Short form guideline: Duplex ultrasound examination of the lower limb for chronic venous disease: evidence-based guideline for sonographers

This short form guideline should be read in conjunction with its parent document, the full guideline.

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A. Introduction to the Guideline

This short form guideline serves as a resource for sonographers when seeking information contained in its parent document, the full clinical guideline. While it offers a convenient quick reference for daily practice, it is important to read and understand the full guideline before using this short form guideline.

In addition to referring to this clinical guideline, clinical decision making must also take into account specific clinical circumstances of each case, including patient preferences, referrer preferences and any local protocols.

The clinical guideline contains numerous documents which are either 1) Explanatory to the guideline, 2) Educative, 3) General guidance, 4) Specific guidance (recommendations), or 5) Useful resources.

1. Explanatory documents

"Section A (preliminary information)" provides introductory information including an executive summary, the scope of the clinical guideline and acknowledgements.

"Abbreviations" lists commonly used abbreviations in the diagnosis and treatment of chronic venous disease (CVD) along with their full terms.

"Glossary" provides explanations of commonly used terms.

"References" provides a full reference list relating to this clinical guideline.

"Appendix 2" provides information on the methodology used to develop this clinical guideline.

Terminology used in the guideline is clarified in Section B and Section C (Some notes about general terminology and nomenclatures of the veins of the lower limb)

2. Educative documents

Educative documents should be treated as a resource to improve understanding of CVD and the key objectives of venous insufficiency duplex ultrasound (US) examinations.

"Section B (Background)" provides information on CVD; contributing risk factors, signs and symptoms, pathophysiology, prevalence and socio-economic burden and the role of duplex ultrasound.

"Section C (Venous anatomy of the lower limb)" provides extensive anatomical descriptions of venous anatomy relevant to the investigation of venous system. Figure C1 *Lower limb superficial venous anatomy* and Figure C2 *Topographic representation of regions of groups of perforating veins* provide reference to the precise location of the superficial and perforating veins, allowing accurate identification and documentation.

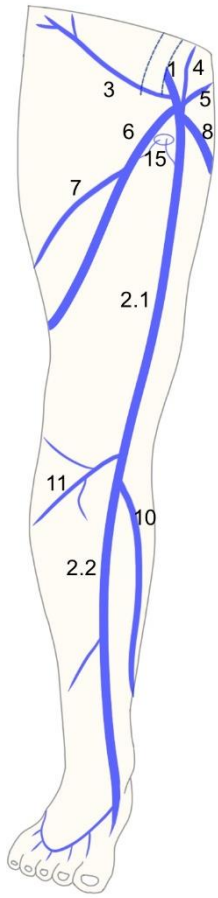
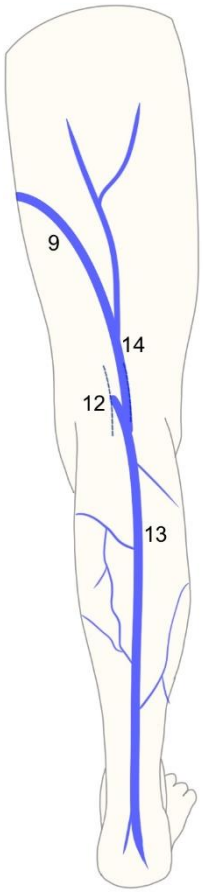
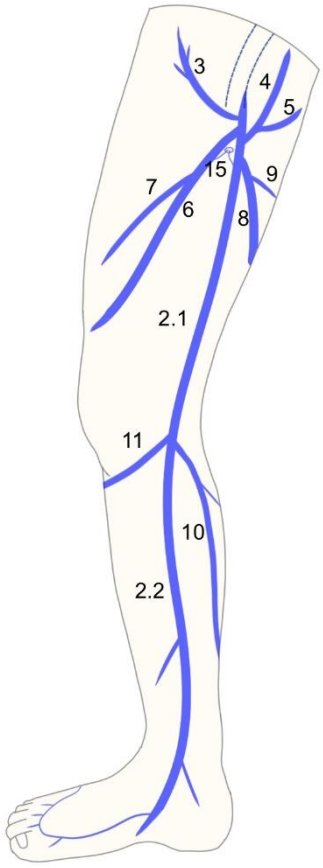
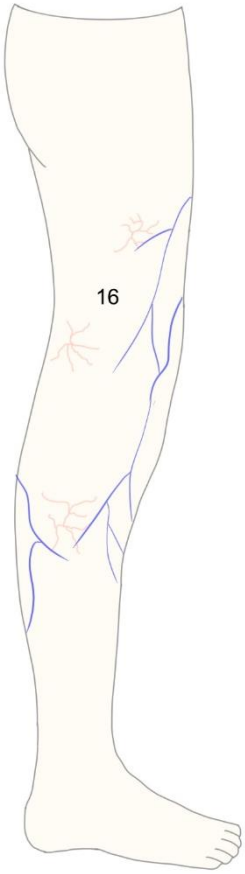
"Section D (Pre-examination considerations)" provides educative information to answer the following questions;

