

Clinical Protocol

LOWER LIMB DEEP VEIN THROMBOSIS DUPLEX

SETTING	Vascular Science Unit
FOR STAFF	Clinical Vascular Scientists
PATIENTS	All patients referred for a lower limb deep vein thrombosis duplex

INTRODUCTION

A lower limb Deep Vein Thrombosis (DVT) duplex is a B-mode, colour and spectral Doppler investigation of the veins of the lower limb to assess for presence of DVT or superficial thrombophlebitis. The result of the investigation guides patient management with the aim to prevent progression to a pulmonary embolus (PE) and alleviate symptoms.

This protocol should be read in combination with the Vascular Science generic protocol which covers preparation, patient communication, environment, equipment, workforce, health & safety, infection control and equality & diversity.

NICE GUIDELINES

NICE guideline NG158 relates to the diagnosis of proximal lower limb DVT [1]. It states:

If DVT is suspected, use the 2-level DVT Wells score to estimate the clinical probability of DVT.

- Offer people with a **likely** DVT Wells score (2 points or more):
 - a proximal leg vein ultrasound scan, with the result available within 4 hours if possible
 - If a proximal leg vein ultrasound scan result cannot be obtained within 4 hours, offer people with a DVT Wells score of 2 points or more:
 - a D-dimer test, then
 - Interim therapeutic anticoagulation and a proximal leg vein ultrasound scan with the result available within 24 hours.
- Offer people with an **unlikely** DVT Wells score (1 point or less):
 - a D-dimer test with the result available within 4 hours or
 - if the D-dimer test result cannot be obtained within 4 hours, offer interim therapeutic anticoagulation while awaiting the result
 - If the D-dimer test result is positive, offer:
 - a proximal leg vein ultrasound scan, with the result available within 4 hours if possible or
 - interim therapeutic anticoagulation and a proximal leg vein ultrasound scan with the result available within 24 hours.

REFERRAL PATHWAY

Inpatient referrals or 'within hospital/Internal outpatients' eg oncology or orthopaedic

All inpatients and internal outpatient referrals are received through the ICE referral system. Referrals are triaged by a senior or junior vascular scientist and an urgent lower limb DVT duplex scanned is arranged.

Outpatient referrals

Outpatient referrals are received and triaged by the Thrombosis Clinical Nurse Specialists (CNS) The CNS contacts the Vascular Science Unit to arrange an urgent lower limb DVT duplex scan.

CLINICAL INDICATION

- Calf swelling or entire leg swelling
- Unilateral localised pain (this is usually throbbing in nature) which occurs when walking, or bearing weight
- Tenderness
- Skin changes, which include oedema, redness, and warmth
- Vein distension
- ? Source of pulmonary embolism (PE)

CONTRAINDICATIONS

There are no known major contraindications of a lower limb DVT duplex.

LIMITATIONS

- Obesity
- Severe oedema/swelling
- Patient discomfort
- Limited patient mobility/compliance
- Dressings, open wounds, casts, frames
- Examination performed with the patient in a chair
- Patient unable to lie in a supine position due existing co-morbidities e.g. chronic obstructive pulmonary disease (COPD) (particularly abdominal veins and the CFV)
- Patients who are unable to cooperate due to reduced cognitive functions e.g. Alzheimer's or dementia and through involuntary movements
- When examining the abdominal veins bowel gas
- Acoustic shadowing from sinus/injection site
- Examinations undertaken portably at the patient's bedside maybe limited due to equipment and room dimensions

EQUIPMENT SPECIFICATION

For accessory equipment, maintenance, QA, calibration and ultrasound safety please refer to the generic vascular Science protocol.

GE Logic 9 ultrasound machines are used for lower limb DVT duplex. The 5-9MHz linear array transducer is routinely used. The Curvilinear array transducer is used when necessary. The lower extremity venous pre-set should be used as standard.

All equipment has regularly safety checks and maintenance.

PREPARATION

For test preparation applicable to all assessments please refer to the generic vascular Science protocol.

PATIENT COMMUNICATION

For patient arrival and waiting time and introduction, information and consent please refer to the generic vascular Science protocol.

