is mainly dependent on the local expertise in performing and evaluating these images.

2.4.1. Magnetic resonance venography. MR venography (MRV) can provide information about the venous system that is enhanced by 3-D reconstruction. Dynamic imaging information can be provided as well with regard to velocity and volume. MRV can visualise deep vein obstruction, fibrotic scarring of the vein wall and in the lumen (post-thrombotic fibrosis), as well as collaterals and VVs.[55]

2.4.2. Computed tomography venography. CT venography (CTV) is generally more available than MRV and its imaging protocols receive wider acknowledgement by the medical community.[56] Obviously, CTV necessitates the use of iodinated contrast and ionising radiation, comparing unfavourably with MRV. There are two main techniques for performing lower limb CTV. Indirect CTV is performed as post-intravenous contrast enhanced CT, with imaging results largely dependent on cardiac output, size of the intravenous line, rate of injection, and degree of hydration. Direct CTV generally involves intravenous injection of contrast in the foot or directly into the FV or POPV with ascending acquisition of imaging, providing improved detail. Direct CTV may allow for increased detailed imaging of luminal pathology. However, contrast transit times are hard to predict and therefore adequate imaging of abdominal, pelvic, and peripheral veins may be cumbersome.

2.5. Endovenous imaging

Historically, angiography has been established as the "gold standard" to diagnose macroscopic vascular pathology. However, for CVD, venography has not been adequately validated. Ever since endovascular treatment became available for chronic venous obstruction, IVUS has challenged venography for dominance. However, it needs to be emphasised that none of the currently available imaging modalities have been validated for clinically relevant CVD.

2.5.1. Venography. Classical ascending venography (also called phlebography) by access and contrast injection from a foot vein has no additional value over DUS to screen for deep venous obstruction and is now considered obsolete. Venography with access gained through the POPV, FV, or CFV, has previously been used to evaluate particular aspects of supra-inguinal venous obstruction. It can indirectly diagnose left CIV obstruction through the identification of a combination of collaterals and a flattened CIV (pancaking).[57] Although multiplanar venographic imaging in at least two perpendicular projections may improve its diagnostic value, it is impractical and increases radiation exposure and iodinated contrast use. Another challenge relates to the immobile, prone, or supine position of the patient, which may over- or underdiagnose CVD. Intravenous imaging of proximal venous outflow obstruction has primarily been substituted by IVUS. However, the method can still be used if other imaging techniques are inadequate or unavailable. Descending venography may also be applicable in rare cases where deep valve reconstructive surgery is being considered (see subsection 5.4).

2.5.2. Intravascular ultrasound. IVUS has become an increasingly useful investigation for deep venous pathology over the last decade. Like CTV and MRV, IVUS accurately determines cross luminal diameter and surface area of the deep veins. However, in addition, IVUS can identify subtle intraluminal changes and vein wall abnormalities that may remain obscure if other imaging techniques are used. It has been shown to be more sensitive than venography in identifying deep venous lesions, as has been shown in the VIDIO trial. In this RCT, 100 patients with C4 to C6 CEAP clinical class and suspected iliofemoral vein obstruction underwent both IVUS and multiplanar venography. IVUS proved to be more sensitive than venography in identification and quantification of iliofemoral vein obstructive lesions. Therefore, IVUS may provide an additional advantage in patient selection for venous stenting.[58] However, IVUS is an invasive modality and can be used only if the lesion of interest can be crossed with a guidewire first.

2.6. Plethysmography

Air plethysmography measures the global change in volume in mL/s of the part of the calf enclosed by the cuff, in response to gravitational filling on dependency (venous filling index) and drainage on leg elevation (venous drainage index).[59,60] Rapid filling and slow elevation drainage are indicative of global venous incompetence and obstruction, respectively.[61] This is in contrast to ultrasound flow measurements in selected vein segments induced by a compression/release manoeuvre.

Strain gauge plethysmography is an alternative that extrapolates global calf volume change from the change in impedance from a circumferential band applied around a selected part of the calf.[62] Photoplethysmography reflects volume in the leg indirectly by changes in the skin microcirculation. These tests may be of clinical value in screening, diagnosis, surveillance, follow up, and outcome assessment.[63–65]

Recommendation 3			Unchanged
For diagnosis and treatment planning in patients with suspected or clinically evident chronic venous disease, full lower limb venous duplex ultrasound is recommended as the primary imaging modality.			
Class	Level	References	ToE
I	B	Blomgren *et al.* (2011)[43]	

Recommendation 4			New
For patients with suspected supra-inguinal venous obstruction, in addition to full leg duplex assessment, ultrasound of the abdominal and pelvic veins should be considered, as part of the initial assessment.			
Class	Level	References	ToE
IIa	C	Metzger *et al.* (2016)[51]	