National Women & Infants Health Programme

National Clinical Practice Guideline

Prevention and Management of Venous Thromboembolism in Pregnancy

INSTITUTE OF OBSTETRICIANS & GYNAECOLOGISTS

ROYAL COLLEGE OF PHYSICIANS OF IRELAND

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Algorithms

Algorithm 1: Antenatal Risk Assessment

Does this woman have a previously agreed plan from Maternal Fetal Medicine/Haematology? If YES, no need to complete this form, follow that plan.

Is this woman on a therapeutic* dose of anticoagulation outside of pregnancy? If YES, switch to a therapeutic dose of LMWH and refer to haematology

All pregnant and recently pregnant women require risk assessment for VTE:

- At confirmation of pregnancy
- At hospital booking visit
- At every antenatal admission
- In the third trimester of pregnancy

MAJOR RISK FACTOR	
Previous VTE	Commence LWMH prophylaxis and refer to Obstetrics & Haematology,
High risk thrombophilia* or thrombotic Anti-Phospholipid Syndrome	
Nephrotic syndrome	
Sickle Cell anaemia	
Severe Chorioamnionitis	
Prophylactic anticoagulation outside of pregnancy*	

TRANSIENT MAJOR RISK FACTOR	
Surgery in pregnancy*	Commence LWMH prophylaxis for 6 weeks and review
Critical care admission	
Ovarian Hyperstimulation Syndrome	
Hyperemesis gravidarum requiring hospital admission for ≥24 hours	

RISK FACTOR	SCORE	Y/N
Family history VTE in a 1st degree relative*	1	
BMI >30* kg/m^2	1	
BMI >40* kg/m^2	2	
Parity >3	1	
Maternal age >40years	1	
Current Smoker	1	
Multiple Pregnancy	1	

RISK FACTOR	SCORE	Y/N
Gross varicose veins	1	
Pre-existing (type 1) Diabetes	1	
Current IV drug use	1	
Immobility*	1	
Heart failure	1	
Active Thrombophlebitis	1	
Active inflammatory or autoimmune disorder	1	
Cancer – current, active treatment	1	
Other relevant risk factors, please specify*	1	
Hospital admission for ≥24 hours	1	
Current infection requiring hospital admission/treatment*	1	
Pre-eclampsia*	1	
Dehydration	1	
TOTAL SCORE If score 3 or more = LMWH prophylaxis		

*DEFINITIONS

- Therapeutic anticoagulation: warfarin INR target 2-3/apixaban 5mg BD/rivaroxaban 20mg OD/edoxaban 60mg OD/dabigatran 150mg BD
- Prophylactic anticoagulation: any agent at a dose less than therapeutic.
- High-risk Thrombophilia: antithrombin deficiency, protein C or S deficiency, compound heterozygous or homozygous for low-risk thrombophilia.
- Low-risk Thrombophilia: heterozygous for factor V Leiden or prothrombin G20210A mutations.
- Anticoagulation outside of pregnancy refers to women who are on anticoagulation prior to pregnancy, unrelated to the pregnancy.
- Family History of VTE: VTE occurring in a first-degree family member (or members) at a young age (typically <50 years) either unprovoked or in the context of a minor provoking factor (e.g. Oral contraceptive pill (OP) use, pregnancy, long-distance travel).
- BMI to be calculated on booking weight.
- Medical comorbidity: Presence of a severe co-morbidity for which the women receive specialist care, e.g. Ulcerative colitis, Crohn's disease, Rheumatic disease, Systemic Lupus Erythematosus, Type 1 Diabetes Miletus, Cardiac disease, Sickle cell anaemia.
- Any surgical procedure: e.g. appendicectomy.
- Pre-eclampsia: Gestational hypertension: ≥140/90mmHg on 2 occasions ≥ 4 hours apart with proteinuria of at least 300mg in a 24-hour urine collection, arising de novo after the 20th week of gestation in a previously normotensive person or protein: creatinine ratio (PCR) above 30mg/mmol
- Current systemic Infection: Proven infection, e.g. chorioamnionitis, pyelonephritis, pneumonia, bacteraemia. Systemic Inflammatory Response Syndrome (SIRS) as defined by early warning score. Less serious infections (e.g. sinusitis, intrapartum fever with no proven infection) are not considered.
- Immobility: Prolonged bed rest with no mobilisation (>3 days) or prolonged seat immobility, e.g. wheelchair user or after a long-distance travel (>4 hours).

Algorithm 2: Postnatal Risk Assessment

Does this woman have a previously agreed plan from Maternal Fetal Medicine/Haematology? If YES, no need to complete this form, follow that plan.

Is this woman on a therapeutic* dose of anticoagulation outside of pregnancy? If YES, remain on a therapeutic dose of LMWH until appropriate to switch to pre-pregnancy anticoagulant.

Maternal weight measurement after birth.

All pregnant and recently pregnant women require risk assessment for VTE:

- After birth
- At every postnatal readmission within 3 months

MAJOR RISK FACTOR	
Previous VTE	Remain on LWMH prophylaxis for 6 weeks post pregnancy/ postpartum
High risk thrombophilia*; thrombotic Anti-Phospholipid Syndrome	
Nephrotic syndrome	
Sickle Cell anaemia > 28 weeks gestation	
Prophylactic anticoagulation outside of pregnancy*	

TRANSIENT MAJOR RISK FACTOR	
Surgery in pregnancy*	Commence LWMH prophylaxis for 6 weeks and review
Critical care admission	
Severe Chorioamnionitis	
Active thrombophlebitis	

PRE-EXISTING RISK FACTOR	**SCORE**	**Y/N**
Family history VTE 1st degree relative*	1	
BMI >30* kg/m^2	1	
BMI >40* kg/m^2	2	
Parity >3	1	
Maternal age >40years	1	
Current Smoker	1	
Gross varicose veins	1	
Pre-existing (type 1) Diabetes	1	
Current IV drug use	1	
Heart failure	1	
Active inflammatory or autoimmune disorder	1	
Immobility*	1	
Cancer – current, active treatment	1	
Other relevant risk factors, please specify*	1	

TRANSIENT RISK FACTOR	SCORE	Y/N
Readmission in postnatal period	1	
Current infection requiring hospital admission/treatment*	1	
Pre-eclampsia*	1	
Stillbirth in current pregnancy	1	
Prolonged active labour, >12 hours	1	
Emergency Caesarean birth in labour	2	
Elective Caesarean birth	1	
Assisted vaginal birth	1	
Postpartum haemorrhage > 1L/Need for transfusion	1	
TOTAL SCORE	**If score 3 = LMWH prophylaxis for 10 days**	
	If score 4 or more = LMWH prophylaxis for 6 weeks	

*DEFINITIONS

- Therapeutic anticoagulation: warfarin INR target 2-3/apixaban 5mg BD/rivaroxaban 20mg OD/edoxaban 60mg OD/dabigatran 150mg BD
- Prophylactic anticoagulation: any agent at a dose less than therapeutic.
- High-risk Thrombophilia: antithrombin deficiency, protein C or S deficiency, compound heterozygous or homozygous for low-risk thrombophilia.
- Low-risk Thrombophilia: heterozygous for factor V Leiden or prothrombin G20210A mutations.
- Anticoagulation outside of pregnancy refers to women who are on anticoagulation prior to pregnancy, unrelated to the pregnancy.
- Family History of VTE: VTE occurring in a first-degree family member (or members) at a young age (typically <50 years) either unprovoked or in the context of a minor provoking factor (e.g. Oral contraceptive pill (OP) use, pregnancy, long-distance travel).
- BMI – women should be weighed in the postnatal period to determine BMI for the purposes of risk assessment.
- Medical comorbidity: Presence of a severe co-morbidity for which the women receive specialist care, e.g. Ulcerative colitis, Crohn's disease, Rheumatic disease, Systemic Lupus Erythematosus, Type 1 Diabetes Miletus, Cardiac disease.
- Any surgical procedure: e.g. appendectomy.
- Pre-eclampsia: Gestational hypertension: ≥140/90mmHg on 2 occasions ≥ 4 hours apart with proteinuria of at least 300mg in a 24-hour urine collection, arising de novo after the 20th week of gestation in a previously normotensive person or protein: creatinine ratio (PCR) above 30mg/mmol.
- Current systemic Infection: Proven infection, e.g. chorioamnionitis, pyelonephritis, pneumonia, bacteraemia, postpartum wound infection, or endometritis requiring IV antibiotics. Systemic Inflammatory Response Syndrome (SIRS) as defined by early warning score. Less serious infections (e.g. sinusitis, intrapartum fever with no proven infection) are not considered.
- Immobility: Prolonged bed rest with no mobilisation (>3 days) or prolonged seat immobility, e.g. wheelchair user or after a long distance travel (>4 hours).

Tables

Suggested dosing guide of Prophylactic Low Molecular Weight Heparin (LMWH) Thromboprophylaxis in pregnancy and Postpartum Period[i]

Maternal weight (booking weight for antenatal dosing; after delivery for postnatal dosing)	Low molecular weight heparin (LMWH)	
	Tinzaparin	Enoxaparin
<50kg	3500 IU OD	20mg OD
50-100kg	4500 IU OD	40mg OD
101-129kg	7000 IU OD	60mg OD
130-169kg	9000 IU OD	80mg OD
≥170kg	*Seek local advice*	
OD – once daily *IU – international units*		

Early mortality risk for pulmonary embolism (PE) adapted from 2019 ESC guidelines

Early mortality risk	Risk Indicator			
	Haemodynamic instability[a]	**Simplified Pulmonary Severity Index Score**[b]	**Right ventricular dysfunction on cardiac echo or CTPA**	**Elevated cardiac troponin levels**
High	Yes	≥ 1	Yes	Yes
Intermediate	No	≥ 1	One or no positive findings	
Low	No	0	No	No

[a] Cardiac arrest, obstructive shock or persistent hypotension
[b] Simplified Pulmonary Severity Index Score[iii]

Simplified Pulmonary Severity Index (PESI) Score

Parameter	Point
Age >80	1
Cancer	1
Chronic heart failure or chronic pulmonary disease	1
Pulse rate ≥ 110 bpm	1
Systolic BP < 100 mmHg	1
Arterial oxygen saturation < 90%	1

i Reducing the Risk of Thrombosis and Embolism during Pregnancy and the Puerperium (Green-top Guideline No. 37a). Position statement – September 2026

ii Konstantinides SV, Meyer G, Becattini C, *et al.* 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS). *Eur Heart J*. 2020;41(4):543-603.

iii Jiménez D, Aujesky D, Moores L, *et al.* Simplification of the pulmonary embolism severity index for prognostication in patients with acute symptomatic pulmonary embolism. *Arch Intern Med*. 2010;170(15):1383-1389.

Key Recommendations

Prevention

1. Systematic and routine venous thromboembolism (VTE) risk assessment should be incorporated into maternity care pathways to identify women at high risk of VTE and promote the initiation of risk-appropriate VTE prevention in those who require it. (Grade 1B)
2. Repeated VTE risk assessments should be documented at specific time points in the antenatal and postnatal periods. These include at confirmation of the pregnancy, at the first hospital booking visit, at every antenatal admission, in the third trimester of pregnancy and after birth, as well as at any postnatal/postpartum admission up to 3 months. (Grade 1C)
3. VTE risk assessment should be documented immediately after pregnancy regardless of pregnancy outcome (live birth, early or late pregnancy loss, termination of pregnancy). (Grade 1C)
4. VTE risk assessment should be repeated during the pregnancy if any additional risk factors are identified or if there is a change in clinical status. (Grade 1C)
5. Women undergoing assisted reproductive therapy should undergo a VTE risk assessment prior to commencing treatment. (Best Practice)
6. All VTE risk assessments should be documented using a standardised format with a scoring system and this should form part of the woman's care record (paper or electronic). An example is included in this Guideline. (Grade 1C)
7. Consideration should be given to the implementation of innovative tools and supports for VTE risk assessment into existing care pathways and electronic health records including alerts, Clinical Decision Support Systems (CDSS) and actionable recommendations for thromboprophylaxis based on level of VTE risk assessed and body weight (e.g. VTE risk calculators, pharmacological thromboprophylaxis dose calculators). (Grade 1C)
8. Standardised VTE risk assessments in pregnant or recently pregnant women should include all VTE risk factors which have shown to be associated with an increased risk of pregnancy-associated VTE (PA-VTE). (Grade 1C)
9. The recommended first line anticoagulant for thromboprophylaxis in pregnancy women with prior VTE is low-molecular-weight heparin (LMWH) unless contraindications exist. (Grade 1B)
10. A minimum dose of tinzaparin/enoxaparin once daily is suggested for thromboprophylaxis but in cases of extreme body weight (≥170kg), this will need to be individualised. (Grade 1C)
11. Some women will require higher dose of LMWH based on their risk factors for VTE; dosing should be guided by the relevant specialists. Decision-making should be shared with the woman and conducted by the relevant specialist team. (Grade 1C)
12. Women with high-risk VTE risk factors – including history of venous thrombosis, high risk thrombophilia, nephrotic syndrome, type I diabetes and sickle cell anaemia, should commence LMWH at a prophylactic dose at confirmation of pregnancy and be referred to the specialist team in the maternity hospital/unit. (Grade 1C)

13. Women with VTE risk factors that arise during pregnancy – including major surgery in pregnancy, OHSS, critical care admission and severe hyperemesis gravidarum requiring admission with IV therapy, should commence LWMH prophylaxis for 6 weeks. This should be reviewed after 6 weeks as not all women will require LMWH for the duration of pregnancy. (Grade 1C)
14. At confirmation of pregnancy, in women with a high risk of VTE, there is no requirement for pregnancy ultrasound before commencing LMWH prophylaxis. (Grade 1C)
15. After birth/the end of pregnancy (including all types of pregnancy loss and termination of pregnancy), women with VTE risk factors should continue on LMWH for a minimum of 10 days. Those with a higher VTE risk score will be advised to continue LWMH prophylaxis for 6 weeks. (Grade 1C)
16. Women who have been commenced on pharmacological thromboprophylaxis in the antenatal period should be considered for continuation of this thromboprophylaxis for the remainder of the pregnancy and puerperium. (Grade 1C)
17. Extended thromboprophylaxis (i.e. beyond 6 weeks postnatally/postpartum) should be considered by the specialist team when the woman is at persistent high risk of VTE. (Grade 1C)
18. If LWMH prophylaxis is contraindicated, women should be referred to the specialist team for advice on alternatives. (Grade 1C)
19. During hospital admission, women at risk of VTE should also be considered for mechanical thromboprophylaxis. (Grade 2C)
20. All women, but particularly those at increased risk of VTE should be given a Blood Clot Alert Card (or a locally determined suitable alternative strategy appropriate to the woman) and educated on the signs and symptoms of VTE. (Grade 2C)
21. Written information provided by health services on VTE should be accurate and easy to understand and should promote engagement with care. This information should be given to all pregnant and recently pregnant women. (Best Practice)
22. The content of VTE written information should include information on: the signs and symptoms of VTE, risk recognition and reduction, treatment and breastfeeding, as well as maternity hospital/unit contact information. (Best Practice)
23. Women should be instructed to contact the maternity hospital/unit for further instructions in the event of anticoagulant side effects or suspected labour while on anticoagulation. (Best Practice)
24. Hospitals should consider prominently displaying VTE awareness posters, which provides accessible information on the signs and symptoms of a blood clot. (Best Practice)
25. Acute hospital sites without an associated maternity unit need to be aware of the VTE risk in pregnancy and their role in VTE risk assessment and prevention and should consult with their local maternity hospital/unit as needed. (Best Practice)