Clinical history, presenting symptoms and risk factors

The written referral for the investigation should contain a relevant clinical history. This should be confirmed and clarified with the patient prior to the starting the examination. A relevant lower limb DVT duplex clinical history should be taken including:

- Presenting symptoms – character, onset, duration, severity and progression
- Previous history of DVT or PE
- Recent periods of immobility
- Recent long journey (plane, car or train)
- Trauma to the limb
- If an intravenous drug user, the date of most recent injection into the limb
- Family history of DVT or a known blood disorders

STANDARD OPERATING PROCEDURE

Please follow see the limb DVT Duplex SOP

REPORTING

The lower limb DVT duplex is reported on CRIS and the vascular science database. Vascular scientists should use the standardised CRIS report whenever possible (see appendix 1). Additional comments can be added when necessary.

All reports should include:

- Type of scan 'LEG DVT DUPLEX'
- Symptoms and relevant clinical history (as stated above)
- Clinical report – see below
- Name of Vascular Scientist performing scan
- VSU end of report statement
- VSU contact phone number
- If acute DVT the phrase 'VTE positive'

Clinical report

The clinical report should include the following where appropriate:

- The status and additional comments set out in table 1 for the following veins:
 - Common Femoral Vein
 - Profunda Vein (origin)
 - Femoral Vein (thigh)
 - Popliteal Vein
 - Anterior tibial veins
 - Peroneal veins
 - Posterior tibial vein
 - Gastrocnemius veins
 - Soleal vein
 - Greater saphenous vein
 - Short saphenous vein

Table 1. Reporting criteria

Status of Vein	Additional reporting comments
Normal	<ul style="list-style-type: none"> • None
Thrombus – partial or occlusive	<ul style="list-style-type: none"> • Proximal to distal extent • If applicable - acute, chronic or unable to determine age of clot • If in superficial vein: <ul style="list-style-type: none"> ○ <5cm or >5cm in length ○ Distal to proximal location ○ Proximal tip of the thrombophlebitis is 1cm, 2cm, 3cm or >3cm from a deep vein junction.
Poor views	<ul style="list-style-type: none"> • Reason for poor views • However, no thrombus suspected
Poor views - unable to exclude presence of thrombus	<ul style="list-style-type: none"> • Reason for poor views
Not assessed	<ul style="list-style-type: none"> • Reason for not assessing
Not present	<ul style="list-style-type: none"> • Suspected reason for not being present if applicable

- The external iliac, common iliac and IVC should be assessed if continuous flow in the proximal CFV, the proximal extent of thrombus has not been seen or whole leg swelling is present. These should be recorded in the report
- If thrombus is seen in the external iliac vein, common iliac vein or inferior vena cava the follow phrase must be added to the report: 'Thrombus has extended into the iliac veins and

this patient should be considered for catheter directed thrombolysis.

Contact Thrombosis Clinic (x 24684) to arrange referral Mon to Fri (9am to 5pm) or Sat to Sun (9.30am to 12pm)

- Any other significant/incidental findings should be documented and reported appropriately – see appendix 2. Examples of common incidental findings are:
 - Enlarged lymph nodes (>3cm)
 - Bakers cyst
 - Other knee cyst
 - Muscle tear
 - Hematoma
 - Fluid collection
 - Superficial oedema
 - Arterial aneurysm
- The following phrase must be added to the report for a non-vascular incidental finding: 'Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer if there is further clinical concern regarding the non-vascular findings.'
- Any poor views, limitations or low confidence findings should be clearly stated in the report
- A summary of the right/left leg should be included at the end of the report

Urgent findings

If an incidental urgent finding is found the referring clinician should be contacted via email or phone call.

RELATED DOCUMENTS AND PAGES

Lower limb DVT Operating procedure

Vascular Science generic protocol

BRISTOL BATH AND WESTON VASCULAR NETWORK Standard Operating Procedures for Clinical Vascular Scientists

Table A

REFERENCES	1. NICE guideline [NG158] Venous thromboembolic diseases: diagnosis, management and thrombophilia testing. Published date: 26 March 2020
RELATED DOCUMENTS AND PAGES	Lower limb DVT Operating procedure Vascular Science generic protocol BRISTOL BATH AND WESTON VASCULAR NETWORK Standard Operating Procedures for Clinical Vascular Scientists
AUTHORISING BODY	Vascular Science
SAFETY	Please refer to the VSU health and safety policy
QUERIES AND CONTACT	Vascular Science Unit A225 Bristol Royal Infirmary Marlborough Street Bristol, BS2 8HW Tel: 0117 342 2836 Email: VSU@UH Bristol.nhs.uk

Appendix 1 – Report Template

CRIS Phrase:
ULLVLN (left leg)
ULLVRN (right leg)

VSU Leg DVT

**DEEP VENOUS THROMBOSIS (DVT) DUPLEX
SYMPTOMS:**

RIGHT/LEFT LEG DEEP VEINS

Common Femoral Vein: Spontaneous and phasic flow indicating no significant proximal obstruction.