- What is the purpose of venous insufficiency ultrasound examination?
- What are the indications, contraindications and limitations of duplex US to investigate CVD?

"Section E (Performing and interpreting venous insufficiency ultrasound examination)" provides information about what information the vascular care provider (referrer) needs, and differential diagnoses that a sonographer may be faced with when performing the scans

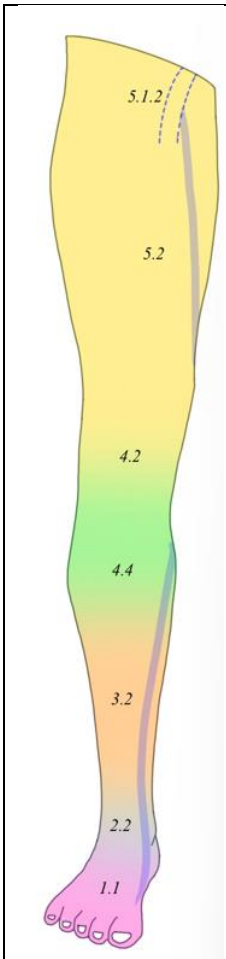
"Appendix 1" provides the full classification of CEAP (Clinical-Etiology-Anatomy-Pathophysiology), a classification system used by clinicians to grade CVD.

Figure C1 Lower limb superficial venous anatomy

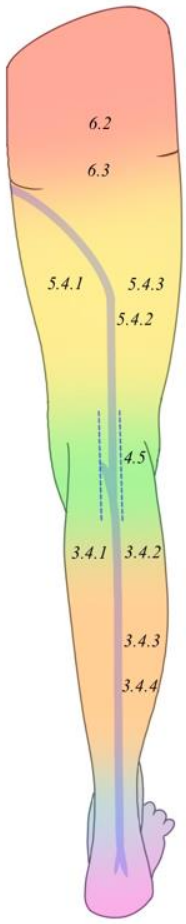
a. Anterior view	b. Posterior view	c. Medial view	d. Lateral view
			

Key:			
1: Saphenofemoral Junction (SFJ).	2.1: Great saphenous vein above knee (GSVa).	2.2: Great saphenous vein below knee (GSVb).	3: Superficial circumflex iliac vein (SCIV).
4: Superior epigastric vein (SEV).	5: Superficial external pudendal vein (SEPV).	6: Anterior saphenous vein (ASV).	7: Anterior thigh circumflex vein (ATCV).
8: Posterior accessory of the great saphenous vein (PAGSV).	9: Posterior thigh circumflex vein (PTCV).	10: Posterior arch vein (PAV, also known as the posterior accessory of the great saphenous vein of the lower leg).	11: Anterior arch vein (AAV, also known as the anterior accessory of the great saphenous vein of the lower leg).
12: Saphenofemoral Junction (SPJ).	13: Small saphenous vein (SSV).	14: Giacomini vein (variation to cranial extension of small saphenous vein).	15: Lymph node venous networks (LNVN).
16: Lateral Sub-dermic Venous System.			