Diagnosis

26. Pregnant women with signs and symptoms of deep venous thrombosis (DVT) should undergo clinical assessment and diagnostic imaging expeditiously. Women should commence therapeutic anticoagulation pending objective imaging, unless anticoagulation is strongly contraindicated. (Grade 1C)
27. Objective confirmatory imaging should take place as soon as practicable; pregnant and recently pregnant women (<3 months) should be triaged as urgent by the radiology department. (Grade 1C)
28. Compression ultrasonography (CUS) is the recommended first line imaging modality to investigate suspected lower limb DVT in pregnant women. (Grade 1A)

29. Serial CUS may be considered if the initial CUS is negative and if clinical suspicion is high. Reimaging twice within 7 days should be considered where only the proximal limb was imaged and when clinical suspicion of DVT remains high. (Grade 1C)
30. If there is a high index of suspicion for ileo-femoral DVT with negative CUS, alternative imaging should be discussed with local Radiology Department taking into account local availability of resources and expertise. (Grade 1c)
31. D-dimer testing and clinical prediction rules should not be used to rule-out DVT in pregnant women. (Grade 1C)
32. D-dimer testing and clinical prediction rules may be considered in the diagnostic evaluation of pulmonary embolism (PE) during pregnancy if there is expertise on interpretation. (Grade 1B)
33. A chest X-Ray and ECG should be performed for pregnant women with suspected PE. (Grade 1B)
34. In suspected high-risk PE, (defined by haemodynamic instability), point-of care echocardiography or emergency CT pulmonary angiogram (CTPA), depending on availability, feasibility and safety, is recommended. (Grade 2C)
35. Specific investigations for PE include CTPA (low-radiation dose protocol) or perfusion lung scan. (Grade 1A)
36. CTPA is safe in pregnancy and in most hospital/units is the first line imaging modality for PE in pregnancy. If the chest X-Ray is normal, a lung perfusion scan is an option and may be considered. CTPA should be considered as the first-line option if the chest X-Ray is abnormal. (Grade 1C)
37. An indeterminate CTPA result occasionally occurs. In such cases, multidisciplinary discussion may be considered. Clinical factors should be taken into account (level of suspicion) and a decision made either to treat/not treat or consider the need for a repeat imaging procedure (CTPA versus perfusion scan). (Grade 2C)
38. In women with a confirmed DVT, and where there is clinical suspicion of PE, imaging may not always be required to confirm a PE diagnosis unless clinically indicated/necessary. (Grade 2C)
39. In pregnant or recently pregnant women with a new diagnosis of any pregnancy-associated VTE (PA-VTE), the local maternity hospital/unit/specialist team should be informed. Multi-disciplinary team involvement should include Obstetrics and Haematology. (Grade 1C)

Management of PA-VTE

40. In the setting of a suspected or confirmed high risk PE (defined by hemodynamic instability), IV anticoagulation with UFH should be started as quickly as possible with urgent critical care review, urgent echocardiography and consideration for reperfusion strategies. (Grade 1B)
41. Women with acute PA-VTE that are haemodynamically stable should be treated with a therapeutic dose of LMWH unless strong contraindications exist. (Grade 1A)
42. Therapeutic dose of LMWH for PA-VTE in pregnancy should be similar to dosing in non-pregnant women (either with once daily or twice daily weight-adjusted regimens). (Grade 1B)
43. Anticoagulation type, dose and treatment duration should be guided by a multidisciplinary team. (Grade 1C)
44. The multidisciplinary team (obstetrics/haematology/midwifery) should guide further monitoring, and local policies should direct the frequency of follow up visits for antenatal women with PA-VTE. (Grade 1C)

45. In patients with a confirmed PE, they should be risk stratified in a similar way to non-pregnant patients, based on the National Clinical Guideline on Venous Thromboembolism (NCG-VTE). (Grade 2C)
46. Women with a PA-VTE should be treated for the remainder of pregnancy and until 6 weeks postpartum; treatment duration should be a minimum of 3 months but may be longer. (Grade 1B)
47. All women with PA-VTE should undergo measurements of vital signs and fetal monitoring. The frequency of monitoring is dependent on clinical status and is determined by obstetric team. (Grade 1A)
48. For women diagnosed with acute PA-VTE, initial in-hospital treatment is suggested but early discharge could be considered if there is good response to initial treatment, minimal symptoms, no other obstetric or other concerns; and the woman is able to self-administer medications, with stable social supports and follow-up care arranged. (Grade 1C)
49. A management plan for the remainder of the pregnancy, labour and delivery should be provided and discussed with the woman. This should be jointly agreed with the woman and all relevant caregivers and documented in the medical chart (paper or electronic). (Grade 1C)
50. For women on therapeutic dose LMWH, a timed delivery should be considered (scheduled induction of labour or Caesarean birth); however individual risks and benefits should also be considered and discussed with involvement of multidisciplinary specialists where relevant. (Grade 1C)

Peripartum Care

51. Prior to any neuraxial procedure, LMWH should be held for >12 hours and >24 hours, when used at prophylactic and therapeutic doses respectively, assuming normal renal function. (Grade 1C)
52. Once daily doses of prophylactic LMWH should be administered no sooner than 4-6 hours after neuraxial anaesthesia or epidural catheter removal. (Grade 1C)
53. LMWH should be recommenced at therapeutic doses at 24-48 hours post delivery, according to individual assessment of bleeding risk by the specialist/multidisciplinary team. (Grade 1C)

Postnatal Care and Post-VTE Long Term Management

54. Women with a PA-VTE should be offered a clinic appointment (in the appropriate specialty clinic) at 3-6 months after the event (especially if the VTE event was a PE), in order to assess for long term sequelae. Earlier or later visits should also be scheduled as appropriate. (Best Practice)
55. For breastfeeding women LMWH or warfarin are the anticoagulants of choice (Grade 1C)
56. Direct oral anticoagulants (DOACs) should not be used when breastfeeding; however, their use can be considered in women that are not breastfeeding. (Grade 2C)
57. Patients should be screened for post thrombotic syndrome and post PE syndromes in a similar way to non-pregnant patients (*See NCG-VTE).* (Grade Best Practice)
58. Safe contraceptive options should be documented. (Best Practice)
59. Future pregnancies should be discussed in terms of risk of recurrence, thromboprophylaxis plan and how to access specialist care. (Best Practice)
60. Use of hormone replacement therapy (HRT) in the future should be discussed. (Best Practice)

Chapter 1: Initiation

The National Clinical Effectiveness Committee (NCEC) and Health Information and Quality Authority (HIQA) define clinical guidelines as systematically developed statements, based on a thorough evaluation of the evidence, to assist practitioner and patient decisions about appropriate healthcare for specific clinical circumstances, across the entire clinical spectrum[1].

1.1 Purpose

The purpose of this Guideline was to develop and provide a comprehensive evidence-based guidance for the prevention and management of venous thromboembolism (VTE) in pregnancy. This Guideline replaces the HSE Guideline published in 2013.

1.2 Scope

Target Users

Healthcare staff, doctors, advanced midwifery practitioner[2], midwives, nurses, health and social care professionals involved in the care of women with pregnancy associated VTE (PA-VTE).

Target Population

Pregnant women; women up to six weeks postpartum; the preconceptual period; and women at risk of or diagnosed with pregnancy associated VTE (PA-VTE).

1.3 Objective

To provide evidence-based recommendations for the care of women at risk or diagnosed with VTE as well as promoting a standardised approach nationally across all maternity units.

1.4 Guideline development process

The Guideline Developers agreed to undertake this work under the direction of the Guideline Programme Team (GPT). An Expert Advisory Group (EAG) was commissioned by the GPT. Their role was to critically review the Guideline prior to submission to the National Women and Infants Health Programme (NWIHP) and National Venous Thromboembolism Programme (NVTEP) for final approval.

See Appendix 1 for EAG membership and Appendix 2 for Guideline Programme Process.

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1 National Clinical Effectiveness Committee (NCEC) and Health Information and Quality Authority (HIQA) (2015) National quality assurance criteria for clinical guidelines. Version 2. Dublin: NCEC and HIQA. https://assets.gov.ie/11533/2d070cb758a44fcb8b56f28784b10896.pdf

2 Nursing and Midwifery Board of Ireland (NMBI) (2018) Advanced Practice (Midwifery) Standards and Requirements. Dublin. www.nmbi.ie/NMBI/media/NMBI/Advanced-Practice-(Midwifery)-Standards-and-Requirements-2018-final.pdf

The following where involved in the development of this Guideline:

a. Professor Maeve Crowley (Consultant Haematology)

b. Professor Fionnuala Ní Áinle (Consultant, Haematology and National Clinical Lead, NCP-VTE – 01/10/22-15/03/26)

c. Professor John R. Higgins (Consultant, Obstetrics and Gynaecology)

d. Dr Geraldine Gaffney (Consultant, Obstetrics and Gynaecology)

e. Dr Aidan Spring (Consultant, Anaesthesia and Intensive Care Medicine)

f. Professor Peter MacMahon (Consultant, Radiology)

g. Dr Fergal O'Shaughnessy (Clinical Pharmacy)

h. Ms Patricia Byrne (Clinical Psychology)

i. Dr Ahmed Lutfi (Registrar, Obstetrics and Gynaecology)

j. Dr Rebecca Cole (Registrar, Obstetrics and Gynaecology)

k. Dr Nicholas Meyer (Registrar, Haematology)

1.5 Stakeholder involvement

Stakeholders are women who have a common interest in improving health services. This includes persons that are responsible for delivering and those who receive services related to the clinical Guideline.

The EAG has representatives from a broad range of professional backgrounds. Relevant to this Guideline there are representatives from Obstetrics, Midwifery and Anaesthesiology. A public, patient representative is also included in the EAG from the Patient Advocacy Service Ireland and the Irish Neonatal Health Alliance.

The guideline was reviewed and approved by the National Women and Infants Health Programme (NWIHP) and National Clinical Programme in VTE (NCP-VTE).

The NCP-VTE was established in October 2022 to provide governance for the prevention, diagnosis, management and long-term care of venous thromboembolism (VTE) in hospitals and in the community. The National Clinical Lead for VTE reported initially to the National Clinical Advisor Group Lead (NCAGL) for Access and Integration and to the National Lead for Integrated Care.

1.6 Disclosure of interests

Guideline developers and reviewers bring a range of experiences and perspectives to the work of the national Guideline Programme. It is likely that both Guideline developers and stakeholders/reviewers will have a variety of interests, arising from different contexts and activities done in a professional or personal capacity. These can include employment and other sources of income, speaking engagements, publications and research, and membership of professional or voluntary organisations. The involvement of individuals with relevant content expertise is essential for enhancing the value of Guideline recommendations, but these individuals may also have interests that can lead to conflicts of interest, as may peer reviewers, patient representatives and researchers.

All interests should be declared if, in the view of a reasonable person, they are relevant, or could be perceived to be relevant, to the work of the Clinical Practice Guideline in question[3]. Declaring an interest does not mean there is a conflict of interest.

It is important that interests are openly declared so they can be appropriately managed. Conflicts of interest can bias recommendations and ultimately be harmful to women and the health system. Disclosures of interests and appropriate management of conflicts of interest, when identified, are therefore essential to producing high-quality, credible health guidelines[4].

The Guidelines International Network (GIN), a global network of Guideline developers that aims to promote best practices in the development of high-quality guidelines, developed a set of 9 principles to provide guidance on how financial and non-financial conflicts of interest should be both disclosed and managed. It is recommended that Guideline developers follow the GIN principles[5].

For this National Clinical Practice Guideline, all Guideline developers are asked to complete a conflict of interest declaration form. The response to declared interests will be managed by the Guideline programme team, in accordance with GIN principles. Conflicts of interest may be reported in the published Guideline and declarations of interest can be made available.

Dr Fergal O'Shaughnessy is involved in the development, maintenance and research of a locally developed electronic VTE risk assessment tool (Thrombocalc) at the Rotunda Hospital. He undertook PhD in the area of VTE prevention which was funded by the Board of the Rotunda Hospital. He was a collaborator on Enterprise Ireland funded feasibility study of an electronic VTE risk assessment tool and risk assessment score (2020).

Professor Fionnuala Ní Áinle is a co-author on Highlow, Artemis and Thrombocalc publications. She is a member of the International Society on Thrombosis and Haemostasis (ISTH) Council and Vice-Chair of the ISTH Guideline and Guidance Committee. She has research funding (Investigator-initiated studies (IIS), paid to university): Bayer, Daiichi-Sankyo, Sanofi. She has consultancy (paid to university): Boston Scientific.

1.7 Disclaimer

These guidelines have been prepared to promote and facilitate standardisation and consistency of good clinical practice, using a multidisciplinary approach. Information in this Guideline is current at the time of publication.

The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the Clinician in light of clinical data presented by the woman and the diagnostic and treatment options available. Clinical material offered in this Guideline does not replace or remove clinical judgment or the professional care and duty necessary for each specific woman. Clinical care carried out in accordance with this Guideline should be provided within the context of locally available resources and expertise.

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3 NICE (2019) Policy on declaring and managing interests for NICE advisory committees https://www.nice.org.uk/Media/Default/About/Who-we-are/Policies-and-procedures/declaration-of-interests-policy.pdf

4 Traversy G, Barnieh L, Akl EA, Allan GM, Brouwers M, Ganache I, Grundy Q, Guyatt GH, Kelsall D, Leng G, Moore A, Persaud N, Schünemann HJ, Straus S, Thombs BD, Rodin R, Tonelli M. CMAJ. 2021, 193(2):E49-E54. DOI: 10.1503/cmaj.200651 https://www.cmaj.ca/content/193/2/E49

5 Holger J. Schünemann, Lubna A. Al-Ansary, Frode Forland, *et al.*; for the Board of Trustees of the Guidelines International Network. Guidelines International Network: Principles for disclosure of interests and management of conflicts in guidelines. Ann Intern Med. 2015;163:548-553. doi:10.7326/M14-1885. https://www.acpjournals.org/doi/10.7326/m14-1885

This Guideline does not address all elements of standard practice and assumes that individual clinicians are responsible for:

a. Discussing care with women in an environment that is appropriate and which enables respectful confidential discussion. This includes the use of interpreter services where necessary.

b. Advising women of their choices and ensure informed consent is obtained.

c. Provide care with professional scope of practice, meeting all legislative requirements and maintaining standards of professional conduct.

d. Applying standard precautions and additional precautions, as necessary, when delivering care.

e. Documenting all care in accordance with local and mandatory requirements.

