Investigation

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Tourniquet tests and the use of hand-held Doppler have now been abandoned. There is good evidence to support the policy of duplex ultrasound scanning for all patients with varicose veins prior to any intervention. The best clinical results come from clinicians who are personally very skilled in the use of duplex ultrasound and use it to design a bespoke treatment for each individual patient, based upon their unique anatomy . A high-frequency linear array transducer of 7.5–13 /uni00A0 MHz is appropriate for the majority of lower limbs in order to obtain good quality images. The B-mode settings (depth, focal zone, overall gain and dynamic g ain) should be optimised to ensure that the area of interest is in the centre and occupies the major ity of the image, and that the lumen of the vein appears as a dark void in the subcutaneous and deep tissues. The pulsed wave spectral or colour Doppler settings should be optimised for the low-flow velocities encountered within veins. It is conventional to use blue to represent antegrade venous flow towards the heart and red for the reverse. Visible venous flow can be augmented by a calf squeeze. The aim of the duplex scan in a patient with varicose veins is to establish: /uni25CF the presence of reflux in the deep and superficial venous system; /uni25CF the exact distribution and extent of reflux in the superficial venous system, including a ff ected junctions and perfora tors; /uni25CF the presence of obstruction in the deep venous system; /uni25CF the suitability of the incompetent superficial veins for the di ff erent treatments available (based upon diameter, extent, tortuosity , saphena varix); Christian Johann Doppler , 1803–1853, Professor of Experimental Physics, Vienna, Austria, enunciated the ‘Doppler principle’ in 1842. Antonio Valsalva , 1666–1723, anatomist, Bologna, Italy . Also described the Eustachian tube and aortic sinuses. /uni25CF - an indication of a pelvic source of reflux or obstruction. In order to standardise measurements of venous diameter and reflux, it is recommended that examination of the super - ficial veins is performed with the patient standing. Superficial or crural vein reflux is defined as retrograde flow in the r everse direction to physiological flow lasting for 0.5 seconds or more. The pr oximal deep veins require a duration of 1 second or more to be classified as incompetent. Reflux may be elicited by release of a calf or foot squeeze for proximal or calf vari - cosities, respectively , manual compression over varicosity clus - ters, pneumatic calf cu ff deflation, active foot dorsiflexion and relaxation or the Valsalva manoeuvre. The patient should stand facing towards the examiner with the leg rotated outwards, heel on the ground and w eight on the opposite limb (Figure 62.11). The use of a platform, ideally - with a handle or support bar for the patient and a stool tha t can drop to a low height, will improve the ergonomic com - fort of both the sonographer and the patient. The scan should commence in the groin, using a transverse view to identify the GSV and CFV lying medial to the common femoral artery (the ‘Mickey Mouse’ sign; Figure 62.12). SFJ competence is assessed in the transverse view and potential destinations for reflux, including the GSV , the AAGSV and other major thigh tributaries superficial to the saphenous fascia, are noted. Any indication of a pelvic source of reflux suggests the need for more proximal imaging. The full length of the GSV within its fascial compartment should be examined (Figure 62.13), and its diameter measured if required. The groin is next examined - -

Figure 62.11 Patient position for venous duplex examination of the great saphenous system.

for reflux or obstruction in the CFV , superficial femoral vein and SFJ using spectral and/or colour Doppler (Figure 62.14 A loss of phasic flow with respiration in the CFV suggests upstream obstruction and the need for proximal imaging. The presence and competence of thigh and calf perforators should be noted and the crural veins examined for reflux or obstruc tion. F or examination of the SSV and posterior thigh extension of the SSV (Giacomini vein), the patient is positioned facing away , knee slightly flexed, heel on the ground and the weight taken on the opposite leg. If the SPJ is incompetent, the level of the SPJ in relation to the knee crease and whether the SSV joins the popliteal vein posteriorly , medially or laterally is noted if open surgical ligation is to be entertained. In the transverse view , the SSV vein is followed distally , checking its competence and diameter in the proximal, mid- and distal calf. Finally , the patency and competence of the popliteal vein is assessed. Pelvic and iliac veins may be investigated using transabdominal or transvaginal duplex. V ery occasionally investigations other than duplex are required, and these may be non-invasive, suc h as magnetic resonance (MR) venography , or invasive, such as contrast venography or intravenous ultrasound (IVUS). The use of varicography has become). historical (Figure 62.15).