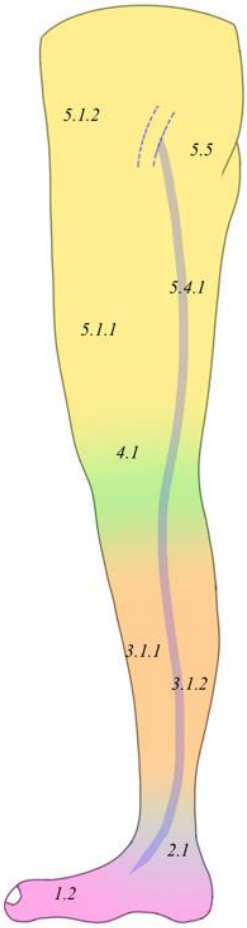
Figure C2 Topographic representation of regions of groups of perforating veins



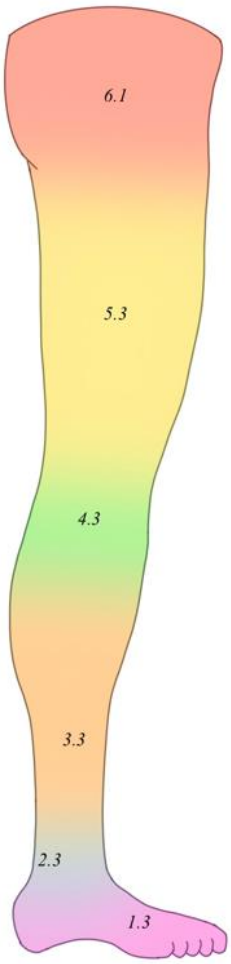
a. Anterior view



b. Posterior view



c. Medial view



d. Lateral view

Key:			
Foot Perforating veins	1.1: Dorsal foot	1.2: Medial foot	1.3: Lateral foot
Ankle Perforating veins	2.1: Medial ankle	2.2: Anterior ankle	2.3: Lateral ankle
Leg (calf) Perforating veins	3.1.1: Paratibial	3.1.2: Posterior tibial	3.2: Medial leg (calf)
	3.3: Lateral leg (calf)	3.4.1: Medial gastrocnemius	3.4.2: Lateral gastrocnemius
	3.3.3: Intergemellar	3.3.4: Para-Achillean	
Knee perforating veins	4.1: Medial knee	4.2: Suprapatellar	4.3: Lateral knee
	4.4: Suprapatellar		
Thigh perforating veins	5.1.1: Femoral canal	5.1.2: Inguinal	5.2: Anterior thigh
	5.3: Lateral thigh	5.4.1: Posteromedial thigh	5.4.2: Sciatic
	5.4.3: Posterolateral thigh	5.5: Pudendal	
Gluteal perforating veins	6.1: Superior gluteal	6.2: Mid gluteal	6.3: Lower gluteal

3. General guidance

'General guidance' answers questions which are not suited to concise recommendations, as multiple facets of information are required to answer the question. The following table lists questions that are answered in this guideline using 'general guidance'.