1.8 Use of language

Within this guidance we use the terms 'woman' and 'women's health'. However, it is important to acknowledge that people who do not identify as cis-gender women are excluded from this descriptor, including people who identify as transgender, gender diverse and gender non-binary[6]. While there has been a trend to remove the word 'woman/women' and use 'gender neutral' language in policy and practice in relation to women's reproductive health and wellbeing, there is no evidence base to inform this change[7]. We also appreciate that there are risks to desexing language when describing female reproduction[8,9].

Services and delivery of care must be appropriate, inclusive and sensitive to the needs of people whose gender identity does not align with the sex they were assigned at birth. This includes training and education regarding diverse pathways to pregnancy and the use of practices which affirm the sexual and gender identities of all people using Obstetrics and Gynaecology services. Finally, all those using maternal and reproductive health care and services should receive individualised, respectful care including use of the gender nouns and pronouns they prefer.

Language use is key to effectively communicate options, recommendations, and respectfully accept a woman's fully informed decision[10]. With this in mind, the use of birth is preferable to the term delivery in all circumstances and is used consistently where possible throughout the guidelines. It is acknowledged that in some circumstances (e.g., in the case of a medically indicated intervention or surgery) and in some contexts, substituting with the term delivery is considered appropriate and this term may be used instead.

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8 Brotto LA, Galea LAM. Gender inclusivity in women's health research. BJOG: An International Journal of Obstetrics & Gynaecology. https://obgyn.onlinelibrary.wiley.com/doi/full/10.1111/1471-0528.17231

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1.9 Adopting a trauma-informed approach to maternity care

Many women accessing maternity services may have experienced historical or current trauma prior to, or during pregnancy – including emotional, physical, sexual abuse, rape and torture. The perinatal period (pregnancy, birth and the postpartum) can be a time when previous trauma is triggered[11]. Maternity care procedures which may seem routine and 'non-invasive' to healthcare professionals (HCPs), e.g., abdominal palpation or providing breastfeeding support can be triggering for some women with a history of trauma, as can intimate procedures such as vaginal examinations[12].

Trauma-informed care (TIC) is a developing approach to healthcare which recognises the importance of psychological safety, and the need to prevent or resist re-traumatisation of individuals[13]. It is based on 4 key principles (known as the 4Rs): (1) realisation of trauma; (2) recognition of trauma; (3) responding to trauma and (4) resisting re-traumatisation[14,]. A trauma-informed approach to maternity care means that all staff in an organisation have an understanding of the impact of trauma on individuals, families and organisations[15]. While a universal approach is yet to be agreed, within clinical practice and research, many organisations recognise the need to move towards becoming trauma-informed in the provision of maternity care[15, 16]. Such an approach requires commitment, investment and transformation within maternity services.

In simple terms, HCPs should recognise the impact of women's previous or current history of trauma (whether disclosed or not) and adopt a universally sensitive approach to care provision that recognises the impact of trauma on service users and HCPs. Examples of this include ensuring clear communication and consent is sought before any procedures/interventions, ensuring women are provided with dignity and respect at all times.

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Chapter 2: Clinical Practice Guideline

Background

Pregnancy-associated VTE (PA-VTE) is a leading cause of direct maternal death in Ireland according to the fifth Maternal Death Enquiry (MDE) report[1]. In many cases, however, PA-VTE is preventable[2,3]. Systematic prevention of PA-VTE has been proposed to be the most effective way to reduce the rate of maternal death[2,3]. Confidential enquiries into maternal death in Ireland and the UK identified suboptimal prevention of PA-VTE in those who were at risk[1,4]. Of the women who died from PA-VTE in Ireland and the UK between 2014 and 2016, improvements in care which may have made a difference to the outcome were identified in 68% of cases[4]. Similarly, authors of the California Pregnancy-Associated Mortality Review (CA-PAMR) report that nearly all deaths which occurred as a result of VTE between 2002 and 2007 in California had at least some chance of preventability[5].

There is a paucity of evidence to inform effective VTE prevention in obstetric populations. Recommendations for VTE prevention included in this guideline are based on the best available evidence. Where evidence is lacking or of low quality, expert opinion or consensus from international clinical guidelines was often used to develop clinical recommendations. International clinical guidelines considered must have systematically developed recommendations on PA-VTE prevention and management, published in English with full text available online. If doubt existed whether guidelines met the criteria or not, discussions were be held to reach consensus agreements.

The most widely cited clinical guidelines on PA-VTE are from the European Society of Cardiology (ESC)[6], the UK Royal College of Obstetricians and Gynaecologists (RCOG)[7], the American College of Chest Physicians (ACCP)[8] and the American College of Obstetrics and Gynaecology (ACOG)[9] in North America. Other guidelines have been published by individual representative bodies in different counties including Thrombosis Canada[10], Swedish Society of Obstetrics and Gynaecology (SFOG)[11], Society of Obstetric Medicine of Australia and New Zealand and the Australian Society of Thrombosis and Haemostasis (SOMANZ-ASTH)[12].

Recommendations relevant to this Guideline can also be found in:

a. National Clinical Guideline on Venous Thromboembolism (NCG-VTE)[17]

b. National Clinical Practice Guideline: Recurrent Miscarriage[18]

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17 National Clinical Guideline on Venous Thromboembolism (NCG-VTE): Eve Protocol Phase 1: Diagnosis & immediate treatment, physical & psychological recovery; awareness of signs & symptoms; general aspects of prevention in non-pregnant adults. HSE. July 2025. https://www2.healthservice.hse.ie/organisation/national-pppgs/national-clinical-guideline-on-venous-thromboembolism-ncg-vte-eve-protocol/

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c. National Clinical Practice Guideline: Management of rheumatic diseases in the preconception, antenatal and postnatal periods[19]

d. National Clinical Practice Guideline: Induction of Labour[20]

e. National Clinical Practice Guideline: Prevention and Management of Primary Postpartum Haemorrhage[21]

Section 1 – Prevention

Introduction

The following section will discuss the prevention of PA-VTE through risk assessment and through implementation of education and specific appropriate prevention strategies.

Clinical Question 2.1: Who should be risk assessed for PA-VTE?

Evidence Statement

All women in pregnancy should receive a VTE and bleeding risk assessment and should receive education on the signs and symptoms of VTE. Women with a personal history of VTE or thrombophilia have an established increased risk of VTE in pregnancy[6-13]. Moreover, it is well established that women with multiple VTE risk factors may be at increased risk of VTE during pregnancy and in the postpartum period, even in the absence of well-defined high-risk characteristics[6-13].

As the absolute risk of VTE is low in the absence of risk factors, universal thromboprophylaxis is not recommended. It is necessary to assess each person's risk of VTE and identify those who need thromboprophylaxis, while excluding those who do not, as the risk of side effects from the treatment may outweigh the individual's VTE risk. Most international guidelines support an individualised approach to VTE risk assessment[6-13]. Of note, no approach has been appropriately validated in pregnancy, and this remains a crucial knowledge gap. No scoring system has been prospectively validated in the obstetric population, and most have extrapolated assigned scores based on VTE relative risk. Moreover, it is not yet known generally whether most risk factors are additive, multiplicative, or neutral. Additional data from high quality studies, which weigh the benefits, harms, and cost-effectiveness of interventions, will need to be conducted to determine the optimal risk assessment practice. Suggested approaches described herein represent an interim solution and require individual decision-making and appropriate clinical governance.

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Evidence to support the need for VTE risk assessment is contributed to by sequential confidential enquiries into maternal death in Ireland and the UK (2011-2013), in which it has been reported that inconsistent VTE risk assessment may have contributed to poor outcomes among the women who died[14].

Despite the publication of many recommendations for universal VTE risk assessment, there are limited published data assessing the impact of risk assessment and appropriate pharmacological thromboprophylaxis on VTE outcomes and therefore lack of validation. Roberts *et al.* reported a 10.8% reduction in hospital-associated thrombosis events in non-pregnant women in the UK following the implementation of a national VTE programme mandating VTE risk assessment[15]. A reduction in maternal death in the UK was also reported following the publication of comprehensive VTE guidelines from the Royal College of Obstetricians and Gynaecologists (RCOG) in the UK which promoted systematic VTE risk assessment[7]. There are no rigorous data to attribute causation to these observations.

As there is a combination of paper and electronic patient records in use, local centres will need to decide how risk assessment is best implemented in their unit. The use of electronic tools to support risk assessment is encouraged.

Clinical Practice

Routine VTE risk assessment in individual women is recommended to identify women at high risk of VTE and to promote the initiation of risk-appropriate pharmacological thromboprophylaxis in those who require it. It should not be forgotten that all women should also be educated on the signs and symptoms of VTE. International guidelines all consistently recommend repeated and documented assessment of VTE risk. Systematic VTE risk assessment may lead to consistent identification of at-risk women and implementation of effective interventions to prevent PA-VTE.

Recommendations

1. **Systematic and routine venous thromboembolism (VTE) risk assessment should be incorporated into maternity care pathways to identify women at high risk of VTE and promote the initiation of risk-appropriate VTE prevention in those who require it.**

Clinical Question 2.2: When should VTE risk assessment take place?

Evidence Statement

Women who are pregnant, or who have just given birth are at increased risk of VTE compared with non-pregnant populations. The epidemiology of PA-VTE changes during pregnancy and into the postpartum period. Increased risk of VTE is present from early pregnancy[16]. The most recent data from MBRRACE in the UK highlights the risk in early pregnancy where 25% of those who died were in their first trimester of pregnancy[17]. The risk appears to increase as the pregnancy progresses, with the highest risk of VTE being reported in the third trimester. An increased risk of VTE also extends to the postpartum period and VTE is highest in the first week after delivery, declining during subsequent weeks[18-22]. Women undergoing assisted reproductive therapy are also at increased risk of VTE, irrespective of the outcome[23].

VTE risk is dynamic and can evolve and change throughout pregnancy. In a cross-sectional study of over 21,000 women who delivered in the Rotunda Hospital, Dublin, more than 40% of women had VTE risk factors which changed during pregnancy or were only identified in the postpartum period. Of these, one in five were reported to have no risk factors before delivery yet went on to develop high or intermediate characteristics[24]. This highlighted the dynamic nature of VTE risk assessment and the need for repeated assessment of VTE risk at defined periods throughout pregnancy and the postpartum period to ensure all risk factors which are identifiable at the time of risk assessment.

Admission to hospital during pregnancy, and especially during the third trimester, is also associated with an increased risk of VTE compared with time outside hospital. Data from a large cohort study in the UK reported that the risk of VTE was 17-fold higher during hospital admission compared with time outside hospital (adjusted incidence ratio 17.5, 95% CI 7.69-40.0)[25]. The increased risk of VTE also persisted after discharge, being six-fold higher in the 28 days after discharge. The risk of VTE was reported to be higher with longer hospital admission; a four-fold increase in risk was reported for admissions lasting less than 3 days which increased twelve-fold for admissions lasting longer than 3 days[25].

Clinical Practice

Individuals identified as being at a high risk of VTE before pregnancy should undergo a pre-conceptual assessment and establish a VTE prevention plan for their pregnancy. Increased risk of VTE is present from the first trimester of pregnancy. Therefore, VTE risk assessment should be undertaken as early as possible once the pregnancy has been confirmed. As a hospital admission during pregnancy is likely to be associated with an increased risk of VTE, the risk assessment should be repeated if there are any antenatal admissions and in the third trimester of pregnancy as this is when many pregnancy complications may emerge. Any change in the clinical status of the woman should prompt a reassessment. Considering the risk of VTE is highest in the postpartum period, and dynamic nature of VTE risk during labour and delivery, a repeated VTE risk assessment is also recommended immediately after delivery or if the woman is admitted in the three months post-delivery.

Recommendations

2. **Repeated VTE risk assessments should be documented at specific time points in the antenatal and post-natal periods. These include confirmation of the pregnancy, at the first hospital booking visit, at every antenatal admission, in the third trimester of pregnancy and after birth, as well as at any postnatal/postpartum admission up to 3 months.**
3. **VTE risk assessment should be documented immediately after pregnancy regardless of pregnancy outcome (live birth, early or late pregnancy loss, termination of pregnancy).**
4. **VTE risk assessment should be repeated during the pregnancy if any additional risk factors are identified or if there is a change in clinical status.**
5. **Women undergoing assisted reproductive therapy should undergo a VTE risk assessment prior to commencing treatment.**

Clinical Question 2.3: How should PA-VTE risk be assessed?

Evidence Statement

VTE risk assessment tools are intended to formalise, facilitate and standardise VTE risk assessment, reduce variation in care and improve the reliability of action in relation to thromboprophylaxis[26]. Published evidence to inform effective VTE risk assessment in maternity settings is limited. Despite this, VTE risk assessment tools are included in most international guidelines on PA-VTE[6-13]. Many adopt a risk factor-based approach, reflecting the individualised nature of VTE risk and the contribution of individual VTE risk factors to each person's overall risk of VTE.

VTE risk assessment can be complex, owing to the number of risk factors which are considered and the evolving nature of VTE risk; traditional risk assessment tools are challenging to implement in resource-poor, high-throughput settings. There is an inevitable tension between ensuring a comprehensive assessment of risk and delivering a simple tool suitable for use in a high throughput setting[27].

Despite recommendations for formal VTE risk assessment in all prominent international guidelines, there is no accepted or validated approach to assessing the risk of PA-VTE and there is no consensus on how VTE-RA should be undertaken.

Measuring VTE risk and VTE risk scoring tools

The mechanism proposed to quantify VTE risk recommended in international guidelines is inconsistent. For example, some organisations adopt blanket recommendations for subgroups of women with specific characteristics such as history of VTE or mode of delivery[7], while others make recommendations for thromboprophylaxis based on the number of VTE risk factors present[12].

Several risk scores have also been developed for use in the prevention of PA-VTE. Here, an individual score is assigned to each risk factor, and a cumulative score is calculated for each patient, representing an estimate of the magnitude of VTE risk[28-37]. These risk assessment instruments vary in the risk factors considered and the contribution of individual risk factors to the overall risk of VTE.

Most recently, a prediction model has been developed and validated for postpartum VTE by Sultan *et al.*[38]. Here, logistic regression was used to generate a statistical equation which can be used to estimate the absolute risk of postpartum VTE in individual women. In terms of rigour of development, this prediction model represents the most robust risk assessment tool available. However, the prediction model may be criticised for failing to include particular VTE risk factors in the initial development and challenges with implementing the model in clinical practice[39].

The data supporting many of these VTE risk models are limited, for a variety of reasons. Apart from the model derived by Sultan *et al.*, most risk assessment models were derived from existing literature and expert opinion as opposed to being empirically derived[38]. Most risk scores have not been validated in the obstetrical population, or where they have, are subject to methodological limitations and bias, and the ability of each risk score to identify women at risk of VTE is unknown.

