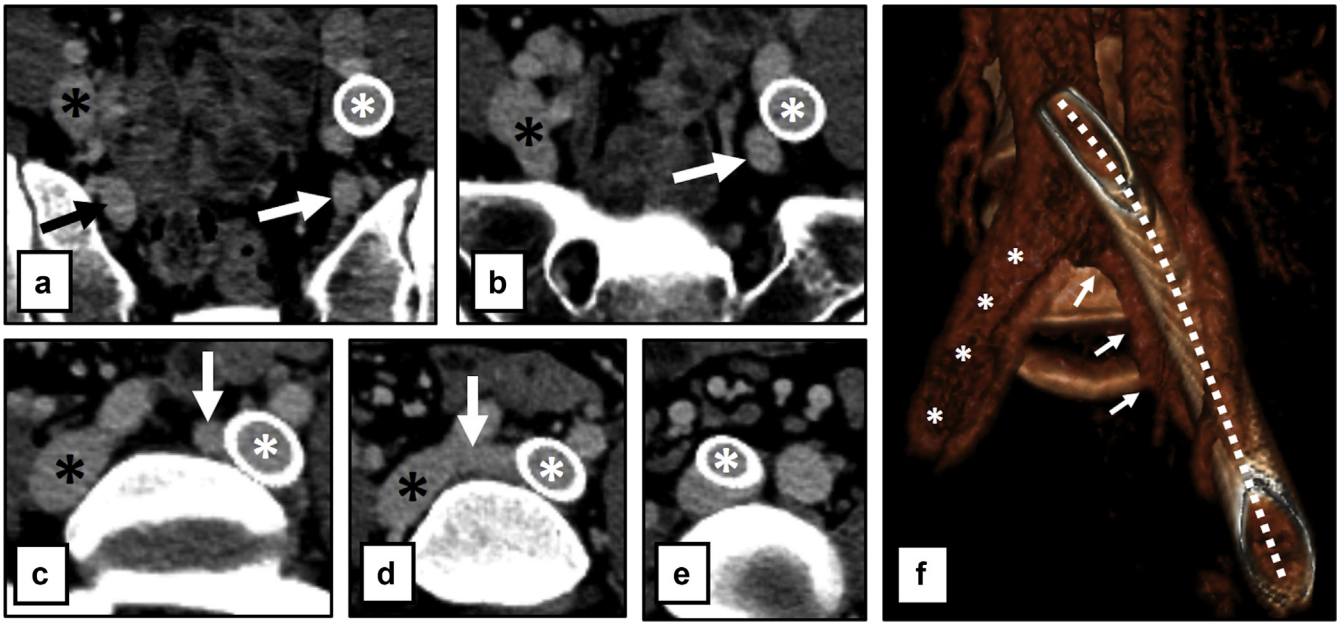


Figure 3. Postprocedural CT venogram shows a patent left EIV and the described variant anatomy. Axial slices **(a–e)** are arranged from inferior to superior. **(a)** Right EIV (black asterisk), right IIV (black arrow), stent-implanted left EIV (white asterisk), and left IIV (white arrow). **(b)** Confluence of right CIV (black asterisk), stent-implanted left EIV (white asterisk), and left IIV (white arrow). **(c)** Right CIV (black asterisk), stent-implanted left EIV (white asterisk), and left IIV (arrow). **(d)** Confluence of left IIV (arrow) and right CIV (black asterisk); the stent-implanted left EIV (white asterisk) remains separate. **(e)** Stent-implanted left EIV (asterisk) joining the IVC. **(f)** Three-dimensional rendering of the right common iliac artery (asterisks), left IIV (arrows), and stent-implanted left EIV (dotted line), with absence of the left CIV.

of CT images reviewed by Shin et al (5), and on an infrequent basis in other studies (4,8).

Category 2

The most common variant, category 2, in which a normally occurring vessel deviates from its typical drainage pattern, occurs when the IIV drains into the contralateral CIV. This has been observed in 2%–11% of individuals in 2 large studies (5,6) and in multiple case reports (7,9), and typically occurs with the right IIV draining into the left CIV, although left IIV drainage to the right CIV potentiating pelvic congestion syndrome has been reported (**Fig 4e**) (10).