Question, its answer, and section in the guideline		Summary of answers (refer to full guideline for comprehensive information)
Section D: Pre-exam	What patient preparation is required?	While no specific patient preparation is required, general guidance is provided on pre-examination patient information, such as preferred attire, obtaining consent, respecting patient preferences.
	What pre-examination explanation should be provided to the patient?	Outlines the necessary conversation with patients prior to commencing the examination.
	What medical and surgical patient history should the sonographer collect?	Refer to Table D3 (Section D in full guideline) for medical and surgical history sonographer should consider prior to commencing the examination
	How should sonographers perform clinical assessment prior to the examination?	Refer to Table D4 (Section D in full guideline) for visual assessments that sonographer should undertake before commencing the examination
Section E: Scanning and interpret-ation	What information does the referring vascular care provider need?	Refer to Section B in this document
Section F: General	What are potential limitations, and difficulties that may be encountered in the examination?	If difficulties or limitations are encountered, they should be documented, and an extended scan time may be required. Difficulties and limitations may occur due to difficult body habitus, ineffective provocation manoeuvres, small veins, right heart failure, patient immobility, fainting and wounds.
	Are there any ethical concerns?	Due to its low risk, there would be few reasons to deny a patient a venous insufficiency ultrasound examination. Written consent is generally not required. However, if a patient considers the groin assessment to be an intimate examination, refer to ASA guidelines on consent and intimate examinations.
	When should a bilateral examination be performed?	This is usually guided by referrer and departmental preferences. If, in a unilateral examination, transmitted pulsatility or loss of phasicity in the common femoral vein (CFV) is detected, then a spectral trace of the contralateral CFV would be beneficial to confirm the influence of either a cardiac cause or an intra-abdominal or pelvic obstruction.
	What instrumentation and settings are required to perform the exam?	Refer to Section F for guidance on room requirements and preparation (includes equipment, ultrasound system settings for B-mode, Colour Doppler, Spectral Doppler. Also refer to Images 99-102 for examples of room setup).
	How long should the venous insufficiency ultrasound examination take?	Unilateral study: It is reasonable for a unilateral booking to be 30-45 minutes (a longer time may be required if sonographer is required to produce schematic/worksheet at end of the appointment) Bilateral study: It is reasonable for a bilateral booking to be 45-90 minutes (a longer time required if sonographer required to produce schematic/worksheet at end of appointment)
	What are relevant quality and safety issues risk and how should they be mitigated?	Work-related musculoskeletal disorders: Workplaces should provide equipment that offers ergonomic solutions to minimise the risk of work-related musculoskeletal disorders. Sonographers have the right to adapt, shorten, or discontinue the scan if they feel that either the patient or themselves are not safe. If this occurs, it should be documented, together with any justifications, alternate arrangements or suggestions. Infection control: refer to existing guidelines ALARA: Aim to keep thermal and mechanical indices as low as possible, without compromising the diagnostic quality of the examination, keep examination times as short as possible.
	How should the venous insufficiency examination be reported?	Refer to Section F of the full guideline
	What criteria should be used to triage patients by urgency for performing and reporting the duplex ultrasound examination?	Refer to Table F1 in Section F of the full guideline

4. Specific guidance (recommendations)

The following table lists questions that are answered by specific, concise recommendations. **Refer to full guideline for explanatory statements, and possible exceptions for the following guidelines.**

Location of the question and corresponding recommendations in the clinical guideline	Question	Recommendation
Section E: Scanning and interpretation	What information does the referring vascular care provider need?	Refer to Section B in this document
Section F: General considerations	What qualification or training is required for sonographers performing duplex ultrasound to investigate chronic venous disease?	**Recommendation F1:** We recommend that sonographers who perform duplex ultrasound in Australia and New Zealand to assess for chronic venous disease in the lower limb should have a recognised qualification. Student sonographers should be supervised by a sonographer or other qualified specialists in vascular ultrasound who have experience in performing venous insufficiency scans.
Section G: Technical considerations	What time of the day should the venous insufficiency ultrasound examination be performed?	**Recommendation G1:** For increased sensitivity in the detection and measurements of venous reflux, it is preferable to perform duplex ultrasound in the afternoon to investigate chronic venous disease.
	What position should the patient be in during the venous insufficiency ultrasound examination?	**Recommendation G2:** We recommend that evaluation of reflux with duplex ultrasound should be performed with the patient standing, with the lower limb under examination non-weight bearing whenever possible. A sitting or reverse Trendelenburg position can be used if the patient cannot stand or if it is not safe for them to stand.
	What provocation manoeuvres should be used to elicit venous reflux?	**Recommendation G3:** We recommend that to confirm valvular incompetence, venous reflux should be elicited using the following manoeuvres for the following veins: Common femoral vein (CFV): Valsalva manoeuvre to increase intra-abdominal pressure and/or distal augmentation. • Saphenofemoral junction (SFJ): Valsalva manoeuvre to increase intra-abdominal pressure and/or distal augmentation • Vein segments distal to SFJ: Distal augmentation Distal augmentation is performed using manual or cuff compression distal to the point of examination. Sonographers should be aware of alternate methods to elicit venous reflux that may be more applicable in different circumstances such as; • Where patient or sonographer comfort is compromised, • When the patient cannot perform Valsalva, • The patient has a large body habitus, • Or if venous reflux is suspected but cannot be demonstrated using Valsalva or distal augmentation.

