Lavery, J

 Clinical assessment of the leg for a suspected deep vein thrombosis

http://researchonline.ljmu.ac.uk/id/eprint/14819/

Article

For more information please contact researchonline@ljmu.ac.uk

Clinical assessment of the leg for a suspected deep vein thrombosis

In this article…

- Understanding the risk factors for deep vein thrombosis

- Diagnostic testing to inform an assessment

- How to assess the leg for a suspected deep vein thrombosis

Key points

There are multiple risk factors for venous thromboembolic disorders, making this a complex condition to diagnose.

The two-level Wells score is a systematic standardised approach to deep vein thrombosis assessment.

Other risk factors and variables must be considered during a deep vein thrombosis assessment.

The procedure of a leg assessment for a deep vein thrombosis assessment is within the skill set of nurses.

Nurses must be aware of referral pathways and National Institute of Health and Care Excellence guidance for managing patients with suspected deep vein thrombosis.

Abstract

Nurses will increasingly be required to identify and assess for deep vein thrombosis

in both primary and secondary care, so need the skills to assess the clinical risk of the

patient. This article explains how to understand deep vein thrombosis in terms of its

associated risk factors, use of the two-level Wells score for estimating a patient's risk and

how to carry out a leg assessment for a suspected deep vein thrombosis.

A deep vein thrombosis (DVT) is a condition whereby a blood clot (a thrombus) is formed in

a vein. This can dislodge and travel into the blood stream, and towards the lungs, where it

can cause a pulmonary embolism (PE), which is a 'blockage' in the pulmonary circulation

known to be life threatening (National Institute of Health and Care Excellence, 2020). DVT

and PE are both in the category of venous thromboembolic (VTE) disorders. A DVT is most

often found in the lower extremities and can be linked to increased morbidity by

progressing to a pulmonary embolism or causing long term complications such as post

thrombotic syndrome (Bhatt et al, 2020). Thromboses can potentially be found in every

deep vein in the body; a DVT of the arm is another of the most common locations and is

estimated to account for around 5% of all thromboses (Isma et al, 2010).

Thomas (2014) identified that patients who are non-complex but have a suspected DVT are

ideally placed to be diagnosed and managed in primary care. The development of treatment

pathways as advocated by NICE (2020) aimed to prevent unnecessary hospital admissions,

thereby reducing cost to the NHS. The NHS Long Term Plan focuses on improving the patient

journey, which is key to increasing patient satisfaction and boosting proactive care by screening and diagnosing at risk patient groups earlier (NHS England, 2019).

NHS England (2017), in *Next Steps on the Five Year Forward View,* identified DVT as a patient safety concern as part of its harm reduction initiative (NHS England, 2017). It reflected that nurses will increasingly be required to identify and assess for DVT in both primary and secondary care, so need the skills to assess the clinical risk of the patient. VTE risk assessment is a National Quality Requirement as part of the NHS standard Contract 2020/21 (NHS England, 2020). Furthermore, studies show that the severe inflammatory processes manifested by Covid-19 can increase the incidence of DVT (Sebuhyan, 2020). Thus, as diagnosing DVT is at the forefront of current care, the objectives of this article are to:

- Understand DVT in terms of its associated risk factors;
- Highlight the use of the two-level Wells score as a decision-making tool to estimate a patient's risk of a DVT (Wells et al, 2003);
- Demonstrate the process of a leg assessment for a suspected DVT.

Causes of a DVT

Virchow's (1998) triad refers to three factors that can contribute to a venous thrombosis:
- Venous trauma, whereby damage occurs to the vessel walls;
- Venous stasis, characterised by poor blood flow;
- Hypercoagulability, otherwise described as abnormal blood constituents (Welch and Bonner, 2010).

The more risk factors people have the greater their risk of developing a thrombus. Patients who are pregnant, or have had recent hospitalisation or surgery, may become high risk because they are less mobile (which causes a reduction in blood flow) or have vascular wall injury as a result of an intervention. People with cancer with already increased coagulability may have had chemotherapy, be immunocompromised or have acquired infections, which can combine to make them high risk. More recently, studies have found increased risk associated with a VTE in patients with severe Covid-19 admitted to critical care, despite prophylactic anticoagulation (Fontana et al, 2020; Hasan et al, 2020). There have been calls for further research into VTE, Covid-19, and therapeutic treatment of patients in this at-risk group on an individual basis instead of it being protocol driven (Hasan et al, 2020). Fig 1 demonstrates the categories and some causes in Virchow's triad, which can contribute to a thrombosis (Dunn and Kendall, 2020).