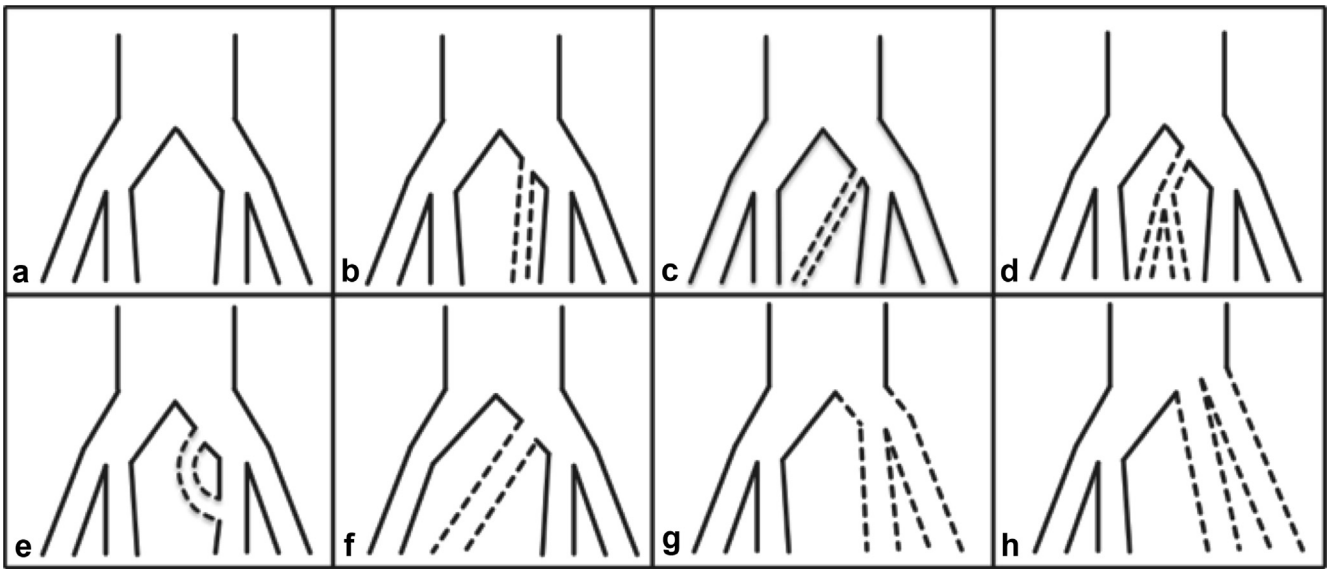


Figure 4. Normal and variant iliac venous anatomy with reported frequencies. **(a)** Normal iliac venous anatomy (73%–81%). **(b)** Extra internal iliac vein draining into ipsilateral common iliac vein (6%–27%). **(c)** Extra internal iliac vein draining into contralateral common iliac vein (11%). **(d)** Bilateral extra internal iliac veins draining into a common iliac vein (infrequent). **(e)** Accessory iliac vein communicating with ipsilateral common iliac vein (2%–10%). **(f)** Internal iliac vein draining into contralateral common iliac vein (up to 11%). **(g)** High confluence of ipsilateral external and internal iliac veins with a short common iliac trunk (8%–9%). **(h)** Parallel drainage of internal and external iliac veins into the IVC with absence of a common iliac vein (8%–9%). This variant was observed in the case described herein.