A systematic review of risk assessment models for VTE in pregnancy and the puerperium was published in 2022[39]. The authors reported that estimates of sensitivity and specificity were highly variable. The authors concluded that the prognostic accuracy of risk assessment models for obstetric VTE are very uncertain, citing weak design and limited generalisability[39]. The utility of currently available risk assessment models in identifying women at risk of VTE is, therefore, unknown. Despite the limited evidence, VTE risk scores are recommended in current guidelines from the UK and Sweden[7,11].

Enhancing VTE risk assessment compliance

The design of VTE risk assessment tools is reported to be a major contributor to uptake and effectiveness. Confidential enquiries into maternal death in Ireland and the UK (2011-2013) highlight urgent need to develop VTE risk assessment tools which make risk assessment more straightforward and more reproducible[14]. VTE risk assessment tools which are easy to use and could be quickly completed by providers are recommended.

Various other systems-level interventions directed towards improving compliance with VTE risk assessment and promoting the use of risk-appropriate thromboprophylaxis have been developed and implemented in non-obstetric settings. For example, multifaceted interventions, including Computerised Clinical Decision Support Systems (CCDSS), interdisciplinary collaboration and feedback were found to be effective at increasing the appropriate use of thromboprophylaxis in medical and surgical patients (4% increase, 95%CI: 3%-11%), and were more effective when combined with an alert (21% increase, 95% CI:15% to 275%)[40]. CCDSS, in particular, has been shown to increase VTE prevention practices in surgical patients, with a two-fold increase reported in the rate of ordering prophylaxis for VTE when compared with controls (OR 2.35, 95%CI: 1.78-3.10, $p<0.001$), 10 studies) and a significant reduction in the risk of developing a VTE (0.78, 95%CI: 0.72-0.85, $p<0.001$)[40].

Despite the limited data on validity of VTE risk scores, there is evidence from studies of low to moderate methodological quality that multifaceted interventions increase the likelihood of appropriate thromboprophylaxis use. For example, evidence from the Rotunda Hospital, Dublin, suggests implementation of an electronic VTE risk assessment tool which incorporates a VTE risk score increases compliance with VTE risk assessment[41]. Unpublished data from the Rotunda Hospital also suggests the introduction of the electronic risk assessment tool increased the use of risk-appropriate thromboprophylaxis. A quality improvement project incorporating education and electronic health record changes led to a high and sustained increase of documented VTE risk stratification in obstetric settings proportion (0% to 98%) after the screening was integrated into the electronic health record[42]. In a retrospective, uncontrolled before and after study, an iterative VTE risk score was reported to increase the likelihood of appropriate thromboprophylaxis in the puerperium (47.31% to 83.0% (OR 5.4; 95%CI; 4.1-7.2; $p<0.001$)[33].

Considering the variability in VTE risk among pregnant and postpartum women and contribution of multiple VTE risk factors to overall VTE risk, an individualised approach to VTE risk assessment is recommended. A standardised risk assessment tool is recommended to formalise VTE risk assessment, reduce variation in care (e.g. missed risk assessment or risk factor consideration) and improve the reliability of action in relation to thromboprophylaxis[27]. The VTE risk assessment should form part of the patient's care record.

There is insufficient evidence to make specific recommendations on most effective means of assessing VTE risk in maternity settings. Most VTE risk scores have not been validated in the obstetrical population, or where they have, are subject to methodological limitations and bias which limits their use. The data to support existing VTE-RA tools are not sufficient to recommend widespread adoption of a specific VTE risk assessment tool into clinical practice.

A suggested VTE risk assessment template is shown in the Algorithms section.

Clinical Practice

VTE risk assessment tools should be easy to use and should be amenable to being quickly completed by care providers with varying levels of VTE knowledge. VTE risk assessment should integrate into existing care pathways and electronic health records, including, where possible, clinical decision support, risk stratification and actionable recommendations for individualised thromboprophylaxis. Electronic VTE risk assessment tools, where available, should be used if integrated into the local maternity care pathway. Despite the absence of high-quality data on the validity of risk scores in assessing risk of PA-VTE, use of a VTE risk score or other VTE risk assessment tools can be considered as a means of promoting systematic VTE risk assessment and use of risk-appropriate thromboprophylaxis in clinical practice. Innovative tools and multifaceted interventions for VTE risk assessment including standardised prophylaxis order sets with decision support, alerts and interdisciplinary collaboration and feedback should be used to promote VTE risk assessment and risk-appropriate thromboprophylaxis. Regardless of the VTE risk assessment structures implemented, clinical judgment should be exercised to identify high-risk individuals who may not fit into the increased risk categories.

Recommendations

6. **All VTE risk assessments should be documented using a standardised format with a scoring system and this should form part of the woman's care record (paper or electronic). An example is included in this Guideline.**
7. **Consideration should be given to the implementation of innovative tools and support for VTE risk assessment into existing care pathways and electronic health records including alerts, Clinical Decision Support Systems (CDSS) and actionable recommendations for thromboprophylaxis based on level of VTE risk assessed and body weight (e.g. VTE risk calculators, pharmacological thromboprophylaxis dose calculators).**

Clinical Question 2.4: What risk factors should be considered when assessing PA-VTE risk?

Evidence Statement

Over the last 20 years, a number of high-quality epidemiological studies from the UK, Denmark, Sweden, Norway, Canada and the US have provided insight into risk factors for PA-VTE[22,43-49]. Several case-control and cohort studies have identified specific maternal, pregnancy and delivery-related characteristics which are associated with increased risk of PA-VTE. The strength of the association between individual risk factors and PA-VTE is commonly described using odds ratio and relative risk.

Estimates of risk associated with individual VTE risk factors vary depending on the definition of the risk factor used, the population studied and the data source used. Importantly, risk factors for antenatal VTE and postpartum differ and the strength of the association between individual risk factors varies between the antenatal and postnatal periods[45,47].

Literature on the epidemiology of VTE can be used to determine what maternal characteristics increase the risk of VTE and therefore should be included in the risk assessment. Similarly, the magnitude of risk associated with specific risk factors can be used to inform by the risk score assigned to specific risk factors.

When considering other published VTE risk assessment models, there is some heterogeneity in what risk factors are considered and the level of VTE risk assigned to each risk factor. This reflects the absence of high-quality studies and reliance on expert opinion and consensus used to guide clinical practice in the prevention of PA-VTE.

Leading publications contributing knowledge on risk factors for PA-VTE are described in a review by Kevane *et al.*[50]. Most risk factors only have a modest effect on the overall risk of VTE; however, a limited number of characteristics are considered to be high-risk, being associated with an absolute risk of postpartum VTE >1%. Risk factors with the highest risk of postpartum VTE are a history of VTE or a recognised thrombophilia.

Even the absence of these high-risk characteristics, women may be at increased risk of VTE during pregnancy and in the postpartum period[7,21]. Increased age, obesity and caesarean section are reported to contribute most substantially to the rate of VTE due to their high prevalence[6]. The important contribution of overweight and obesity to the risk of PA-VTE is increasingly being recognised[21,49-53]. Enquiries into maternal deaths in the UK and California reported that approximately 60% of women who died from PA-VTE had a BMI >30kg/m[5,26]. The risk of VTE following an emergency caesarean delivery is reported to be twice that of a planned caesarean and four times that of a vaginal delivery[21,45]. Other maternal risk factors which contribute to increased risk of VTE include severe medical comorbidities, including active autoimmune and inflammatory conditions, varicose veins, heart disease and renal comorbidities. Additionally, the strong risk of VTE associated with conditions which are identifiable in the postpartum period such as systemic infection (OR 4.1), postpartum haemorrhage and receipt of a blood transfusion (OR 5.0-7.6), and stillbirth delivery (IRR 6.24) are increasingly being recognised[44,47,54].

The risk of VTE is thought to increase depending on the nature and number of risk factors which are present[55].Although most risk factors are associated with a low risk of VTE in isolation, the cumulative risk of VTE when risk factors co-occur has not been defined. The magnitude of VTE risk may be modified in the presence of a combination of VTE risk factors. For example, a higher risk of postpartum VTE is associated with a systemic infection following a vaginal delivery, compared with a systemic infection following a caesarean section (OR 20.2 and 6.2, respectively)[45]. In this way, risk factors are thought to interact. However, little is known on the interaction between individual risk factors. It is not known whether the risk of VTE is additive, multiplicative or confounded when two or more risk factors co-occur.

Clinical Practice

Maternal, pregnancy and delivery-related characteristics which are associated with increased risk of PA-VTE should be considered when assessing PA-VTE risk. The magnitude of risk associated with each risk factor should be informed by the strength of association (odds ratio and relative risk) reported in epidemiological studies published in the literature. VTE risk factors to be considered in PA-VTE risk assessment models and the magnitude of risk associated with each risk factor have been derived from expert opinion and consensus in the absence of robust data. Table 1 lists VTE risk factors which should be considered when assessing VTE risk in pregnant and postpartum women. The risk of VTE is thought to be additive and increases with each additional risk factor which is identified. VTE risk factors considered in VTE risk assessment should be clearly defined within the VTE risk assessment tool.

The guideline development group have included a VTE risk assessment template which is shown in the Algorithms section. Individual risk factors included in the algorithm, and the magnitude of VTE risk assigned to each risk factor, was informed by evidence from epidemiological studies and a review of other international guidelines.

Recommendations

8. **Standardised VTE risk assessments in pregnant or recently pregnant women should include all VTE risk factors which have shown to be associated with an increased risk of pregnancy-associated VTE (PA-VTE).**

Clinical Question 2.5: How do you prevent PA-VTE in those at high-risk?

Table 1: Risk factors for PA-VTE to be considered during PA-VTE risk assessment.

Postpartum VTE risk factor	Categories	Definition	Strength of association with VTE[50,56-58]
Age >40 years	Yes/No	Age >40 years at time of delivery	Low
Parity ≥3	Yes/No	Para ≥3 at time of booking	Low
BMI	<25kg/m^2	Body Mass Index at time of booking	Low
	25.1-29.9kg/m^2		
	30.0-39.9kg/m^2		
	>40kg/m^2		Intermediate
Current smoker	Yes/No	Any amount at the time of delivery	Low
Gross varicose veins	Yes/No	Symptomatic or above knee, or with associated phlebitis, oedema or skin/ changes	Low
Multiple pregnancy	Yes/No	Twin, triplet or higher-order pregnancy	Low
Thrombophilia	Yes/No	Acquired or inherited thrombophilia (e.g. factor V Leiden, Protein C deficiency, Protein S deficiency, antithrombin deficiency, prothrombin gene mutation, antiphospholipid syndrome).	Variable
Previous VTE	Yes/No	Personal history of VTE	High
Family history of VTE	Yes/No	VTE occurring in a first-degree family member (or members) at a young age (typically <50 years) either unprovoked or in the context of a minor provoking factor (e.g. Oral contraceptive pill (OCP) use, pregnancy, long-distance travel).	Low
Significant medical co-morbidity	Yes/No	Presence of a severe active co-morbidity for which the person receives specialist care, e.g. Ulcerative Colitis, Systemic Lupus Erythematosus, Crohn's disease, cardiac disease, sickle cell anaemia.	Intermediate and variable

Postpartum VTE risk factor	Categories	Definition	Strength of association with VTE[50,56-58]
Pre-eclampsia	Yes/No	Gestational hypertension: ≥140/90mmHg on 2 occasions ≥ 4 hours apart with proteinuria of at least 300mg in a 24-hour urine collection, arising de novo after the 20th week of gestation in a previously normotensive person or protein:creatinine ratio (PCR) above 30mg/mmol	Low
IUGR	Yes/No	Intra-uterine growth restriction/Small for gestational age or birth weight less than the 5th centile.	Low
Stillbirth	Yes/No	Fetal death after 24 weeks' gestation	Intermediate
Systemic infection	Yes/No	Proven infection, e.g. chorioamnionitis, pyelonephritis, pneumonia, bacteraemia. Systemic Inflammatory Response Syndrome (SIRS) as defined by early warning score. Less serious infections (e.g. sinusitis, intrapartum fever with no proven infection) are not considered.	Intermediate
Pre-term delivery	Yes/No	Delivery at less than 37 weeks' gestation	Low
Prolonged labor	Yes/No	Partogram lasting more than 12 hours	Low
Cesarean delivery	Planned	-	Low
	Emergency	-	Intermediate
Operative vaginal delivery	Yes/No	Forceps or vacuum delivery	Low
MROP	Yes/No	Manual removal of the placenta following vaginal delivery	Low
PPH >1000ml or blood transfusion	Yes/No	Postpartum hemorrhage greater than 1000ml or receipt of a blood transfusion	Intermediate
Immobility	Yes/No	Prolonged bed rest with no mobilisation or prolonged seat immobility, e.g. wheelchair user or after a long-distance travel (>4 hours).	Intermediate
Current hospital admission, surgical procedure or bedrest	Yes/No	Currently admitted to hospital during pregnancy	Intermediate
Diabetes Mellitus	Yes/No	Type 1 Diabetes Mellitus	Low
Hyperemesis	Yes/No	Antenatal only	Intermediate
Assisted Reproductive Technology (ART)	Yes/No	Assisted Reproductive Technology (ART) or In vitro fertilisation (IVF)	Low

Evidence Statement

Pharmacological thromboprophylaxis

Antenatal patients at significant risk for PA-VTE following VTE risk assessment should be offered pharmacological thromboprophylaxis[7-12,59,60]. International guidelines favour low molecular weight heparin (LMWH) as a first line anticoagulant for thromboprophylaxis unless contraindications exist, as it does not cross the placenta and has been shown to be safe in pregnancy[7-12]. Contraindications to LMWH include active bleeding and medication side-effects (e.g. heparin induced thrombocytopenia, osteoporosis, skin reactions). If a woman is deemed to require pharmacological thromboprophylaxis but low molecular weight heparin is contra-indicated, she should be referred to the relevant specialist services. If a patient has a known bleeding disorder or significant thrombocytopenia (platelets <50), consult haematology. Refer to Section 5 for information on postnatal anticoagulation.

If a woman is on anticoagulation outside of pregnancy, ideally she should have an individualised plan based on whether she is on a therapeutic or prophylactic dose of anticoagulation. She should be changed from her oral anticoagulant to low molecular weight heparin. If she is on a therapeutic dose of anticoagulation outside of pregnancy, she should be converted to a therapeutic dose of low molecular weight heparin, e.g. tinzaparin 175 units/kg once a day or enoxaparin 1mg/kg twice a day.

International guidelines suggest that, where pharmacological thromboprophylaxis is commenced antenatally, it should continue for the remainder of the pregnancy if the patient is at a persistent high risk for PA-VTE[6,8,11,12,59,60]. The optimal duration of thromboprophylaxis is unclear, with no high-quality supporting data and significant discrepancy between international guidelines. It should be noted that suggestions on the duration of postpartum thromboprophylaxis do not apply to women who are already receiving therapeutic anticoagulation, as these women should have an individualised plan made by a specialist multidisciplinary team.