The evidence-based screening tool advocated by NICE (2020) is the two-level Wells (2003) score (Fig 2). The tool is used to support decision making in practice and although the Wells score is systematic it cannot safely rule out a DVT in isolation. When the Wells score is calculated as 1 or less (which is considered low probability) and combined with a negative D-dimer test it explicitly excludes a DVT (Iorio and Douketis, 2014). Patients score 1 point for any of the clinical features they present with on the screening tool. If it is considered that an alternative diagnosis to DVT is likely, it is always important to subtract 2 points from the total final score to produce the final outcome. In practice, decision-making tools should never override clinical autonomy, and patient safety is always our key priority. It must be noted that pregnancy is one exclusion of the Wells risk assessment, as the tool has not been

validated for use in this situation and false positives, plus the potential for unnecessary anticoagulation of such a high-risk group, could lead to unnecessary harm (Righini, 2013).

The Wells score as highlighted is comprehensive, but a patient's history must not be overlooked, as many conditions that could predispose an individual to a thrombus are not included in its scoring system. For example, haematological conditions such as thrombophilia, pregnancy, autoimmune disorders, obesity and, more recently, Covid-19 can also increase the risk of a VTE.

D-dimer testing

Diagnostic testing is required to exclude VTE and inform the assessment and in addition to clotting, investigations including a D-dimer (see below), general inflammatory markers, a baseline blood count and hepatic and renal function are all considered best practice (NICE, 2020). A D-dimer is a blood test that can detect levels of fibrin degradation (fibrin is a protein in the blood and a primary component of blood clotting). A value below 500 µg/L is conventionally used to safely rule out VTE with a low false negative rate. However, a D-dimer range can vary according to the reagents used in laboratory testing and so may be different across hospitals; this must be taken into account when following a local pathway. A D-dimer has the advantage that it is quick and can be taken with other routine blood test for use in conjunction with a clinical history wherever there is clinical suspicion of VTE. Elevated levels are generally found in patients with conditions associated with thrombosis such as pregnancy and advanced cancer, and as such the D-dimer test should not be used independently of other investigations because it can produce false negatives (Weitz et al, 2017).

Developments in D-dimer testing mean that the age-adjusted D-dimer is now being used in combination with other clinical probability assessments to rule out suspicion of VTE, and the level of the result is adjusted accordingly to calculate the risk to the individual. An age-adjusted D-dimer, with a cut off for patients aged 50 and above, for ruling out DVT has been deemed safe in some studies (Nybo and Hyas 2017; Rigini et al, 2014) and is recommended in the NICE (2020) guidance, although local policies and procedures must always be adhered to when treating and assessing DVT patients.

Clinical assessment of the leg

The leg needs to be examined fully to correctly use the Wells screening tool (Wells et al, 2003) and examining a leg properly requires nurses to demonstrate a series of competencies and the steps are outlined in Box 1.

Communication must be maintained throughout and the patient informed of the proposed plan of care. The clinical examination and consultation with the patient must be taken in the context of a full clinical history and the National Early Warning Score (NEWS 2) system (Royal College Physicians, 2017).

A thorough clinical examination is important to highlight concerns, as in the next stage of the patient's journey, it will be used in conjunction with a D-dimer test, or ultrasound in secondary or ambulatory care, to make a diagnosis following NICE guidance (NICE, 2020). Symptoms of a PE such as pleuritic chest pain, haemoptysis, or acute shortness of breath need assessed and as this will inform the need for diagnostic imaging, such as a CT

pulmonary angiogram. Fig 3 shows a patient with a DVT; notable features are an acutely swollen leg, dilatation of superficial veins, hot to touch and pain on palpation of calf. However, less than 50% of positive DVT patients present like this (Forbes and Jackson, 2003).

Differential diagnosis

It is important to consider differential diagnosis when assessing for a DVT, not just for calculating the Wells Score, but to treat the patient's symptoms, alleviate anxiety and, if the cause for the leg swelling is unclear, potentially investigate further. Other causes for a swollen leg may include chronic venous insufficiency, a baker's cyst, superficial thrombophlebitis, cellulitis and musculoskeletal pain. Schellong et al (2013) identify that other occurrences such as lower limb oedema, lymphoedema, diabetic foot lesions, and even tumours, can also lead to symptoms that resemble those of a DVT. This list of differential disgnosis is however is not exhaustive.