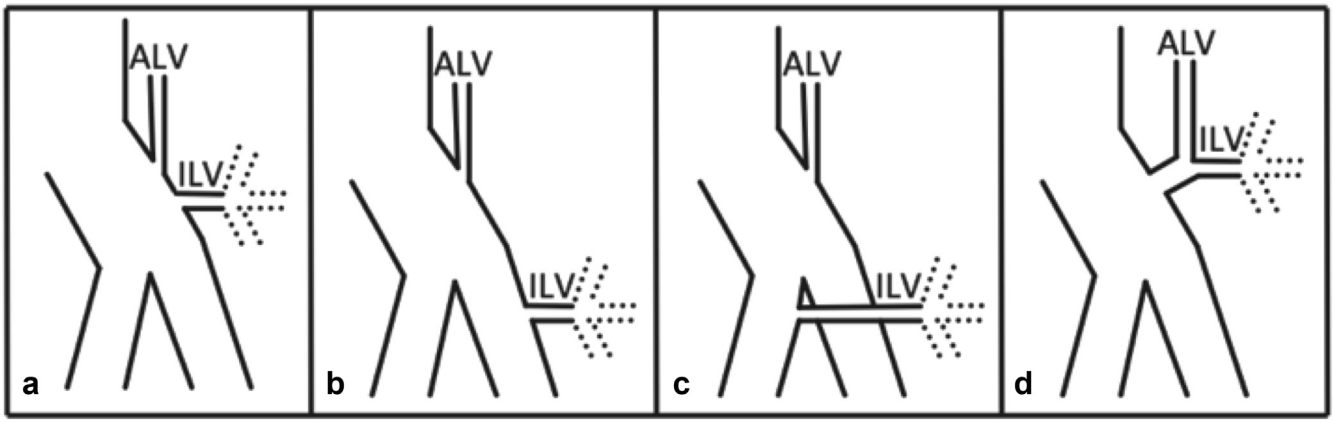


Figure 5. Normal and variant ALV and ILV anatomy with reported frequencies. **(a)** Separate drainage of the ALV and ILV into the CIV (45%–85%). **(b)** Drainage of the ALV into the CIV and ILV into the EIV (1%–22%). **(c)** Drainage of the ALV into the CIV and ILV into the IIV (3%–16%). **(d)** Drainage of a common ALV and ILV trunk into the CIV (13%–70%).

Category 3

Category 3 consists of shortening or absence of the CIV. Shortening of the CIV, with high confluence of the IIV and EIV, was reported in 8% of individuals by Morita et al (6) and Shin et al (5). The extreme of this variant, parallel drainage of the IIV and EIV into the IVC with absence of the CIV, as observed in the present case, has also been described (**Fig 4f**) (3,4,7). Venieratos et al (4) reported this variant in 8.5% of patients studied. It is unclear whether different studies considered shortening of the CIV or absence of the CIV separate entities or the same variant, as most studies report only one or the other, and have reported their occurrences at similar rates. However, a clear anatomic distinction can be made.

ASCENDING LUMBAR AND ILIOLUMBAR VENOUS ANATOMY

The ALV communicates between the lumbar, iliolumbar, and iliac veins in the paravertebral line, and the ILV drains blood from the iliac fossa, iliacus, and psoas muscles (8). The 2 are distinguished from each other based on their orientation; the ALV runs longitudinally, whereas the ILV runs horizontally. The ALV and ILV may drain separately into the iliac system or form a common trunk before doing so.

The ALV drains separately from the ILV in 45%–85% of cases (4,11,12). When it does so, it typically drains into the CIV, in what is considered the normal drainage pattern (**Fig 5a**). If the ALV does not drain into the CIV, it drains

into the confluence of the IIV and EIV or into the EIV. The aforementioned drainage patterns account for 95% of ALVs. The ALV infrequently drains into the IVC or IIV (4).

The ILV consists of 1 vein or 2–3 tributaries forming a common ILV trunk. When draining separately from the ALV, the ILV most commonly drains into the CIV (**Fig 5a**), but may drain into the EIV in 1%–22% of cases (**Fig 5b**) and into the IIV in 3%–16% of cases (**Fig 5c**) (11–13). Lolis et al (12) reported absent ILVs in 29% of individuals, although this is not described at such a high frequency in other studies (12).

When the ALV and ILV do not drain separately, they form a common trunk before joining the iliac veins (**Fig 5d**). This has been reported in 13%–70% of individuals (12). Common ALV–ILV trunks join the CIV in the large majority of cases, but may also join the EIV or IIV. In the limited number of reported cases of a common trunk that drains into the external or internal iliac vein, it was found that all trunks joining an EIV occurred on the left, as seen in the patient presented here (**Fig 1b,c**), whereas all common trunks joining an IIV occurred on the right.

In a cadaveric study, Venieratos et al (4) reported on the drainage of the ALV and ILV in multiple subjects who had absent CIVs, as described in the present case. In all cases of absent CIVs, the ALV and ILV drained into the EIV separately or with a common trunk (4).

In conclusion, variant iliac venous anatomy is not uncommon and may be encountered in the diagnosis and treatment of various venous diseases. Thrombotic and nonthrombotic lesions may limit opacification of the affected vessels during contrast-enhanced cross-sectional or venographic imaging, and the variant anatomy may not be apparent. In the case presented here, knowledge of iliac venous variants and identification of the ALV and ILV aided in recanalization of a variant EIV that drained directly into the IVC.

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