Physiological changes which occur during pregnancy, including increased glomerular filtration rate, plasma volume and body weight which may affect the pharmacokinetics of LMWH. These changes may impact LMWH plasma levels and efficacy[61]. There is a lack of evidence to inform appropriate dosing of LMWH for pregnant and postpartum women. LMWH dosing recommendations for pregnant and postpartum women has been extrapolated from non-pregnant populations and are based on limited evidence. A small number of randomised studies have been carried out in pregnant populations, but none provide adequate evidence to inform optimal dosing of LMWH in pregnant and postpartum populations. The optimal dose of LMWH for antepartum and post-partum thromboprophylaxis remains unknown[62]. Guidelines from professional bodies internationally do not provide clear guidance. Guidelines from the RCOG include weight-adjusted LMWH doses banded by body weight with a target dose of 75units/kg and 0.6mg/kg suggested for tinzaparin and enoxaparin respectively[7]. Neither the ACCP and American Society of Hematology (ASH) guidelines make clear recommendations, suggesting either low or intermediate LMWH doses can be used in postpartum women[8,55].

Despite the clear high risks, answering the question “does pharmacological thromboprophylaxis reduce the risk of PA-VTE?” has proven to be difficult. In a 2014 Cochrane review, authors came to the conclusion that “there is insufficient evidence on which to base recommendations for thromboprophylaxis during pregnancy (and that) large scale, high-quality randomised trials of currently used interventions are warranted”[63]. The same conclusions arise from a recent (2023) systematic review and meta-analysis, stating that the existing literature is insufficient[64]. Therefore, few trials have examined the optimal dosing of LMWH for VTE prevention, given the many barriers to enrolment in this population.

In an open-label, randomised controlled trial of more than 1000 women with a history of VTE (Highlow), weight-adjusted intermediate – dose low molecular weight heparin during the combined ante-partum and post-partum periods was not associated with a lower risk of recurrence than fix-dose low molecular weight heparin[65]. On review of deaths due to pregnancy associated VTE, it appears that a lack of thromboprophylaxis in high risk women rather than the wrong dose is mainly the issue so for simplicity, a minimum dose of LMWH (tinzaparin 4500 units/enoxaparin 40mg once daily) is recommended[66]. It is accepted that women at extremes of body weight and with certain risk factors making them very high risk for VTE may require adjustment of this dose, but this should be made by relevant specialists.

VTE risk reduction in pregnant women with prior VTE

As mentioned earlier, there is randomised controlled data available for dosing of LMWH for women with a history of VTE[65]. Pregnant women ≤14 weeks' gestation with a history of prior objectively confirmed VTE were randomised to weight-adjusted intermediate-dose or fixed low-dose LMWH. No significant difference was observed in the primary efficacy outcome of objectively confirmed, adjudicated VTE up to 6 weeks postpartum. The primary outcome was reported in 3% and 2% of women in the low and intermediate-dose groups respectively (relative risk [RR] 0.69 [95% CI 0.32-1.47]; p=0.33). There was also no significant difference between the groups in the primary safety outcome, major bleeding (RR 1.16 [95% CI 0.65-2.09]). Based on this study, low-dose LMWH is appropriate for prevention of recurrent VTE in pregnancy. Interestingly, antepartum VTE was numerically similar in both study arms (1% and 1%), whereas postpartum VTE recurrence was more frequent in those receiving low-dose LMWH compared with intermediate-dose LMWH (2% and 1% respectively).

VTE risk reduction in pregnant women with multiple, common VTE risk factors

Remarkable variation in worldwide guideline recommendations[6,7,10,55,67] as well as heated debate[68,69], highlight the important knowledge gap that remains regarding the optimal approach to PA-VTE prevention in women with more commonly occurring VTE risk factors. Of note, the 2018 ASH guideline panel made particular note of urgent research priorities, including a need for greater evidence regarding estimation of absolute VTE risk in women with combinations of known risk factors, and pointed out that the balance of thrombosis and bleeding risk remains uncertain[55].

Ongoing trials and observational studies have the potential to improve the available evidence to guide optimal postpartum thromboprophylaxis strategies in particular. The PARTUM pilot trial has investigated the use of low dose aspirin for post-natal thromboprophylaxis but further trials are required prior to incorporating the findings into guidelines[70]. The PP-HEP pilot trial demonstrated that one in every four women was willing to participate in a pragmatic, open-label trial of 10-day LMWH following delivery, with a positive recruitment rate, in contrast to earlier negative results in Canada in previous years[71].

Clinical Practice

Women deemed at high risk of VTE based on risk assessment should be offered pharmacological thromboprophylaxis with LMWH as the preferred first line agent. If this is contraindicated, they should be referred to a specialist. As there are limited data to guide the optimal dose of LMWH for thromboprophylaxis in pregnancy or postpartum period, a pragmatic approach should be adopted so that women at high risk of VTE receive LMWH as early as possible in their pregnancy.

In line with previous guidelines, there is no requirement for an ultrasound to confirm an intrauterine pregnancy prior to starting LMWH[7]On review of deaths due to PA-VTE, it appears that a lack of thromboprophylaxis in high risk women rather than the wrong dose is mainly the issue so for simplicity, a minimum dose of LMWH is suggested (Table 2) is recommended for thromboprophylaxis[65,66].

Table 2: Dosing of Prophylactic Low Molecular Weight Heparin (LMWH) Thromboprophylaxis in Pregnancy and Postpartum

Maternal weight (booking weight for antenatal dosing; after delivery for postnatal dosing)	Low molecular weight heparin (LMWH)	
	Tinzaparin	Enoxaparin
<50kg	3500 IU OD	20mg OD
50-100kg	4500 IU OD	40mg OD
101-129kg	7000 IU OD	60mg OD
130-169kg	9000 IU OD	80mg OD
≥170kg	*Seek local advice*	
OD – once daily		
IU – international units		

It is accepted that women at extremes of body weight and with certain risk factors making them very high risk for VTE may require adjustment of this dose, but this should be made by relevant specialists.

If women have a pre-conception anticoagulation plan, then this should be followed. A standard dose of LMWH should be used, in keeping with the findings of the HIGHLOW trial[65]; this may need to be modified when a patient is seen by a specialist.

Certain maternal conditions such as high-risk thrombophilia, nephrotic syndrome and sickle cell anaemia are considered high risk in their own right and women with these conditions should commence LMWH prophylaxis at confirmation of pregnancy, irrespective of their other risk factors and be referred to the specialist team in the maternity hospital/unit.

Women with transient VTE risk factors that arise during pregnancy such as major surgery in pregnancy, Ovarian Hyperstimulation Syndrome (OHSS), critical care admission and severe hyperemesis gravidarum requiring admission with IV therapy – should commence LWMH prophylaxis for 6 weeks. This should be reviewed after 6 weeks as not all women will require thromboprophylaxis for the remainder of the pregnancy.

After birth/the end of pregnancy, women with VTE risk factors should continue on LMWH for a minimum of 10 days. Those with a higher VTE risk score will be advised to continue LWMH prophylaxis for 6 weeks. Women who required ante-natal thromboprophylaxis should continue on LMWH for at least 6 weeks post-delivery. The requirement for LMWH >6 weeks should be made by a specialist team.

If women are admitted to hospital, mechanical thromboprophylaxis (compression stockings) should also be considered.

LMWHs are renally excreted and may accumulate in severe renal impairment. If renal impairment is suspected, renal function should be assessed by an appropriately qualified clinician and specialist advice sought regarding the use and dosing of LMWH. In cases of thrombocytopenia, or where platelets are <50 x 109/L, a risk benefit decision should be undertaken by a senior obstetrician, haematologist or anaesthesiologist.

Recommendations

9. The recommended first line anticoagulant for thromboprophylaxis in pregnancy women with prior VTE is low-molecular-weight heparin (LMWH) unless contraindications exist.
10. A minimum dose of tinzaparin/enoxaparin once daily is suggested for thromboprophylaxis but in cases of extreme body weight (≥170kg), this will need to be individualised.
11. Some women will require higher dose of LMWH based on their risk factors for VTE; dosing should be guided by the relevant specialists. Decision-making should be shared with the woman and conducted by the relevant specialist team.
12. Women with high-risk VTE risk factors – including history of venous thrombosis, high risk thrombophilia, nephrotic syndrome, and sickle cell anaemia, should commence LMWH at a prophylactic dose at confirmation of pregnancy and be referred to the specialist team in the maternity hospital/unit.
13. Women with VTE risk factors that arise during pregnancy – including major surgery in pregnancy, OHSS, critical care admission and severe hyperemesis gravidarum requiring admission with IV therapy, should commence LWMH prophylaxis for 6 weeks. This should be reviewed after 6 weeks as not all women will require LMWH for the duration of pregnancy.
14. At confirmation of pregnancy, in women with a high risk of VTE, there is no requirement for pregnancy ultrasound before commencing LMWH prophylaxis.
15. After birth/the end of pregnancy (including all types of pregnancy loss and termination of pregnancy), women with VTE risk factors should continue on LMWH for a minimum of 10 days. Those with a higher VTE risk score will be advised to continue LWMH prophylaxis for 6 weeks.
16. Women who have been commenced on pharmacological thromboprophylaxis in the antenatal period should be considered for continuation of this thromboprophylaxis for the remainder of the pregnancy and puerperium.
17. Extended thromboprophylaxis (i.e. beyond 6 weeks postnatally/postpartum) should be considered by the specialist team when the woman is at persistent high risk of VTE.
18. If LWMH prophylaxis is contraindicated, women should be referred to the specialist team for advice on alternatives.
19. During hospital admission, women at risk of VTE should also be considered for mechanical thromboprophylaxis.

Clinical Question 2.6: What written information should be provided to patients about PA-VTE?

Evidence Statement

Despite the incidence, mortality and long-term health impact of VTE, awareness of this condition in the general population is very poor. A global survey to quantify baseline global public awareness about thrombosis in general and VTE in particular found that public awareness about thrombosis overall, and VTE in particular, is low[72]. This is a major clinical and societal risk that must be urgently addressed, given the missed opportunities to prevent death and long-term disability.

There is no research or best practice guideline specifically addressing the requirements for effective written patient education on PA-VTE. A patient-centred approach to PA-VTE education should consider what information is important according to patients.

A small survey which included 421 non-obstetric members of several national stakeholder organisations and a single local patient and family advisory board in the USA, identified that respondents wanted to learn about VTE symptoms, risk factors, prevention, and compilations[73].

Written patient education materials on PA-VTE are available online from UK, Australia, USA and Canada[74-81]. These patient information materials describe VTE as a "blood clot" in a blood vessel and detail incidence levels of PA-VTE[74-81]. Specific reference is made to why PA-VTE is serious with emphasis on PA-VTE as a leading cause of pregnancy-related death. The information material lists the signs and symptoms of DVT and PE with instructions to seek medical attention if experienced. Risk factors for PA-VTE are communicated and can be categorised according to risk level (e.g. high, intermediate and low) or according to pregnancy period (e.g. before, during and after pregnancy). Information is provided on risk reduction and includes behaviour modifications such as weight loss, smoking cessation, hydration, use of elastic compression stockings, and avoiding prolonged immobilisation (e.g. during long travel or hospitalisation).

The patient information material also describe anticoagulants as "blood thinners"[74-81]. Information on anticoagulant medication safety is explained and includes routes of administration and side effects. The information material also provides actionable steps and practical guidance on managing anticoagulant side effects or delivery while on anticoagulation. For the patient, this should entail avoiding further anticoagulant doses and contacting the maternity unit for further instructions. Information on breastfeeding while on anticoagulation are also included.

Patient information regarding VTE, including a pregnancy specific poster is available on the HSE website[82]. Hospital quality and patient safety (QPS/Quality) departments should ensure that all pregnant women receive either an HSE Blood Clot Alert Card (Appendix 7) or similar appropriate information such as:

- A poster including QR codes linking to information in different languages, such as the Irish Heart Foundation, NVTEP pregnancy-specific information and booklet (Appendix 7),
- Electronic reminders sent by text message,
- Visual aids on OPD TV screens,
- Videos with audio information.

It is important to note that effective patient education is a dynamic process that requires continuous adaptation and improvement based on patient feedback and circumstances[83].

Clinical Practice

Effective patient education is a dynamic process, necessitating an assessment of the specific learning needs and preferences of the person which considers their knowledge level, language proficiency, cultural background and any barriers to learning. Accurate patient education may be delivered through direct interaction or indirectly through reading or video materials. The information should be interactive and should empower patients to participate in shared decision-making and encourage them to be active participants in their care. Patient information materials should be clear, concise and easy to understand with a well-organised layouts and designs.

Recommendations

20. All women, but particularly those at increased risk of VTE should be given a Blood Clot Alert Card (or a locally determined suitable alternative strategy appropriate to the woman) and educated on the signs and symptoms of VTE.
21. Written information provided by health services on VTE should be accurate and easy to understand and should promote engagement with care. This information should be given to all pregnant and recently pregnant women.
22. The content of VTE written information should include information on the signs and symptoms of VTE, risk recognition and reduction, treatment and breastfeeding, as well as maternity hospital/unit contact information.
23. Women should be instructed to contact the maternity hospital/unit for further instructions in the event of anticoagulant side effects or suspected labour while on anticoagulation.
24. Hospitals should consider prominently displaying VTE awareness posters, which provide accessible information on the signs and symptoms of a blood clot.
25. Acute hospital sites without an associated maternity unit need to be aware of the VTE risk in pregnancy and their role in VTE risk assessment and prevention and should consult with their local maternity hospital/unit as needed.

Section 2 – Diagnosis

Introduction

The following section will discuss the investigation and diagnosis of suspected PA-VTE through clinical assessment, biomarkers, clinical prediction rules and diagnostic imaging. We focus on diagnosing lower limb deep vein thrombosis (DVT) and pulmonary embolism (PE). Clinical assessment of women with suspected VTE during pregnancy may be challenging, as symptoms and signs of VTE (including, for example, breathlessness or lower limb swelling) are not infrequent during normal pregnancy and may be more common at later gestations[6,84].

Clinical Question 2.7: How do you investigate and diagnose lower limb DVT during pregnancy and the puerperium?

Evidence Statement

DVT is reported to be diagnosed in ~5-12 per 10,000 pregnancies, and most commonly affects the left leg and the proximal rather than the distal lower limb[85-87].