Post procedure documentation

Once a full assessment of the patient has been completed document the patient's presenting complaint, history of presenting complaint, past medical history, current medication and the two-level Wells score at the time of your assessment. You should also document whether further investigation are required as per NICE guidance (2020). Date, time, printed name, signature and designation is required. The Nursing and Midwifery Council (2019) noted that safe and effective learning is a factor in proficient practice and use

of documentation that has transferability across environments can support this. The Wells score is standardised and is transferrable for use in different areas of practice.

Medical management

NICE (2020) guidance states that once a patient has been assessed, if a DVT needs excluding, a proximal leg vein ultrasound scan is required. If a scan cannot be arranged within four hours the patient must receive an interim therapeutic dose of anticoagulation therapy, such as a low molecular weight heparin, until a DVT is excluded. Patients must be weighed for the correct dose and best practice is to explain the therapy they are receiving and supplement it with a patient information leaflet to alert them to the risk of bleeding or other complications they may experience while on therapy. Patients can be treated and discharged if they are medically stable and return for their scan and follow up at the earliest opportunity.

Conclusion

The identification of a suspected DVT is the responsibility of nurses in all clinical settings, and the risk factors, implications and clinical assessment of suspected patients is in the skill set of all nurses. The identification of Covid-19 as a potential risk factor for a VTE may increase the prevalence of DVTs. There should therefore be greater awareness of the pathway of referral for further investigation to simplify the investigative process of this treatable disorder, which can save lives.

References

Bhatt M et al (2020) Diagnosis of deep vein thrombosis of the lower extremity: a systematic review and meta-analysis of test accuracy. *Blood Advances*; 4:7,1250-1264.

Fontana P et al (2020) Venous thromboembolism in Covid-19: systematic review of reported risks and current guidelines. *Swiss Medical Weekly*; 2020 Jun 21; 150: w 20301.

Dunn J S, Kendall J M (2020) Deep Vein Thrombosis.

https://www.rcemlearning.co.uk/reference/deep-vein-thrombosis/

Forbes C D, Jackson W F (2003) *Color Atlas and Text of Clinical Medicine*. London: Mosby.

Hasan S S et al (2020) Venous thromboembolism in critically ill Covid-19 patients receiving prophylactic or therapeutic anticoagulation: a systematic review and meta-analysis. *Journal of Thrombosis and Thrombolysis*; 50:4, 814-821.

Health Education England (2017) Next Steps on the NHS Five Year Forward View.

https://www.england.nhs.uk/wp-content/uploads/2017/03/NEXT-STEPS-ON-THE-NHS-FIVE-YEAR-FORWARD-VIEW.pdf

Howard LSGE et al (2018) British Thoracic Society Guideline for the initial outpatient management of pulmonary embolism (PE) *Thorax*; 73, ii1–ii29.

Iorio A and Douketis J D (2014) Ruling out DVT using the Wells rule and a D-dimer test.

British Medical Journal; 348:g1637.

Isma N et al (2010) Upper extremity deep venous thrombosis in the population-based

Malmo thrombophilia study (MATS). Epidemiology, risk factors, recurrence risk, and

mortality. *Thrombosis Research;* 125, E335-E338.

National Institute of clinical excellence (2020) Venous Thromboembolic Diseases:

Diagnosis, Management and Thrombophilia Testing [NG158]

https://www.nice.org.uk/guidance/ng158/resources/venous-thromboembolic-diseases-

diagnosis-management-and-thrombophilia-testing-pdf-66141847001797

NHS England (2020) NHS Standard Contract 2020/21:Technical Guidance

https://www.england.nhs.uk/wp-content/uploads/2020/03/7-contract-technical-guidance-

2020-21-210220.pdf

NHS England (2019) The Long Term Plan; https://www.longtermplan.nhs.uk/wp-

content/uploads/2019/08/nhs-long-term-plan-version-1.2.pdf

NHS England (2017) Next Steps on the Five Year Forward View.

https://www.england.nhs.uk/wp-content/uploads/2017/03/NEXT-STEPS-ON-THE-NHS-FIVE-

YEAR-FORWARD-VIEW.pdf

Nursing and Midwifery Council (2019) Safe and Effective Learning.

https://www.nmc.org.uk/supporting-information-on-standards-for-student-supervision-

and-assessment/learning-environments-and-experiences/safe-and-effective-learning/

Nybo M and Hvas A M (2017) Age-adjusted D-dimer cut-off in the diagnostic strategy for deep vein thrombosis: a systematic review. *Scandinavian Journal of Clinical Laboratory Investigation*; 77:8, 568-573.

Public Health England (2020) Putting on Personal Protective Equipment (PPE): Standard Infection Control Precautions.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911311/PHE_Putting_on_PPE__Standard_infection_control_procedures.pdf

Righini M et al (2014) Age-adjusted D-dimer cut off levels to rule out pulmonary embolism: the ADJUST-PE study. *Journal of the American Medical Association*; 311:11,1117-11124.