5. Useful resources

Supplementary file 1 (Patient information): To be used or adapted to assist in communicating with patients prior to duplex ultrasound investigation for venous insufficiency.

Supplementary file 2 (Example worksheets and templates): Example sonographer worksheets with templates to guide sonographer reporting of duplex ultrasound examinations for venous insufficiency.

Supplementary file 3 (Image Gallery): Provides visual examples of both clinical and ultrasound images, illustrating normal and pathological findings. Within the full guideline, referenced images are denoted in purple text.

B. Performing and interpreting venous insufficiency ultrasound examinations

This section is an extract from Section E in the full guideline. It is recommended to read the full guideline before referring to this shortform guide.

What information does the vascular care provider (referrer) need?

The primary aim of the venous insufficiency ultrasound examination is to assess the competency of the valves in the deep and superficial venous systems, along with the junctions and perforating veins. The source of reflux responsible for superficial varices should be established and mapped, including any clinically relevant perforating veins, or possible alternative refluxing venous pathways. [23, 47, 85, 89, 103]
Secondary aims include the following, which are relevant to the treatment decisions of the vascular care provider:

- To identify deep venous obstruction, including partially occluded venous segments
- To identify superficial venous thrombosis
- To evaluate the tortuosity of the target vein (for ablation)
- To identify the diameter of saphenous veins
- To identify tributary veins (veins superficial to saphenous fascia) as the target veins for ablation. [42, 83]

Recommendation E1: A complete duplex ultrasound examination for chronic venous disease of the lower limb should evaluate deep, superficial, and perforating veins for patency and competency. B-mode ultrasound and spectral Doppler imaging are essential for assessment; however, colour Doppler is also an important complimentary tool for assessing vein patency and competency.
Measurements of reflux duration *(refer to Recommendation E5 and Table E1) and vein diameters (refer to Recommendation E2 and Table E1)* should also be made.

Vein diameter measurements:

The measurement of vein diameters is used to guide treatment decisions, [10, 44, 45, 62, 105] and may also serve as surrogate markers for reflux and disease severity as studies have demonstrated associations between diameter measurements and reflux, as well as reflux severity. [107-113]

Recommendation E2: In relation to the method of measuring vein diameter, between the anterior and posterior vein walls, we recommend that the measurement should be made:
a. with patient's legs in a dependent position
b. from a transverse image of the vein
c. between the inner walls
d. with the vein at rest and not during any reflux provocation manoeuvres
e. with the vein uncompressed

During an examination, if a venous segment is found to be grossly dilated and aneurysmal, particularly outside the valve sinus, its maximum diameter should be measured. A venous aneurysm is generally defined as a persistent, isolated dilatation of the vein to twice its normal diameter, although no consensus exists on the exact definition. [112]

Role of colour Doppler for assessment of venous reflux

Recommendation E3: Sonographers should not use static colour images for the representation and documentation of venous reflux within a sampled vein segment; instead, a Doppler spectral trace should be used.

How to obtain an accurate spectral Doppler trace:

Recommendation E4:
For best accuracy in detecting venous reflux, a spectral Doppler trace should be made:

- from a longitudinal image of the vein
- with the sample gate placed in the centre of the vein, and covering the entire lumen of the vein
- with spectral Doppler sampling performed with a 45-60 degrees angle between the vein wall and the ultrasound beam.

An example of spectral Doppler analysis illustrating venous incompetence is provided in **Image 24** of the Image Gallery.

What cut-off values should be used for diagnosing venous reflux of the veins of the lower limb?

Recommendation E5: Venous reflux is defined as:

- > 1second of reversed flow in the femoropopliteal segments (e.g., common femoral, femoral and popliteal veins).
- >0.5 seconds of reversed flow in superficial veins (e.g., the GSV, SSV, ASV, PAGSV, Giacomini vein), calf veins (e.g. posterior tibial veins) and deep (profunda) femoral veins.
- >0.5 seconds for perforating veins.