Common Femoral Vein:

Profunda Vein (origin):

Femoral Vein (thigh):

Popliteal Vein:

Anterior tibial veins:

Peroneal veins:

Posterior tibial veins:

Gastrocnemius veins:

Soleal veins:

RIGHT/LEFT LEG SUPERFICIAL VEINS

Greater saphenous vein: normal

Short saphenous vein: normal

Comments:

SUMMARY LEFT LEG: No DVT

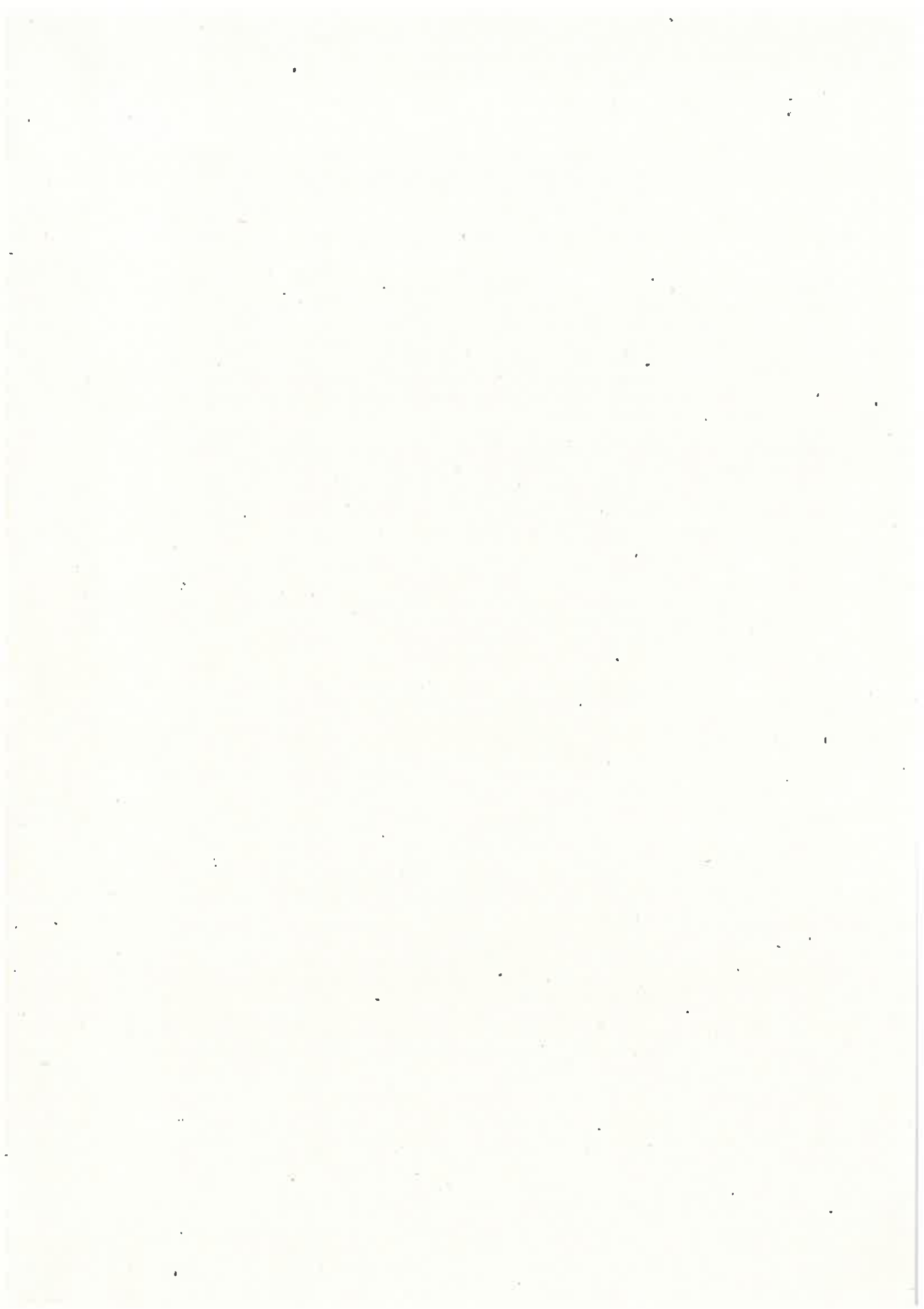
****PUT INCIDENTAL FINDINGS HERE****

Scanned by:

NB: the adjective "distal" is used to indicate the part of the vein furthest from the heart, whereas "proximal" is nearest the heart. Any queries please contact Vascular Science on 0117 34 27530.

Appendix 2 – Incidental findings

Phrase: UIFBC VSU Bakers Cyst	INCIDENTAL FINDING MEDIAL POPLITEAL FOSSA: anechoic fluid filled structure with internal debris, originating between the medial head of the gastrocnemius and semimembranosus tendon, indicating a popliteal synovial cyst (BAKER'S CYST). Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer if there is further clinical concern regarding the non-vascular findings.
UIFRBC VSU Ruptured Bakers Cyst	INCIDENTAL FINDING MEDIAL POPLITEAL FOSSA: anechoic fluid filled structure with internal debris, originating between the medial head of the gastrocnemius and semimembranosus tendon. Rupture at lower pole of cyst with oedema tracking down calf, indicating a ruptured popliteal synovial cyst (RUPTURED BAKER'S CYST). Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer if there is further clinical concern regarding the non-vascular findings.
Phrase: UIFLM VSU Lateral meniscus	INCIDENTAL FINDING LATERAL MENISCUS: anechoic fluid filled structure may indicate a meniscal cyst caused by a tear in the meniscus cartilage. Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer as a MENISCAL TEAR REQUIRES FURTHER INVESTIGATION AND TREATMENT.
UIFMM VSU medial meniscus	INCIDENTAL FINDING MEDIAL MENISCUS: anechoic fluid filled structure may indicate a meniscal cyst caused by a tear in the meniscus cartilage. Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer as a MENISCAL TEAR REQUIRES FURTHER INVESTIGATION AND TREATMENT.
UIFK VSU knee fluid	INCIDENTAL FINDING KNEE (SUPRAPATELLAR/MEDIAL PARAPATELLAR/LATERAL PARAPATELLAR): fluid noted around the knee, which may indicate knee joint effusion. Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer if there is further clinical concern regarding the non-vascular findings.
UIFC VSU Calf tear	INCIDENTAL FINDING CALF: linear fluid filled structure at the junction of the fascia between the gastrocnemius and soleus muscles consistent with a calf muscle injury. Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer if there is further clinical concern regarding the non-vascular findings.
UIFG VSU groin mass	INCIDENTAL FINDING GROIN: INCIDENTAL FINDING GROIN: Enlarged lymph node (>3cm) INCIDENTAL FINDING GROIN: mixed echogenic fluid collection consistent with a haematoma/abscess. Please note: this was a DVT scan carried out by a vascular specialist and therefore detailed analysis of the MSK anatomy has not been carried out. Please consult an MSK specialist sonographer if there is further clinical concern regarding the non-vascular findings.



Clinical Protocol

VENOUS INSUFFICIENCY DUPLEX

SETTING	Vascular Science Unit
FOR STAFF	Clinical Vascular Scientists
PATIENTS	Patients referred for a venous insufficiency duplex

INTRODUCTION

A venous insufficiency duplex is a B-mode, colour and spectral Doppler investigation of the deep and superficial veins of the lower limb. The aim is to assess for venous incompetence, locate incompetent perforators and assess suitability for different treatment options (eg foam sclerotherapy, endothermal ablation).

This protocol should be read in combination with the Vascular Science generic protocol which covers preparation, patient communication, environment, equipment, workforce, health & safety, infection control and equality & diversity.

NICE GUIDELINES

NICE clinical knowledge summaries for varicose veins (February 2020) states [1]:

- Duplex ultrasound provides both anatomical and haemodynamic data on the functioning of the superficial and deep venous systems
- People with varicose veins who are seen by a vascular service should be assessed with duplex ultrasound to confirm the diagnosis of varicose veins and the extent of truncal reflux, and to plan treatment for suspected primary or recurrent varicose veins

REFERRAL PATHWAY

Referrals can be made by vascular consultants and vascular nurse specialists. Referrals can be made from GPs or doctors within the trust following discussion with the vascular science team. Referrals are received through the ICE referral system and triaged by a clinical vascular scientist.