Figure 62.12 ‘Mickey Mouse’ transverse B-mode image of the right (R) common femoral vein (CFV) and artery (CFA), great saphenous vein (GSV) and saphenofemoral junction. Figure 62.13 ‘Saphenous eye’ transverse B-mode view of the great saphenous vein in fascial

compartments of the thigh. The fascial line above the vein is the saphenous fascia. A true great or small saphe nous vein will not cross this line, although the fascia may become discontinuous around the knee. The line deep to the vein is the fascia lata, with the muscle beneath. Figure 62.14 Spectral Doppler trace of the saphenofemoral junction showing antegrade and retrograde /f_l ow. The downward spike on the trace is the antegrade augmented /f_l ow and this is followed by approximately 4 seconds of

retrograde /f_l ow.

Figure 62.15 Varicogram. (This is now a historical investigation.)

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The diagnosis of DVT and pulmonary embolus should be established by special investigations as the symptoms and signs are non-specific and may be absent. In addition, treatment with anticoagulation is not without risk and the diagnosis must be made with reasonable certainty . Many centres direct investigations based upon the modi - fied Wells score (Table 62.4) , with further imaging dictated by these results. These scores can be unreliable though, especially in hospital inpatients, and should only be considered a guide. V enous duplex ultrasound is commonly performed to look for evidence of thrombosis throughout the deep or superficial venous system. Ideally , this should be performed by an expe - rienced vascular sonographer, but the v olume of cases is such that compression ultrasound is frequently being performed by non-specialists. Compression ultrasound involves applying pressure with the ultrasound probe over the common femoral). This or Vascular

TABLE 62.4 Modi /f_i ed Wells criteria for predicting deep

vein thrombosis (DVT). Variable Score Lower limb trauma or surgery or immobilisation in a 1 plaster cast Bedridden for >3 days or surgery in last 4 weeks 1 Tenderness along the line of femoral or popliteal veins 1 Entire limb swollen 1 Calf >3 /uni00A0 cm larger circumference than other side 10 /uni00A0 cm 1 below tibial tuberosity Pitting oedema 1 Dilated collateral super /f_i cial veins (not varicose veins) 1 Previous DVT 1 Malignancy (including treatment up to 6 months ago) 1 Intravenous drug abuse 3 Alternative diagnosis more likely than DVT –2 Low probability (5%) of DVT (score –2 to 0); moderate probability (17%) of DVT (score 1 or 2); high probability (17–53%) of DVT (score

> 2).

will compress tightly shut. In the presence of DVT they will not fully compress. It is rapid to both learn and perform, but not ideal and most importantly misses calf vein thrombosis. Calf vein thromboses may propagate to form a more extensive thrombus, which may in turn embolise. The optimal manage ment of calf vein thrombosis when detected is not clear; some units use surveillance, with others anticoagulating such patients upon detection. Ascending venography , which shows a thrombus as a fill ing defect, is now rarely r equired unless thrombolysis is being considered (Figure 62.34). MR venography may also be used. Pulmonary embolus is diagnosed

definitively by computed tomography (CT) pulmonary angiogram, which will demon stra te the presence of filling defects in the pulmonary arter ies (Figure 62.35). Pulmonary angiography is rarely required unless thrombolysis is being considered. The di ff erential diagnosis of a DVT includes a ruptured Baker’s cyst, a calf muscle haematoma, a ruptured plantaris muscle, a thrombosed popliteal aneurysm and arterial isch aemia. Duplex scanning will detect many of these conditions but often patients present with non-specific pain in the calf that resolves with no firm diagnosis being made. The di ff eren tial diagnosis of a pulmonary embolism includes m yocardial infarction, pleurisy , pneumonia and aortic dissection.

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