Diagnostic Imaging for suspected DVT

Compression ultrasonography (CUS) has been studied for DVT exclusion during pregnancy. Serial proximal CUS safely excluded DVT during pregnancy in two prospective cohort studies, with 3-month diagnostic failure rates of 0.6% (95% CI: 0.01-3.1%) and 0.5% (95% CI: 0.1-2.7%) respectively[84,88]. The performance of a single whole-leg CUS has also been validated prospectively during pregnancy for DVT exclusion, with a failure rate of 1.1% (95% CI: 0.3-4.0%)[89]. In a systematic review and meta-analysis including pregnant patients with DVT symptoms (n=635), a pooled false-negative rate for single lower limb ultrasound of 1.27% (95% CI: 0.42-2.56%) was reported[90]. However, the potential consequences of a missed iliac vein DVT are very serious. Therefore, international guidelines recommend that imaging of iliac veins must be included when lower limb CUS is performed during investigation of suspected DVT in pregnancy, suggesting in addition that serial imaging, within 7 days, should be considered if the initial CUS is negative[10,55,59]. Serial imaging is also wise in certain circumstances such as if additional risk factors are present, if clinical suspicion is high, and if symptoms are worsening. Iliac vein thrombosis is more common in pregnant women than in the non-pregnant population presenting with suspected DVT and care should be taken to ensure iliac vein thrombosis is ruled out in women with unexplained buttock inguinal or back pain[91].

Clinical Prediction Rules for DVT

D-dimers and clinical prediction rules are not currently validated for rule-out of suspected DVT during pregnancy and therefore, pregnant women with suspected DVT must undergo diagnostic imaging. A clinical decision rule termed “LEFt” (Left leg symptoms (1 point), Extremity swelling (≥2 cm difference in calf circumference; 1 point) and First-trimester symptom onset (1 point)) is being investigated for diagnostic evaluation of women with suspected DVT during pregnancy[87]. The clinical probability of DVT is deemed “unlikely” in those with a LEFt score of 0 or 1 points and “likely” in those with a LEFt score of >1 points. However, LEFt rule diagnostic failure rates of 3.1% (95% CI: 0.8-7.7%) and 0% (95% CI: 0-8.2%) were reported in retrospective analyses of two cohort studies including 157 and 89 females respectively[92,93]. A prospective clinical management study (LEaD: “Safely Ruling Out Deep Vein Thrombosis in Pregnancy With the LEFt Clinical Decision Rule and D-Dimer”; NCT02507180), which aims to validate a diagnostic algorithm including the LEFt rule, is currently ongoing[94]. In the meantime, d-dimers and clinical prediction rules should not be used for diagnostic evaluation of DVT in pregnant women.

Clinical Practice

The work up of a woman with suspected DVT should include a clinical assessment and compression ultrasonography (CUS) of the lower limb with imaging of the iliac veins where necessary. If the initial CUS is negative, consideration should be made for repeated interval imaging, twice within 7 days in line with international guidelines or an alternative modality of imaging such as MR venography, following consultation with radiology, if there is a strong clinical suspicion of a proximal DVT[95].

Recommendations

26. **Pregnant women with signs and symptoms of deep venous thrombosis (DVT) should undergo clinical assessment and diagnostic imaging expeditiously. Women should commence therapeutic anticoagulation pending objective imaging, unless anticoagulation is strongly contraindicated.**
27. **Objective confirmatory imaging should take place as soon as practicable; pregnant and recently pregnant women (<3 months) should be triaged as urgent by the radiology department.**
28. **Compression ultrasonography (CUS) is the recommended first line imaging modality to investigate suspected lower limb DVT in pregnant women.**
29. **Serial CUS may be considered if the initial CUS is negative and if clinical suspicion is high. Reimaging twice within 7 days should be considered where only the proximal limb was imaged and when clinical suspicion of DVT remains high.**
30. **If there is a high index of suspicion for ileo-femoral DVT with negative CUS, alternative imaging should be discussed with local Radiology Department taking into account local availability of resources and expertise.**
31. **D-dimer testing and clinical prediction rules should not be used to rule-out DVT in pregnant women.**

Clinical Question 2.8: How do you investigate for PE in pregnancy and the puerperium?

Evidence Statement

During the investigation of suspected PE during pregnancy, competing risks can be challenging and include exposure of the mother and fetus to ionizing radiation and the consequences of a missed PE diagnosis.

Diagnostic Imaging of PE

When modern imaging techniques are used, radiation exposure to both mother and fetus is low[6]. Fetal radiation doses are extremely low with both perfusion lung scanning and computed tomography pulmonary angiography (CTPA), well below the ~50-100mSv threshold for potential fetal radiation complications[96,97]. Given the usual normality of chest plain film radiography, avoidance of ventilation lung scans, and the performance of low dose perfusion scans are both acceptable, which reduces radiation exposure even more. CTPA does confer a slightly higher breast radiation doses than either ventilation-perfusion or perfusion only scanning, but technological advances have dramatically reduced exposure without compromising image quality[98-100]. These include anatomic scan coverage (which can reduce

radiation exposure by as much as ~70%), iterative reconstructive techniques, reduced kilovoltage and reducing the CTPA contrast-monitoring component[101,102]. It is now possible to safely achieve breast radiation doses that are as low as 3-4 mGy[100]. The effective maternal dose varies depending on maternal BMI and the fetal dose is dependent upon both maternal BMI and gestational age[103]. The recently published OPTICA study demonstrated the safety of this low-dose CTPA protocol for diagnosing PE in pregnancy[100]. Conducted from May 2018 to February 2022, the study (which included 116 CTPAs) reported that the protocol safely ruled out PE with no recurrent VTE at 3 month follow-up (0.0%; one-sided 95%CI: 2.66%). The optimised protocol demonstrated minimal radiation exposure, with a mean absorbed breast dose of 2.9mGy and a maternal effective dose of 1.4mSv[100]. Another Irish study by the same group also recently reported that additional breast radiation dose savings can be achieved by combining low-dose CTPA with breast shields in pregnancy without impacting image quality: shielding reduced surface breast radiation dose by 66% (to 0.5±0.3 mGy) in an anthropomorphic phantom and by 48% (to 0.7±0.2 mGy) in study participants[104].

Provided that modern, low-radiation-dose technology is utilised (as summarised in recent international guidelines), the theoretical effect on the pregnant women's breast cancer risk may be extremely low, if present at all[6,100]. A retrospective population-based cohort study aimed to evaluate the short-term risk of breast cancer in pregnant or postpartum mothers exposed to chest CT (n=5,859), V/Q scan (n=4075) or neither (n= 1,292,059)[105]. Women were followed up for a median duration of 5.9, 7.3 and 11.1 years, respectively (from 1 year after exposure). Imaging with thoracic CT was not associated with a significantly increased maternal breast cancer risk compared to the unexposed group (adjusted HR 1.17 (95% CI 0.80-1.70)[105]. These data suggest that deciding to avoid CTPA because of a perceived increase in breast cancer is not, based on published data, currently justified, particularly when a low-radiation-dose modern protocol is utilised. This is of clinical relevance because radiation exposure is frequently cited as a rationale to avoid CTPA in diagnostic algorithms in favour of V/Q or perfusion scanning. However, given the widespread availability of CT scanning in Irish emergency departments (particularly out of hours), and experience of trainees with CTPA, we should not discourage its use in PE imaging during pregnancy. Local availability of imaging modality for initial PE imaging in pregnancy should be taken into account.

There is no evidence that V/Q or perfusion scanning is superior to CTPA in PE diagnosis during pregnancy. A normal perfusion scan and a negative CTPA appear equally safe for ruling out PE in pregnancy, as shown by several retrospective series[106-108]. Inconclusive or indeterminate results are common and the chance of an inconclusive or suboptimal CTPA scan increases with advancing gestation[106-111]. Decreased arterial enhancement in pregnancy contributes to the high proportion of inconclusive CTPA scans. However, sensitivity and negative predictive value of lung scintigraphy and CTPA are reported to be high. A 2017 Cochrane review reported median negative predictive values (range) of 100% (99-100%) and 100% (96-100%) and median sensitivity of 100% (0-100%) and 83% (0-100%) for lung scintigraphy and CTPA respectively[110]. Moreover, a retrospective cohort study of 322 consecutive pregnant women reported 100% and 97.5% negative predictive value at 90 day follow up with the use of low dose perfusion (LDQ) scanning and CTPA scanning respectively[109]. A recent UK survey of 24 sites reported a similar proportion of inadequate and indeterminate CTPA and scintigraphy scans[112].

In light of these data, recently published ESC guidelines recommend that "Perfusion scintigraphy or CTPA (with a low-radiation dose protocol) should be considered to rule out suspected PE during pregnancy; CTPA should be considered as the first-line option if the chest X-ray is abnormal"[6]. If a high risk PE (defined by haemodynamic instability) is suspected, point-of care echocardiography or emergency CTPA (depending on availability, feasibility and safety) is recommended for diagnosis in line with the National Clinical Guideline on VTE (NCG-VTE)[113].

Clinical Prediction Rules for PE

Until recently, clinical prediction rules and D-dimer levels had not been clinically validated to exclude PE during pregnancy. Therefore, the overall prevalence of PE during pregnancy was low, approximately 2-5%[109,110,114]. A combination of data from clinical prediction rules and D-dimers may be used to rule out PE in non-pregnant patients without the need for radiological imaging. However, D-dimers continuously increase during pregnancy and levels are above the threshold for VTE "rule-out" of 500 µg/L in almost one-quarter of pregnant women in the third trimester[115,116]. A negative D-dimer has not been clinically validated as a stand-alone rule-out test for PE during pregnancy.

A prospective UK cohort study ("Diagnosis of PE in Pregnancy" or DiPEP) augmented with additional cases of confirmed disease did not confirm that D-dimers or clinical decision rules were of benefit in women with suspected PE during pregnancy or the puerperium[117,118]. However, in this study, PE was diagnosed by either objective diagnostic imaging or by clinical diagnosis and a fixed diagnostic algorithm was not utilised (clinical probability was not prospectively assessed at the time of D-dimer testing).

Subsequently however, the results of two multicentre, multinational prospective diagnostic management outcome studies have supported the incorporation of D-dimers and clinical prediction rules into diagnostic algorithms for women with suspected PE during pregnancy. The first was the CT-PE study of Righini *et al.* in 2019[92]. In this study, PE was excluded without CTPA in pregnant women who had a low or intermediate pretest clinical probability assessment (using the revised Geneva score) and a negative D-dimer (defined as <500 µg/L). Women fulfilling these criteria did not undergo diagnostic imaging, were not treated and were followed up at 3 months. A total of 395 women were included in the study. Pretest probability was low in 192 women (48.6%), intermediate in 200 (50.6%), and high in 3 (0.8%). PE was diagnosed in 7.1% of patients and the rate of symptomatic VTE events at 3 months was 0.0% (95% CI: 0.0-1.0) among untreated women. Among the 392 women who did not have a high pretest probability, 11.7% had a negative D-dimer result and did not require diagnostic imaging according to this algorithm. Bilateral CUS was mandated in women with a high pretest probability or low/intermediate pretest probability with a positive D-dimer because CTPA could be avoided if the CUS revealed DVT. Of these 397 women undergoing CUS, only 7 had a positive result (an overall diagnostic yield of only 2%).

A second multicentre, international prospective management study with a design that also included withholding of anticoagulation in algorithm-defined lower-risk women and clinical follow-up at 3 months, evaluated a pregnancy-adapted YEARS algorithm (ARTEMIS study) with parallel assessment of the three YEARS criteria (clinical signs of DVT, haemoptysis and pulmonary embolism as the most likely diagnosis) and D-dimer levels followed by selective CTPA in 498 women with suspected PE during pregnancy[119,120]. In patients with no YEARS items and a D-dimer <1000ng/mL, or with ≥1 YEARS item and D-dimer <500ng/mL, PE was deemed excluded. All other women underwent diagnostic imaging, consisting of CTPA (or CUS if patients had clinical signs of DVT, without further imaging if the CUS revealed DVT). The primary outcome was the cumulative incidence of symptomatic VTE, with confirmation by objective tests, during a 3 month follow up period in women in whom anticoagulation had been withheld on the basis of a negative algorithm result. In 510 consecutive patients screened, 4.0% were diagnosed with PE. At 3-month follow up, only one person developed a popliteal DVT (0.21%; 95% CI: 0.04-1.2%) and none developed PE, demonstrating the safety of this algorithm for ruling out PE during pregnancy. Exposure to diagnostic imaging could be avoided in 39% (95% CI: 35-44%) of patients. D-dimers increased throughout pregnancy. Consequently, the proportion of women in whom PE could be excluded without diagnostic imaging was higher in the first trimester (65%) and lower in the third trimester (32%). The diagnostic yield of targeted CUS was higher than that reported in the Righini *et al.* study, at 7%.

A recent individual patient data meta-analysis (IPDM) including data from 893 patients from the CT-PE-pregnancy and ARTEMIS studies support the use of non-invasive diagnostic strategies in pregnant women with suspected PE, because PE could be ruled out based on non-high clinical probability and a normal D-dimer in up to 40% of patients[121]. Point estimates of the failure rates were acceptably low, applying a safety threshold dependent on PE prevalence at baseline. For the YEARS algorithm, the sensitivity, failure rates and efficiency (number of CTPA scans avoided) were 98% (95% CI 88-100%), 1.4% (95% CI 0.49-3.3%) and 43% (95% CI 40-46%) respectively. The efficiency of CUS in patients without DVT symptoms was low at 0.79% (95% CI 0.16-2.4%) but 10-fold higher in those with DVT symptoms, at 7.9% (95% CI 3.9-15%). Baseline PE prevalence was 5.4%.

Collectively, these prospective data derived from high-quality clinical management studies prompted a change in the recommendation given in the ESC guidelines: that D-dimer measurement in conjunction with clinical prediction rules "should be considered" during investigation of suspected PE in pregnancy[6]. This was also the approach supported by the 2026 AHA/ACC/ACCP/ACEP/CHEST/SCAI/SHM/SIR/SVM/SV Guideline for the Evaluation and Management of Acute Pulmonary Embolism in Adults: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines[165]. Further prospective clinical trials and studies may consider further evaluating the optimal d-dimer threshold and clinical prediction rule in the evaluation of a pregnant woman with a suspected PE.

As pregnant and recently pregnant women have specific factors that need to be taken into account, their obstetric team should be contacted if they are diagnosed with a VTE as choice of anticoagulant agent, duration of treatment and planning of future contraception and pregnancies are impacted by their status.

Clinical Practice

The evidence to support the recommendations are largely derived from published literature on PE diagnosis during pregnancy and the postpartum period. Patients with suspected PE require a clinical assessment. Clinical prediction rules utilising D-dimer testing can be considered to guide further investigations when local expertise in their use is available. Other instigations include a chest x-ray, a CUS of the lower limb only if concurrent DVT symptoms, a CTPA (low-radiation dose protocol) or a perfusion lung scan.