CLINICAL INDICATION

- Chronic leg swelling
- Leg pain or discomfort, particularly after prolonged standing
- Skin changes (hyperpigmentation and venous eczema)
- Venous ulceration
- Spontaneous bleeding from a varicose vein site
- Venous claudication
- Recurrent superficial thrombophlebitis
- Visible varicose veins
- Post venous intervention

CONTRAINDICATIONS

There are no known major contraindications of a venous insufficiency duplex.

LIMITATIONS

- Obesity
- Severe oedema/swelling
- Dressings, open wounds, casts, frames
- Patient discomfort
- Limited patient mobility/compliance
- Patient unable to stand
- Examination performed with the patient in a chair
- Patients who are unable to cooperate due to reduced cognitive functions e.g. Alzheimer's or dementia and through involuntary movements
- Examinations undertaken portably at the patient's bedside may be limited due to equipment and room dimension

EQUIPMENT SPECIFICATION

For accessory equipment, maintenance, QA, calibration and ultrasound safety please refer to the generic vascular Science protocol.

GE Logic 9 ultrasound machines are used for a venous insufficiency duplex. The 5-9MHz linear array and 6-15MHz matrix linear array transducers are routinely used. The curvilinear array transducer can be used when necessary (eg for swollen/larger limbs). The lower extremity venous (LEV) pre-set should be used as standard.

All equipment has regular safety checks and maintenance.

PREPARATION

For test preparation applicable to all assessments please refer to the generic vascular Science protocol.

PATIENT COMMUNICATION

For patient arrival and waiting time and introduction, information and consent please refer to the generic vascular Science protocol.

Clinical history, presenting symptoms and risk factors

The written referral for the investigation should contain a relevant clinical history. This should be confirmed and clarified with the patient prior to the starting the examination. A relevant venous insufficiency clinical history should be taken including:

- Presenting symptoms – character, onset, duration, severity and progression
- Previous history of deep vein thrombosis (DVT) or superficial thrombophlebitis
- History of lower leg ulceration
- History of or current intravenous drug use
- Previous varicose vein treatment

STANDARD OPERATING PROCEDURE

Please see the venous insufficiency duplex SOP

VENOUS AUGMENTATION TECHNIQUE

In general, a single vascular scientist can perform adequate venous augmentation with one hand by squeezing the calf or foot.

If adequate venous augmentation cannot be achieved by a single vascular scientist, a second vascular scientist or vascular science associate should assist in the scan by using both hands to perform a calf/foot squeeze to produce adequate venous augmentation. Common examples of when two persons are required are:

- Large circumference leg
- Firm/hard leg
- Ulceration/skin breaking
- Patient in an sub-optimal position (eg. due to limited mobility)

REPORTING

The venous insufficiency duplex is reported on CRIS and the vascular science database. The standardised CRIS report template and reporting phrases should be used where possible (see appendix 1 and 2). Additional comments can be added when necessary.

All reports should include:

- Type of scan 'LOWER LIMB VENOUS DUPLEX (INCOMPETENCE)'
- Symptoms and relevant clinical history (as stated above)
- Clinical report – see below
- Name of Vascular Scientist performing scan
- VSU contact phone number

Clinical report

The following veins should be assessed:

- Common Femoral Vein
- Femoral Vein (thigh)
- Popliteal Vein
- Greater saphenous vein (including the sapheno femoral junction)
- Short saphenous vein (including the sapheno popliteal junction)
- Any other superficial veins (if present)

The report should comment on the following for each vein stated above:

- The presence/absence of phasic flow (in the common femoral vein CFV)
- The presence/absence of thrombus
- Competent/ incompetent (see criteria in table 1)

→ **If an incompetent vein:**

- The length of reflux (see criteria in table 1)
- The location and extent of the incompetent section
- If the vein is straight/uniform or tortuous (superficial veins only)
- The depth and diameter (superficial veins only)
- Presence of any large incompetent perforators

Table 1. Reporting criteria

Length of reflux	Interpretation and reporting phrase
<0.5 seconds	Competent
0.5-1 second	INCOMPETENT (mild reflux 0.5 – 1 seconds)
>1 seconds	INCOMPETENT (reflux of > XX seconds)

- If a vein is not present, possibly due to previous vein stripping, this should be clearly noted in the report
- If an acute thrombus is seen then proceed to perform a full lower limb DVT scan – please refer to the lower limb DVT protocol and SQP
- Any significant/incidental findings should be documented, reported and acted upon appropriately
- Any poor views, limitations or low confidence findings should be clearly stated in the report

Urgent findings

If an incidental urgent finding is found the referring clinician should be contacted via email or phone call.