Righini M et al (2013) EDVIGE study group. Predicting deep venous thrombosis in pregnancy: external validation of the LEFT clinical prediction rule. *Haematologica;* 98:4, 545-548.

Royal College of Physicians (2017) National Early Warning Score (NEWS) 2: Standardising the Assessment of Acute-illness Severity in the NHS.

http://allcatsrgrey.org.uk/wp/download/governance/clinical_governance/NEWS2-final-report_0.pdf

Schellong S M et al (2013) Leg Swelling. *Der Internist;* 54:11, 1294-1303.

Sebuhyan M et al (2020) How to Screen and Diagnose Deep Venous Thrombosis (DVT) in Patients Hospitalized for or Suspected of COVID-19 Infection, outside the Intensive Care Units. *Vasculaire*; 45:6, 334-343.

Schutte T et al (2016) Never ignore extremely elevated D-dimer levels: they are specific for serious illness. Netherlands Journal of Medicine; 74:10, 443-448.

Stubbs M J et al (2018) Deep vein thrombosis. *British Medical Journal;* 360:k351

Thomas S (2014) Point of care testing: assessing DVT *Practice Nursing*; 25: 5, 252-253.

Virchow R (1998) *Thrombosis and Emboli* (1846-1856)*.* Canton, Mass: Science History Publications.

Weitz JI et al (2017) A Test in Context: D-Dimer. Journal of the American College of Cardiology; 70: 19, 2411-2420.

Welch E and Bonner L (2010) *Venous Thromboembolism a Nurse's Guide to Prevention and Management.* UK:Wiley Blackwell.

Wells P S et al (2003) Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis. *New England Journal of Medicine;* 349:13, 1227–35.

Wells P S et al. (1997) Value of assessment of pretest probability of deep-vein thrombosis in clinical management. *Lancet*; 350:9094, 1795–1798.
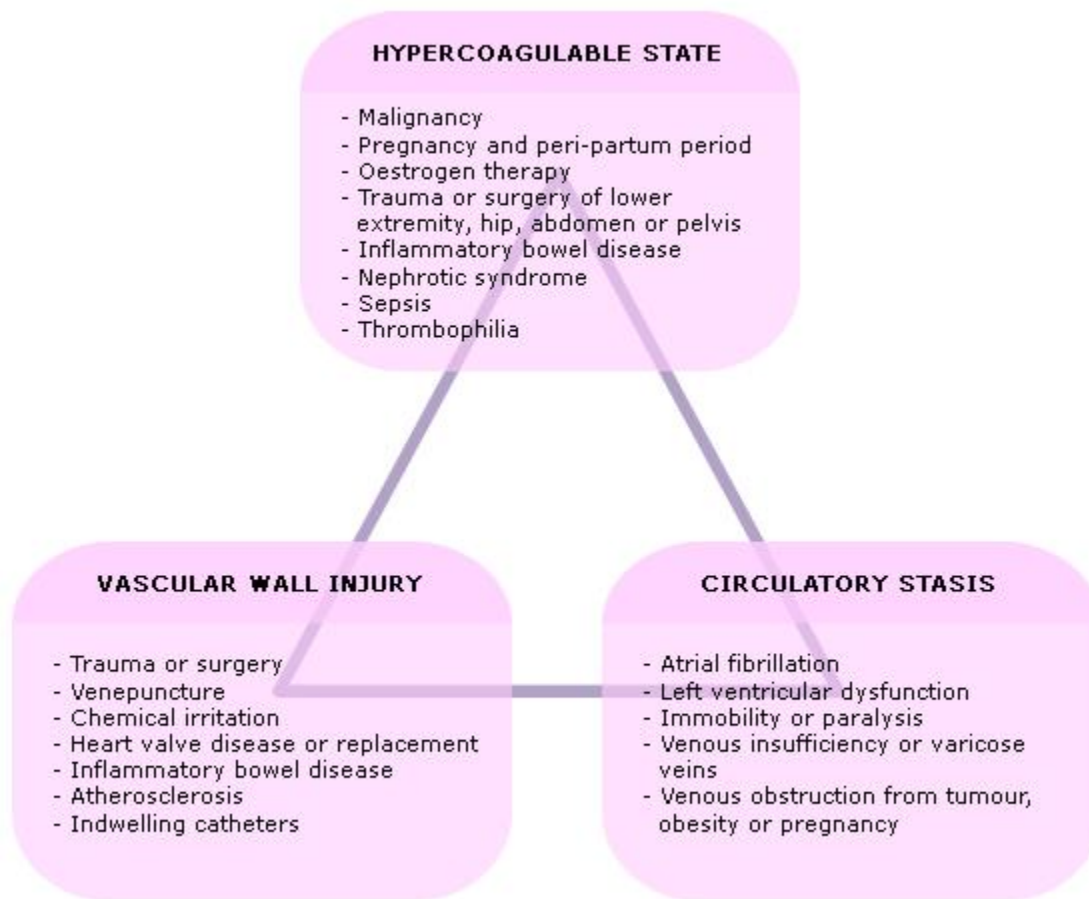
Fig 1. The two level Wells screening tool