Recommendations

32. D-dimer testing and clinical prediction rules may be considered in the diagnostic evaluation of pulmonary embolism (PE) during pregnancy if there is expertise on interpretation.
33. A chest X-Ray and ECG should be performed for pregnant women with suspected PE.
34. In suspected high-risk PE, (defined by haemodynamic instability), point-of care echocardiography or emergency CT pulmonary angiogram (CTPA), depending on availability, feasibility and safety, is recommended.
35. Specific investigations for PE include CTPA (low-radiation dose protocol) or perfusion lung scan.
36. CTPA is safe in pregnancy and in most hospital/units is the first line imaging modality for PE in pregnancy. If the chest X-Ray is normal, a lung perfusion scan is an option and may be considered. CTPA should be considered as the first-line option if the chest X-Ray is abnormal.
37. An indeterminate CTPA result occasionally occurs. In such cases, multidisciplinary discussion may be considered. Clinical factors should be taken into account (level of suspicion) and a decision made either to treat/not treat or consider the need for a repeat imaging procedure (CTPA versus perfusion scan).
38. In women with a confirmed DVT, and where there is clinical suspicion of PE, imaging may not always be required to confirm a PE diagnosis unless clinically indicated/necessary.
39. In pregnant or recently pregnant women with a new diagnosis of any pregnancy-associated VTE (PA-VTE), the local maternity hospital/unit/specialist team should be informed. Multi-disciplinary team involvement should include Obstetrics and Haematology.

Section 3 – Management of Acute PA-VTE

Introduction

The following section will discuss the management of PA-VTE including DVT and PE.

Clinical Question 2.9: What is the optimal management of acute PA-VTE?

Evidence Statement

Almost all clinical practice guidelines agree that care of women with acute PA-VTE requires a multidisciplinary team[6,8,10,11,55,59,60]. The clinical scenario dictates which specialists should be involved and the team could include obstetricians, haematologists, anaesthetists, intensivists, cardiologists, respiratory physicians, vascular surgeons, (interventional) radiologists and pharmacists.

Risk Stratification for Acute Management and Early Mortality

While the NCG-VTE (https://www2.healthservice.hse.ie/files/534/) is intended for use in non-pregnant adults, in the absence of pregnancy specific data, it can be followed for the purposes of risk stratification of PA-VTE and to help guide the care of high risk PE[113].

In suspected high-risk PE, (defined by haemodynamic instability), point-of care echocardiography or emergency CTPA (depending on availability, feasibility and safety) is recommended for diagnosis. Urgent echocardiogram and urgent review by critical care team and senior decision makers so that reperfusion strategies can be considered. In the absence of haemodynamic instability at presentation, further risk stratification of PE is recommended, as it has implications for early discharge vs. hospitalisation or monitoring of the patient (Figures 3 and 6 of NCG-VTE document)[113]. The pulmonary embolism severity index (PESI; Table 3 of NCG-VTE document) is not validated in pregnant women but in the absence of a suitable tool is recommended for prognostication in patients with suspected PE[113].

For all patients, early mortality risk from PE should also be determined by considering[6,113]:

- The haemodynamic stability of the patient
- Presence of right ventricular dysfunction on cardiac echography or CTPA
- Laboratory biomarker markers (e.g. cardiac troponin, B-type natriuretic peptide)
- Early mortality risk scoring tools (e.g. PESI or simplified PESI).

Anticoagulation

All women with acute PA-VTE should be treated with anticoagulation. Anticoagulation reduces VTE-associated mortality and the risk of recurrent VTE[6,8,10,11,55,59,60]. The choice of anticoagulant should consider the location of the initial VTE, pregnancy status (antenatal or postnatal), gestation, medical comorbidities (e.g. renal failure or hepatic dysfunction), anaesthetic preferences, drug-allergy status and patient preferences (Table 3). In cases of haemodynamic instability associated with PE, IV unfractionated heparin (UFH) is recommended. Low molecular weight heparin (LMWH) is recommended as an initial treatment for haemodynamically stable patients (unless a strong contraindication exists), which may in rare circumstances be later switched to another alternative[6,8,10,11,55,59,60]. Clear local polices should guide the initial dosing of therapeutic LMWH. The initial therapeutic LMWH dose should be calculated according to early pregnancy or booking body weight[6,8,10,11,55,59,60]. If the booking weight is not available,

her current weight should be used. Although no randomised controlled trial has evaluated the optimal dose of LMWH for treatment of PE during pregnancy, currently published data favour similar dosing to non-pregnant patients, either with once daily or twice daily weight-adjusted regimens[6]. Prior to (or, if not possible, during) the commencement of anticoagulation, laboratory tests including a full blood count, a coagulation profile, renal and liver function tests, are recommended at baseline, to evaluate the patient's haemoglobin level and platelet count and to investigate for renal or liver function abnormalities. Anti-Xa is not routinely recommended, in line with other international guidelines[59].

UFH use in previous decades was associated with heparin-induced thrombocytopenia and bone loss[122]. However, it remains uncertain whether risk is increased with LMWH use: in a more recent observational cohort study, in which bone mineral density was measured by dual energy X-ray absorptiometry (DEXA) 4-7 years after the last delivery in 152 women (92 of which received prolonged LMWH during pregnancy, 17 at treatment dose), lumbar spine bone mineral density was similar in LWMH-treated women and controls following adjusting for potential confounders. No osteoporosis or osteoporotic fractures were reported[122].

Placental transfer of UFH or LMWH is expected to be minimal due to the physiochemical properties of the drug. To date, no embryo-fetal effects have been attributed to the use of these agents in pregnancy. UFH and LMWH are appropriate to use during pregnancy.

Few data are available on the use of danaparoid in pregnancy. Limited published case reports do not suggest increased risk of congenital malformations[123,124]. Some sources state that danaparoid can be used for anticoagulation in pregnant women with a heparin intolerance[123,124]. Experience with the use of fondaparinux in pregnancy is very limited. No reports of embryo-fetal harm have been reported in specialist reference sources. Some sources state that fondaparinux may be used in pregnancy where there is a clear indication and should not be withheld because of pregnancy[123,124].

Vitamin K antagonists (VKA) cross the placenta and are associated with a well-defined embryopathy during the first trimester. Administration of VKAs in the third trimester can result in fetal and neonatal haemorrhage, as well as placental abruption. Warfarin may be associated with central nervous system anomalies throughout pregnancy. DOACs are contraindicated in pregnancy[125].

Anticoagulant dose and timing may also be influenced by:

- Gestation and expected day of delivery
- Mode of delivery
- Information from laboratory tests, e.g. renal function
- Body weight changes
- Duration of time since the initial diagnosis
- The occurrence of recurrent VTE while on anticoagulation
- Risk of postpartum haemorrhage.

If PA-VTE was diagnosed antenatally, all guidelines recommend that anticoagulant treatment should be extended for the remainder of the pregnancy and for a minimum of six weeks postnatally[6,8,10,11,55,59,60]. The recommended total minimum duration of anticoagulation is three months in four guidelines and six months in one guideline[6,8,10,11,55,59]. However, longer anticoagulant duration, with or without dose changes, may be appropriate, under specialist management, if the risk of recurrent VTE is considered to be high.

Table 3: Therapeutic anticoagulant for PA-VTE.

Anticoagulant Type	Suggested suitable patient with acute PA-VTE
Therapeutic-intensity low molecular weight heparins (LMWH) e.g. Tinzaparin 175 units/kg OD or Enoxaparin 1 mg/kg BD	• Used antenatally or postnatally, including if breast feeding. • Normal renal profile. If renal profile abnormal, discussion with haematologist is recommended to guide optimal management. • No history of adverse drug reactions (e.g. heparin-induced thrombocytopenia, osteoporosis or allergic skin reactions)
Unfractionated heparin (UFH)	• Used antenatally or postnatally, including breast feeding. • Consider if haemodynamically unstable or if estimated renal function <30ml/min • Ideally used at term (>37 weeks gestation) or within 2-3 weeks from expected date of delivery, if LMWH is not deemed optimal by the multidisciplinary team. • Patients at high risk of haemorrhage, if LMWH is not deemed optimal by the multidisciplinary team • No history of adverse drug reactions (e.g. heparin-induced thrombocytopenia, osteoporosis or allergic skin reactions)
Heparinoids (Fondaparinux, Danaparoid)	• Used antenatally or postnatally. • Declining or not suitable for neuraxial anaesthesia • May be considered if intolerance to LMWH or UFH. Should not be withheld due to pregnancy when indicated.
Vitamin K antagonists (VKA)	• Used postnatally only and when the patient is no longer at risk of postpartum haemorrhage. • Safe if breastfeeding • No evidence of hepatic dysfunction
Direct-acting oral anticoagulants (DOACs)	• Not recommended for acute PA-VTE • May have a role in the postpartum setting if not breastfeeding and no longer at risk of postpartum haemorrhage – seek local guidance

DVT-Specific Therapy

In addition to anticoagulation, accurately fitted graduated elastic stockings may be utilised to reduce acute lower limb oedema and therefore alleviate symptoms. However, compression therapy may not reduce the risk of Post Thrombotic Syndrome (PTS). In limb-threatening DVT, consideration should be given to catheter-directed thrombolysis or mechanical/pharmaco-mechanical thrombectomy by the multidisciplinary team according to ANZJOG, ASH and GTH guidelines[12,55,60].

PE-Specific Therapy

Severe or life-threatening PE during pregnancy is a rare but potentially devastating event. A systematic review included 127 cases of severe PE during pregnancy (until 6 weeks postpartum) that were treated with thrombolysis, thrombectomy and/or extracorporeal membrane oxygenation[125]. Both high and intermediate-risk PE cases (defined according to ESC guidelines) were included and 23% of women experienced cardiac arrest[6,125]. Reported survival was 84% and 94% following thrombolysis and surgical thrombectomy respectively (which may reflect reporting bias)[116]. Major bleeding occurred in 17.5% during pregnancy and 58% in the postpartum period following thrombolysis and in 86% following surgical thrombectomy[125]. Fetal deaths occurred in 12% and 20% following thrombolysis and thrombectomy respectively. Thrombolytic treatment should not be used peripartum, except for critical cases[125]. Consideration should be given to catheter-directed thrombolysis or mechanical/pharmaco-mechanical thrombectomy if expertise available.

In life threatening PE or high-risk acute PE (PE with haemodynamic instability), reperfusion treatment, such as thrombolysis or mechanical/pharmaco-mechanical thrombectomy, if appropriate. Consideration should be given to contacting a tertiary centre in this context however this should not delay urgent administration of systemic thrombolytic therapy.

Inferior vena cava (IVC) filters, while rarely indicated due to competing risks may be considered by the multidisciplinary team in cases of contraindication to therapeutic anticoagulation or rarely, for recurrent PE despite anticoagulation.

Clinical Practice

Care of a woman with PA-VTE requires input from multidisciplinary team. The first line anticoagulant choice is therapeutic LMWH. Women with PA-VTE may benefit from other therapies as guided by the multidisciplinary team.

Recommendations

40. **In the setting of a suspected or confirmed high risk PE (defined by hemodynamic instability), IV anticoagulation with UFH should be started as quickly as possible with urgent critical care review, urgent echocardiography and consideration for reperfusion strategies.**
41. **Women with acute PA-VTE that are haemodynamically stable should be treated with a therapeutic dose of LMWH unless strong contraindications exist.**
42. **Therapeutic dose of LMWH for PA-VTE in pregnancy should be similar to dosing in non-pregnant women (either with once daily or twice daily weight-adjusted regimens).**
43. **Anticoagulation type, dose and treatment duration should be guided by a multidisciplinary team.**
44. **The multidisciplinary team (obstetrics/haematology/midwifery) should guide further monitoring, and local policies should direct the frequency of follow up visits for antenatal women with PA-VTE.**
45. **In patients with a confirmed PE, they should be risk stratified in a similar way to non-pregnant patients, based on the National Clinical Guideline on Venous Thromboembolism (NCG-VTE).**
46. **Women with a PA-VTE should be treated for the remainder of pregnancy and until 6 weeks postpartum; treatment duration should be a minimum of 3 months but may be longer.**

Clinical Question 2.10: What additional antenatal care is needed for women with PA-VTE?

Evidence Statement

Care Setting

The ESC, ANZJOG and SOGC guidelines recommend that patients diagnosed with acute PA-VTE be hospitalised for initial treatment[6,10,12]. For antenatal inpatients, the location of care should allow for fetal monitoring if required. For postnatal inpatients, location of care should allow for contact with their babies. The duration of inpatient care will be dependent on the response to initial treatment, symptom control, the ability of patient to self-administer anticoagulation and any other obstetric concerns.

The ASH and GTH guidelines suggest that suitable patients with PA-VTE could also receive initial treatment as an outpatient rather than be admitted[55,60]. If outpatient treatment is considered following the initial diagnosis, the SOGC guidelines specify that close outpatient monitoring should last at least two weeks[10].

Monitoring

The haemodynamic profile of all patients with PA-VTE should be monitored[6,8,10,11,55,59,60]. Fetal monitoring should be arranged in antenatal patients[6,8,10,11,55,59,60]. Laboratory test monitoring (e.g. platelet counts, activate partial thromboplastin time (aPTT), International normalised ratio (INR)) may be required for specific patient groups (e.g. UFH or warfarin treatment) and should be following the advice of a multidisciplinary team. RCOG and GTH guidelines recommend performing platelet count monitoring every two to three days for patients receiving UFH from day 5 to 14 of treatment or until UFH is stopped[59,60].

For the majority of patients receiving LMWH treatment for PE during pregnancy (except in exceptional circumstances including renal impairment and at extremes of body weight), the measurement of plasma anti-FXa activity to guide dosing is not recommended in view of the predictable pharmacokinetic profile of LMWH, lack of data on optimal anti-FXa levels and limitations of the assay[125-127]. All anticoagulant type and dose changes should be guided by multidisciplinary team input.

Delivery Planning

For antenatal patients with VTE, all reviewed guidelines suggest consideration of a planned delivery (induction of labour or scheduled Caesarean delivery) to minimise time off anticoagulation and simplify their peripartum anticoagulant management[6,8,10,11,55,59,60]. The multidisciplinary team should advise on the management and interruption of the anticoagulant during the peripartum period. This may involve discontinuing or reducing the dose of the anticoagulant for the peripartum period. Ideally, such plans should be jointly agreed by the relevant multidisciplinary stakeholders and written in advance of labour and delivery. Section 4 further details the peripartum care of pregnant women on anticoagulation for PA-VTE with particular focus on LMWH. UFH may be considered in patients at high risk of haemorrhage. As pregnant women on anticoagulants are at risk of postpartum haemorrhage (PPH), we refer the reader to the clinical practice guideline for the prevention and management of PPH[128]. The RCOG guidelines suggest utilising wound drains (abdominal and rectus sheath) and interrupted skin suturing following Caesarean delivery to allow drainage of haematomas in patients who are fully anticoagulated[59]. In some cases, delivery may proceed on pregnant women who are fully anticoagulated with LMWH or UFH. Protamine sulphate administration may partially reverse the anticoagulant effects of LMWH and, if dosed appropriately, is expected to reverse the anticoagulant effects of UFH (discussion with consultant haematologist in this context is advised)[11,59].

Follow Up

No reviewed guideline provides recommendations on the frequency of follow up visits after antenatal discharge of patients with PA-VTE. Antenatal follow up also factors obstetric concerns. Local policies should consider available resources when planning follow up frequency. See Section 5 for postnatal follow up information.