The most common incidental finding on a venous insufficiency scan is an acute DVT or superficial thrombophlebitis. The referring clinician should be contacted immediately to arrange onwards patient management.

RELATED DOCUMENTS AND PAGES

Venous insufficiency Operating procedure

Vascular Science generic protocol

Bristol, Bath and Weston Vascular Network Standard Operating Procedures for Clinical Vascular Scientists

Table A

REFERENCES	1. NICE CKS: varicose veins. Last revised in February 2020
RELATED DOCUMENTS AND PAGES	<p>Venous insufficiency Operating procedure</p> <p>Vascular Science generic protocol</p> <p>Bristol, Bath and Weston Vascular Network Standard Operating Procedures for Clinical Vascular Scientists</p>
AUTHORISING BODY	Vascular Science Unit
SAFETY	Please refer to the VSU health and safety policy
QUERIES AND CONTACT	<p>Vascular Science Unit A225 Bristol Royal Infirmary Upper Maudlin Street Bristol, BS2 8HW</p> <p>Tel: 0117 342 7530 Email: VSU@uhbw.nhs.uk or uhb-tr.vascular-science@nhs.net</p>

Appendix 1 – Report Template

Phrase: ULVIN
VSU VV normal

LOWER LIMB VENOUS DUPLEX (INCOMPETENCE) SYMPTOMS:

RIGHT LEG DEEP VEINS:

The common femoral, femoral and popliteal veins were competent and compressible with phasic flow.

RIGHT LEG SUPERFICIAL VEINS

The sapheno-femoral junction and greater saphenous vein were competent

The sapheno-popliteal junction and the short saphenous vein were competent

LEFT LEG DEEP VEINS

The common femoral, femoral and popliteal veins were competent and compressible with phasic flow

LEFT LEG SUPERFICIAL VEINS

The sapheno-femoral junction and greater saphenous vein were competent

The sapheno-popliteal junction and the short saphenous vein were competent

Scanned by:

NB: the adjective "distal" is used to indicate the part of the vein furthest from the heart, whereas "proximal" is nearest the heart

Any queries please contact Vascular Science on 0117 34 27530.

Appendix 2 - Report phrases

<p>Phrase: ULVIP VSU VV phrases</p>	<p>The common femoral, femoral and popliteal veins were INCOMPETENT (reflux of XX) but compressible with phasic flow</p> <p>The sapheno-femoral junction and greater saphenous vein (GSV) were INCOMPETENT (reflux of XX)</p> <p>The GSV was predominately STRAIGHT AND UNIFORM throughout with a diameter and depth of:</p> <p>Upper thigh: DDcm diameter DDcm depth (in fascia) Mid thigh: DDcm diameter DDcm depth (in fascia) Lower thigh: DDcm diameter DDcm depth (in fascia) Upper calf: DDcm diameter DDcm depth (in fascia) Mid calf: DDcm diameter DDcm depth (in fascia) Lower calf: DDcm diameter DDcm depth (in fascia)</p> <p>The sapheno-popliteal junction and the short saphenous vein (SSV) were INCOMPETENT (reflux of XX)</p> <p>The SSV was predominately straight and uniform throughout with a diameter and depth of:</p> <p>Upper calf: DDcm diameter DDcm depth (in fascia) Mid calf: DDcm diameter DDcm depth (in fascia) Lower calf: DDcm diameter DDcm depth (in fascia)</p> <p>The sapheno-popliteal junction was not identified but the short saphenous vein was competent</p> <p>The sapheno-popliteal junction was not identified but the short saphenous vein (SSV) was INCOMPETENT (reflux of XX)</p> <p>The GSV was extremely TORTUOUS throughout with multiple branches and visible varicosities. The SSV was extremely TORTUOUS throughout with multiple branches and visible varicosities.</p> <p>No evidence of large incompetent perforators</p>
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