Assessments required for specific veins (General guidance):

Refer to Table E1 in Section E1 of the full guideline for explanatory notes.

Veins to be evaluated (note in some cases, the listed veins may not be present)	Visualise	Test for venous obstruction	Test for venous reflux	Measure vein diameter (Yes/Optional)
Deep Veins				
Common Femoral Vein (CFV)	Yes	Yes	Yes	Optional
Femoral Vein (FV)	Yes	Yes	Yes	Optional
Popliteal Vein	Yes	Yes	Yes	Optional
Superficial Veins				
Sapheno-femoral Junction (SFJ)	Yes	Yes	Yes	Yes
Great Saphenous Vein (GSV)	Yes	Yes	Yes	Yes
Anterior Saphenous Vein (ASV)	Yes	Yes	Yes	Optional
Posterior Accessory of the Great Saphenous Vein (PAGSV)	Yes	Yes	Yes	Optional
Superficial Circumflex Iliac Vein (SCIV)	Yes	Yes	Yes	Optional
Superficial Epigastric Vein (SEV)	Yes	Yes	Yes	Optional
Superficial External Pudendal Vein (SEPV)	Yes	Yes	Yes	Optional
Sapheno-popliteal Junction (SPJ)	Yes	Yes	Yes	Yes
Small Saphenous Vein (SSV)	Yes	Yes	Yes	Yes
Thigh extension of the SSV or Giacomini Vein (TE)	Yes	No	Yes	Optional
Un-named tributaries	Yes	Yes	Yes	Optional
Perforating Veins (PV)	Yes	Yes	Yes	Optional
Non-saphenous Veins				
Vulval Varicosities	Yes	No	Yes	Optional
Gluteal Varicosities	Yes	No	Yes	Optional
Popliteal Fossa Vein (PFV)	Yes	No	Yes	Optional
Posterolateral Thigh Perforator (PLTP)	Yes	No	Yes	Optional
Sciatic Nerve Varices (SNV)	Yes	Yes	Yes	Optional
Knee Perforating Veins	Yes	Yes	Yes	Optional
Bone Perforating Veins	Yes	Yes	Yes	Optional
Lymph Node Venous Networks	Yes	No	Yes	Optional

When to extend the examination? (General guidance)

This table has been abridged slightly from the full clinical guideline.

Circumstance	Action
Patient has suspected pelvic venous disorders. (These patients may present with varices *in the pubis, labia, perineum, or buttocks, extensive unilateral oedema, abdominal wall collaterals).*	-record suspected pelvic source of reflux even if a pelvic ultrasound study is not performed. -consider duplex ultrasound assessment of abdominal and/or pelvic veins, (including transvaginal assessment) taking into account views of the reporting physician or vascular care provider (referrer) and the patient, the availability of persons with expertise to perform the assessments, availability of alternate cross-sectional imaging, technical difficulty of ultrasound assessment (i.e, abdominal obesity, presence of bowel gas).
Abnormal CFV flow; loss of spontaneous flow with respiratory and cardiac modulation	-At minimum, assess iliac veins and IVC for obstruction. If there is iliac occlusion, collateral circulation in the groin with suprapubic flow that crosses to the opposite groin can be visualised. [46]
An incompetent vein becomes competent.	-The outflow needs to be determined.
Multiple segmental reflux is noted in one vein.	-If multiple segmental reflux is noted, check for a refluxing vein connecting the segments.
Patient with varices but without SFJ or SPJ incompetence.	-Consider non-saphenous sources of reflux. Assess for incompetent perforating veins and deep veins. Track varicose side branches both distally and proximally to help locate the source of reflux.
Patient has clinical signs of CVD, but there is no deep or superficial incompetence on duplex US.	-Other reasons for these signs include: calf muscle pump deficiency, coexisting microvascular arterial disease, increased central venous pressure from underlying cardiac dysfunction or popliteal vein compression syndrome.
Patient with deep vein reflux to the level of the popliteal vein	-Extend assessment to the calf veins. If calf veins are duplicated, test both duplicated vessels, because one may reflux while the other remains competent.