HYPERCOAGULABLE STATE

Malignancy

Pregnancy and peri-partum period

Oestrogen therapy

Trauma or surgery of lower extremity, hip, abdomen or pelvis

Inflammatory bowel disease

Nephrotic syndrome

Sepsis

Thrombophilia

VASCULAR WALL INJURY

Trauma or surgery

Venepuncture

Chemical irritation

Heart valve disease or replacement

Inflammatory bowel disease

Atherosclerosis

Indwelling venous catheters

CIRCULATORY STASIS

Atrial fibrillation

Left ventricular dysfunction

Immobility or paralysis

Venous insufficiency or varicose veins

Venous obstruction from tumour, obesity or pregnancy

Fig 2. Two-level Wells risk assessment score (NICE, 2020)

Clinical Feature	Point
Active Cancer (treatment ongoing, within 6 months or palliative)	1
Paralysis, paresis or recent plaster immobilisation of the lower extremity	1
Recently bedridden for 3 days or more or major surgery within 12 weeks requiring general/regional anaesthesia	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3cm larger than asymptomatic side	1
Pitting oedema confined to the symptomatic leg	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternative diagnosis is at least as likely as DVT	-2
Clinical probability simplified score	
DVT likely	2 points or more
DVT unlikely	<2 points

Clinical feature	Point
Active cancer (treatment ongoing, within 6 months or palliative)	1
Paralysis, paresis or recent plaster immobilisation of the lower extremity	1
Recently bedridden for 3 days or more, or major surgery within 12 weeks requiring general/regional anaesthesia	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than asymptomatic side	1
Pitting oedema confined to the symptomatic leg collateral superficial veins (non-varicose)	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternative diagnosis is at least as likely as DVT	-2

Clinical probability simplified score

DVT likely   2 points or more

DVT unlikely   <2 points

[annotations end]

[box starts] Box 1. How to examine a leg for assessment using the Wells screening tool

1. Obtain informed consent from the patient and explain the procedure

2. Maintain privacy and dignity at all times and consider a screened or cubicle area to assess your patient

3. Wash your hands following local policy, and use PPE according to local policy

4. Position the patient to allow full visibility of both legs and patient comfort

5. Expose both patient limbs for assessment to compare and contrast limbs, and remove any tight clothing if necessary

6. Observe both legs to identify any asymmetry or unilateral swelling, skin changes, wounds, oedema, erythema, superficial varicosities or existing varicosities

7. Check for heat with your hand above the suspected area of DVT before palpation

8. Palpate both legs, checking for pitting oedema, pain and breaks in the skin. Pain specific to the deep venous system can be a symptom of a DVT (Wells et al, 2003)

9. Measure the difference in circumference of the calves; this is measured 10 cm below the tibial tuberosity. If there is more than 3 cm difference to the asymptomatic side a DVT is likely diagnosis (Wells et al, 1997)

10. Palpate foot pulses. Check capillary refill time <2-3 seconds. Check the dorsalis pedis pulse (on the top of the foot)(Fig 4) and the posterior tibial pulse (located behind the medial malleolus - the ankle bone) (Fig 5)

11. Assess if your patient can weight bear and mobilise effectively as part of your assessment and observation

12. **Assess range of movement in the patient's joints by gently moving the leg to detect any arthritic swelling or acute pathology which may explain symptoms**

13. **At the end of the assessment, make the patient comfortable and ensure their privacy and dignity**

14. **Decontaminate your hands**

15. **Documents your finding and report any concerns according to local policy**
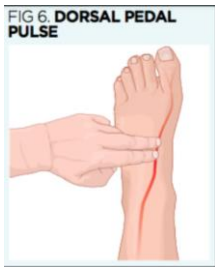
Fig 3. Patient with a DVT

Fig 4 Dorsal pedal pulse

Fig 5 Posterior pedal pulse