Post treatment considerations (General guidance)

The duplex ultrasound should focus on the regions of the SFJ and SPJ , which are the most frequent sources of recurrence [21, 45] and also on possible perforating vein incompetence, as this is more common after surgery than previously thought. [21]

Post-treatment instructions for the sonographer

- Assess treated and untreated veins [42] including saphenous and non-saphenous veins (e.g., lateral venous system), as well as the site of previous perforating vein ligation, for the presence or absence of reflux and thrombosis. [92]
- The source of persistent or recurrent varices should be identified by their 'escape points', as either: (a) refluxing vein where a connection with the deep veins exists via a perforating vein, or (b) veins where the reflux is not linked to a perforating vein but is generated by the filling of the incompetent tributary veins. All 'escape points' to varices should be documented where possible. In many cases of recurrent veins, no clear source of the recurrent veins can be identified on duplex US. Visualisation may be difficult due to the small size of vessels or image degradation due to body habitus or soft tissue scarring related to past surgery. To optimise visualisation, correct adjustment of duplex US equipment with sensitive imaging settings and/or vigorous methods of eliciting reflux is required to highlight low-velocity reflux.
- Assess for neovascularisation at the surgical site (especially at the SFJ) or arteriovenous malformations.
- Be aware of possible complications (Table E3, in Section E), and if there are concerning sonographic or clinical appearances, the reporting doctor or referring doctor should be made aware in a timely fashion according to urgency. In most cases, it will be sufficient to provide this information in the report to the referring health practitioner.
- The diameter of the treated vein may be measured. The non-treated veins may be assessed for reversal of venous incompetence for consideration of future treatment.

Specific to post-endovenous procedure, the sonographer should:

- Assess for endothermal heat induced thrombosis (EHIT) **(Images 68-72)** or endovenous glue induced thrombosis (EGIT) **(Image 73)** which can occur at the saphenofemoral or saphenopopliteal junctions.
- Assess for deep vein thrombosis and deep vein sclerosis **(Image 74).**
- Assess the treated vein for residual patency and reflux.
- Measure the length of patent sections of treated veins. [92,99]

General guidance for post treatment duplex ultrasound at specific sites

This table has been abridged slightly from the full clinical guideline.

Assess:	Treatment	
	Post ablation	**Post stripping with or without ligation**
SFJ and terminal GSV	• The terminal part of the GSV usually remains open with obliteration of the upper GSV/ASV. • The upper GSV may receive inflow from one or more tributaries of the SFJ, such as from a Giacomini vein or pudendal veins. • A patent terminal portion of the GSV of <3cm length is considered a normal finding. • Assess the CFV for thrombus extension from the GSV; if present, assess its extent. Thrombus extension into the CFV should always be considered a pathological finding. • Assess for reflux, and if present, it is always pathological. • Reflux may not be detectable with obliteration of the upper GSV/ASV as the compliance of the terminal GSV is reduced. • Assess any varicose veins in this area. The source of varicosities may be an incompetent or non-obliterated saphenous trunk, an incompetent part of the GSV in the groin, a pelvic source, recanalisation of previously sclerosed veins, an incompetent ASV or PAGSV, newly developed perforating vein incompetence, or an untreated, refluxing double SFJ. There is usually no detectable connection with any visible varicose veins at short-term follow-up.	• A normal post-flush ligation CFV lacks any residual GSV segment or any incompetent superficial vein in the groin. The GSV terminal valve will not be present. • A residual stump of the GSV is present if the ligation was performed at a distance from the CFV (low ligation), rather than a flush ligation. In this case, the terminal valve is usually seen with one or more residual SFJ tributaries. Measure the diameter of a residual stump and assess for reflux in the stump or any of its connections. Reflux from the residual stump can connect with a residual ASV or other varices, which differs from the more common pattern of recurrent veins through the SFJ and its residual tributaries. If the terminal valve is competent, the stump receives inflow from its tributaries that drain normally into the SFJ. This pattern of flow is usually seen after successful ablation, but may also be found after selective stripping of the GSV trunk with a low ligation which preserves the saphenofemoral confluence.
Above-knee GSV and ASV	• Assess both veins as the ASV may be involved in recurrence after GSV ablation, and vice-versa. Less frequently, PAGSV and Giacomini vein may have a role in recurrence. • Assess veins in entirety, as is usual to treat complete vein above knee, if successful it will be obliterated in its entire course. Test reflux across whole length of vein as reflux can be segmental or occur across the whole vein length. Any evident reflux is always pathological. • Vein diameters will vary post-ablation due to inhomogeneous reduction across vein length. The vein may be not visible on ultrasound, or visible as a hyperechogenic tract in the saphenous compartment. Sometimes, it may contain heterogeneous content with no flow or reflux, and a partially compressible lumen, possibly representing blood or thrombus in the lumen in an early stage. • Describe reflux distribution and possible escape points (i.e., SFJ, perforating veins, refluxing pelvic veins) • Antegrade flow without reflux may sometimes be demonstrated in a partially or completely patent residual GSV trunk. This may result from reduced vein size and the obliteration of escape points; it may represent a good physiological result, as the reflux is abolished.	• Presence/absence should be determined by assessing the saphenous compartment. If still completely or partially present within its 'saphenous eye', the diameter and length of the residual GSV segment should be measured, and reflux assessed. Reflux may be due to persistence in the varicose network after removing the GSV, or to the varicose network dilating and developing reflux postoperatively. Revascularisation of the strip-track may occur, with multiple convoluted channels in the track of the previously stripped GSV. This should be described as 'multiple venous channels in the saphenous compartment' to distinguish it from the pre-operative varicose network. These venous channels should be assessed for reflux, and for their connections with any clinically obvious recurrent varicose veins. In multiparous women, it is typical for incompetent abdominal pelvic veins to connect directly with residual GSV segments, or superficial tributaries in the thigh after surgery; they may have even been present before surgery.
GSV below the knee	• Assess for reflux and thrombosis • Even if incompetent pre-treatment, it is usually ablated just to knee level. • May exhibit reflux or no reflux post-treatment. • Partial or complete thrombosis of the GSV remnant may occur after ablation of the above-knee GSV.	
SPJ and the SSV.	• Post ablation, the SPJ is usually patent, with obliteration of the SSV at the proximal-mid calf.	• note if ligation has been performed flush at the level of the popliteal vein, or at the confluence with one or

	• Exclude DVT in the calf muscle veins (e.g., gastrocnemius veins, intergemellar vein) • The proximal tributaries at the SPJ may remain patient, especially any thigh extension of the SSV. • Measure length of the patent SSV from the SPJ, rather than from the skin crease of the popliteal fossa. • Obliteration of the treated SSV segment should be assessed and any residual segments of the SSV should be tested for reflux.	more gastrocnemius veins; in which case, a residual stump has been left intentionally, since it represents a common track between gastrocnemius vein(s) and the proximal SSV. • Assess residual stump for reflux, which is frequently seen after SSV surgery, due to the great variation at the level of the SPJ. • Look for sources of recurrent varicose veins such as: ○ (pre- or) postoperative incompetence of the popliteal fossa vein. ○ (pre- or post-operative gastrocnemius vein incompetence ○ (pre- or) postoperative popliteal vein incompetence. ○ incompetent proximal veins (e.g., pelvic, gluteal veins and/or sciatic nerve varices) which may connect directly with residual SSV segments; often seen in women with pelvic varices.
Perforating veins (PVs)	• Assess treated PVs for obliteration or persistent flow, particularly outward flow during the release (diastolic) phase of the compression-release manoeuvre. If the perforator remains patent, assess with Doppler to determine its competency. Any extension of the reflux into saphenous or tributary veins should be traced.	• After saphenous stripping and phlebectomy, PVs mainly show normal inward flow and a diameter reduction at short- and mid-term follow-up, though long-term data are still lacking.

Differential diagnosis (General guidance)

Sonographers should always be aware that the signs and symptoms of CVD can overlap or co-exist with other conditions. Table E5 in Section E of the full guideline describes a range of these conditions and their sonographic appearances, with examples provided in the Image Gallery.