Clinical Practice

Women with PA-VTE must be cared for in an appropriate setting with monitoring. Ongoing risk assessment of for recurrent PA-VTE and bleeding should guide the anticoagulation plan in a manner that provides optimal balance of competing thrombotic and bleeding risks. Input from a multidisciplinary team should guide further care during the peripartum and postpartum periods.

Recommendations

47. All women with PA-VTE should undergo measurements of vital signs and fetal monitoring. The frequency of monitoring is dependent on clinical status and is determined by obstetric team.
48. For women diagnosed with acute PA-VTE, initial in-hospital treatment is suggested but early discharge could be considered if there is good response to initial treatment, minimal symptoms, no other obstetric or other concerns; and the woman is able to self-administer medications, with stable social supports and follow-up care arranged.
49. A management plan for the remainder of the pregnancy, labour and delivery should be provided and discussed with the woman. This should be jointly agreed with the woman and all relevant caregivers and documented in the medical chart (paper or electronic).
50. For women on therapeutic dose LMWH, a timed delivery should be considered (scheduled induction of labour or Caesarean birth); however individual risks and benefits should also be considered and discussed with involvement of multidisciplinary specialists where relevant.

Section 4 – Peripartum Care

Introduction

The following section will discuss the peripartum care of pregnant women on anticoagulation for PA-VTE with particular focus on low molecular weight heparin (LMWH). As the highest risk procedure for women on anticoagulation in terms of bleeding is regional anaesthesia, this section predominantly focuses on this topic. Ideally, LMWH would be held for >12 hours and >24 hours, when used at prophylactic and therapeutic doses respectively, prior to elective deliveries but in the setting of spontaneous labour, this is often not possible and special attention should be paid to haemostasis if an anticoagulant has recently been injected at the time of delivery. If a VTE is diagnosed prior to delivery, then an anticoagulation plan should be put in place for delivery. Gestation at which the VTE was diagnosed, and current bleeding and thrombosis risk factors will need to be considered. This plan should be individualised and be multidisciplinary.

Clinical Question 2.11: What is the management of regional anaesthesia in the setting of anticoagulation?

Evidence Statement

Vertebral canal haematoma is a rare but feared complication of neuraxial anaesthesia that can result in permanent disability. A true estimate for the incidence of this complication is uncertain. A 2006 meta-analysis reported an incidence of 1 in 168,000 following obstetric epidural insertion[129]. The 2009 Third National Audit Project of the Royal College of Anaesthetists did not identify a single case in 320,425 obstetric neuraxial procedures (both epidural and spinal) performed over the audit period[130]. Similarly, just a single patient with a vertebral canal haematoma was identified by a prospective study performed by the Society for Obstetric Anesthesia and Perinatology (SOAP)[131]. This study looked at complications of obstetric anaesthesia in over 250,000 women across 30 different academic institutions during the years 2004-2009.

The risk of vertebral canal haematoma is believed to be increased with the concurrent use of anticoagulant drugs. Several professional anaesthesia societies have published guidelines on the use of neuraxial techniques in the anticoagulated patient[132-136]. These are largely based on expert consensus opinion. It is universally recommended that low molecular weight heparins (LMWH) be held for >12 hours and >24 hours, when used at prophylactic and therapeutic doses respectively, prior to any neuraxial procedure. Reassuringly, a systematic review published in 2017 found no case of attributable vertebral canal haematoma in obstetric patients receiving thromboprophylactic doses of LMWH[137].

Guidelines specifically addressing the needs of the obstetric patient recognise that decision making in obstetric anaesthesia can be nuanced[133-135]. They recognise that neuraxial anaesthesia may represent the safest mode of anaesthesia in a variety of scenarios, despite being within the “window” of anticoagulation. A decision to perform a neuraxial technique that deviates from the accepted guidelines should ideally be made following a multidisciplinary risk-benefit analysis involving senior decision makers and the patient themselves. It is not currently recommended to use anti-Xa levels to guide this conversation as the level below which it is safe to proceed with a neuraxial technique is unknown[138]. The risk of a vertebral canal haematoma is probably greatest when an epidural technique is employed compared to a single shot spinal, however the guidelines do not make any distinction[130,139,140]. Arguably the procedure should also be attempted by the most senior anaesthetist available, although there is no evidence to endorse this. Each maternity unit should have a policy to guide escalation of care should vertebral canal haematoma be suspected[144].

Altered pharmacokinetics in pregnancy means that the volume of distribution and clearance of enoxaparin is increased[141]. For this reason, anti-Xa levels are reduced in pregnancy compared to nonpregnant women. Consequently, the LMWH prescription may be weight based and exceed usual prophylactic doses in certain women at high risk of VTE[59]. It may also be administered twice daily in divided doses. The SOAP guideline refers to this practice and advises that there are insufficient data to suggest a safe time interval (i.e. 12 vs 24 hours) to perform neuraxial anaesthesia following these "intermediate doses" [135]. The neuraxial anaesthesia protocol used in the previously described Highlow trial was ≥12 hours for standard-dose LMWH time and ≥24 hours for higher doses intervals since last injection[65]. Insights from the Highlow trial show that with spontaneous labour, neuraxial procedures were performed less often in women using intermediate-dose LMWH than low-dose LMWH irrespective of labour onset[66]. It is acknowledged that there is not unanimity around what LWMH dose qualifies as thromboprophylaxis with respect to neuraxial anaesthesia/analgesia. Ultimately, the final decision to proceed with a neuraxial technique in such a scenario will rest with the consultant anaesthetist and local policies.

When to resume anticoagulation following a neuraxial technique is also an important consideration, particularly in patients at high risk of VTE. The previous Irish guidance recommended that administration of prophylactic LMWH be delayed until at least six hours post spinal anaesthetic administration or epidural catheter removal[13]. The 2010 the European Society of Anaesthesiology (ESA) recommended a minimum interval of four hours[130]. The 2010 American Society of Regional Anaesthesia (ASRA) guidelines advised a six-to-eight-hour interval[142]. The Association of Anaesthetist of Great Britain and Ireland (AABGI) currently recommend a four-hour window[136]. This AABGI guidance informs the RCOG recommendation in their Green-top guideline[59]. In contrast, the current ASRA guidelines recommend a twelve-hour interval[142]. The ASRA guidelines also draw a distinction between needle placement and catheter removal, unlike the European guidelines. They recommend a minimum interval of four hours after catheter removal prior to the administration of prophylactic LMWH. The SOAP guidance follows the ASRA convention[135].

The reported time for LMWH to reach maximum plasma concentration or antithrombotic activity (Tmax) is 3-4 hours[143]. The time needed for the initial platelet plug to stabilise and remain intact after LMWH administration is approximately 8 hours[143]. Therefore, the minimum time safety window for administering LMWH after neuraxial anaesthesia or epidural catheter removal can be estimated as 8 hours – Tmax[143]. As such, it would seem reasonable to suggest that once daily doses of prophylactic LMWH be administered no sooner than 4-6 hours after neuraxial anaesthesia or epidural catheter removal. However, there is unanimity with regard to the recommendation to wait at least 24 hours prior to administering therapeutic LMWH following a neuraxial procedure[133-135]. There is also agreement that neuraxial catheters may be safely maintained in the context of prophylactic LMWH administration[131-133]. The ASRA, SOAP and the European Society of Regional Anaesthesia (ESRA) guidelines advise against administration of therapeutic LMWH with a neuraxial catheter in situ[133-135]. Both the ASRA and SOAP guidelines caution against the administration of other medications known to affect haemostasis with a neuraxial catheter in situ[133,135].

Clinical Practice

The evidence to support the recommendations are largely derived from published literature on the care of pregnant women receiving neuraxial anaesthesia while on anticoagulation and are referenced for the reader. This guidance only applies to pregnant women receiving LMWH as prophylaxis against or treatment of VTE.

A multidisciplinary plan to guide peripartum management should be in place for women prescribed alternative anticoagulation for this indication. This guidance also assumes that the pregnant woman is not taking any other medication or have a condition that interferes with normal haemostasis.

All women should be monitored following a neuraxial technique to ensure resolution of the sensorimotor blockade. Each maternity unit should have a policy to guide escalation of care should vertebral canal haematoma be suspected.

Recommendations

51. **Prior to any neuraxial procedure, LMWH should be held for >12 hours and >24 hours, when used at prophylactic and therapeutic doses respectively, assuming normal renal function.**
52. **Once-daily doses of prophylactic LMWH should be administered no sooner than 4-6 hours after neuraxial anaesthesia or epidural catheter removal.**
53. **LMWH should be recommenced at therapeutic doses at 24-48 hours post-delivery, according to individual assessment of bleeding risk by the specialist/multidisciplinary team.**

Section 5 – Postnatal Care and Post-VTE Long Term Management

Introduction

The following section will discuss the postnatal care of women with PA-VTE who are breastfeeding while on anticoagulation and the screening of the long-term complications of VTE.

Clinical Question 2.12: What anticoagulation is appropriate for breast feeding?

Evidence Statement

The choice of postpartum anticoagulant is frequently affected by the decision to breastfeed given potential infant exposure to anticoagulation. This is owing to differential breast milk concentrations of anticoagulants[145]. If compelling clinical indications exist for the use of a specific agent (e.g. heparin intolerance, antiphospholipid syndrome) then this must also be considered in agent selection in this population. In the absence of evidence guiding the optimal choice of anticoagulant agent, maternal choice should be prioritised.

Warfarin demonstrates negligible excretion into breast milk due to extremely high binding to serum protein[146]. No transmission of warfarin to the infant has been observed, even in cases of maternal warfarin overdose with markedly supratherapeutic levels[147]. Similarly, LMWH exhibit limited excretion into breast milk due to their large molecule size[148]. Oral bioavailability of heparinoids is also negligible, further reducing infant risk. Given the extensive clinical experience with these agents, we recommend the use of LMWH or warfarin for postpartum breastfeeding patients. In general, warfarin can be started 5-7 days post-delivery, but this needs to be individualised based on a woman's risk of thrombosis and bleeding and her ability to attend for appropriate INR monitoring.

Fondaparinux and danaparoid are suggested as the agents of choice in the management of patients who have a diagnosis of heparin-induced thrombocytopenia (HIT) or other contraindications to heparinoids. Their extremely low oral bioavailability suggests that any excretion into breast milk will confer negligible risk to the infant. Safety data are limited to case series and retrospective cohort studies. No studies examine fondaparinux excretion into breast milk, however trials of their use in this setting have not demonstrated an increase in infant bleeding[149,150]. In a small trial of 51 patients, Danaparoid was not detectable in breast milk and no increased infant bleeding was seen[151]. These cases should be managed in close conjunction with a haematologist with an interest and expertise in obstetric haematology.

In contrast to heparinoids and warfarin, all direct oral anticoagulants (DOACs) are secreted into human breast milk however concentrations are highly variable between agents[152]. Comparison of milk concentrations and the relative infant dosages of apixaban, rivaroxaban and dabigatran suggest that apixaban may be associated with the highest potential infant exposure and dabigatran the lowest[152-154]. No information is available on the use of edoxaban in breastfeeding.

Several case reports suggest that rivaroxaban (15 to 30 mg daily) and dabigatran are poorly excreted into breastmilk, resulting in milk levels which are considerably below doses required for anticoagulation in infants[155]. Based on this, some authors recommend that if the mother requires rivaroxaban or dabigatran, it is not a reason to discontinue breastfeeding provided, while others recommend avoiding their use in breastfeeding until additional data are available[155].

No trials have specifically assessed the safety or efficacy of DOACs in a post-partum population, and very low numbers of postpartum women were included in initial efficacy trials. DOAC use in non-breastfeeding patients is generally endorsed by expert opinion in obstetric haematology though there are some concerns that pharmacokinetic changes associated with the postpartum period may reduce DOAC efficacy[156,157].

Clinical Practice

Options for anticoagulation in breastfeeding women include LMWH, warfarin or heparinoids like danaparoid and fondaparinux. DOACs may be considered in women not breastfeeding.

Recommendations

54. **Women with a PA-VTE should be offered a clinic appointment (in the appropriate specialty clinic) at 3-6 months after the event (especially if the VTE event was a PE), in order to assess for long term sequelae. Earlier or later visits should also be scheduled as appropriate.**
55. **For breastfeeding women LMWH or warfarin are the anticoagulants of choice.**
56. **Direct oral anticoagulants (DOACs) should not be used when breastfeeding; however, their use can be considered in women that are not breastfeeding.**

Clinical Question 2.13: What pathways should be implemented for identification and management of long-term VTE complications in pregnant women?

Evidence Statement

Chronic complications of VTE

Chronic complications of VTE are common. Post Thrombotic Syndrome (PTS) occurs in 20-40% of patients after DVT, with severe symptoms being reported in 5-10% by two years in a non-pregnant population[158,159]. No trials have specifically addressed PTS prevention following DVT in pregnancy. No published evidence exists to guide PTS treatment in the pregnancy-associated DVT setting. Treatment of established PTS should be similar to those patients diagnosed in a non-pregnancy setting[158]. The post-pulmonary embolism syndrome (PPES) is formally defined as "new or progressive dyspnoea, exercise intolerance, and/or impaired functional or mental status after at least 3 months of adequate anticoagulation following acute PE, which cannot be explained by other (pre-existing) comorbidities[160]. It is reported in up to 40-60% of people following a diagnosis of PE[160]. Given the lack of pregnancy specific evidence for the diagnosis and management of the chronic complications of VTE, the authors direct the reader to section 3 of the NCG-VTE 'Physical and psychological recovery following VTE: What is important in addition to anticoagulation?'[113].

Chronic thromboembolic pulmonary hypertension (CTEPH) is the most serious form of PPES. Pregnancy in the context of established pulmonary hypertension carries an extremely high risk of both fetal and maternal mortality. Some historical data series have reported maternal mortality rates of 30-50%[161]. Contemporary data series from both USA and Europe suggest maternal mortality rates of 1-3%, major cardiac maternal adverse events in 15-60% and fetal mortality of up to 10% despite appropriate

intervention and prior knowledge of pulmonary hypertension diagnosis[162,163]. CTEPH was not specifically included in these data sets. Case reports of successful pregnancies with CTEPH managed with and without intervention are described however the overall risk remains high[164-166]. In light of case complexity and requirement for specialist multidisciplinary involvement, such cases should be referred to a centre with expertise in the management of CTEPH in line with recent ESC guidance[6].

Clinical Practice

Patients with a PA-VTE are at risk of long-term complications. To ensure appropriate recognition and management of these conditions and to encourage optimal physical and psychological recovery, we recommend that all patients are offered a review appointment 3-6 months after their index event[160,164]. This appointment is termed the "post-PE follow up appointment". In addition, this appointment should be used as an opportunity to discuss future thromboembolic risk and the need for thromboprophylaxis. Specific care should be taken to document specific plans to manage hormonal challenges in the future including contraception, further pregnancies and hormone replacement therapy. Thromboprophylaxis plans for subsequent pregnancies is particularly important as many women may not see a specialist in VTE prior to their next pregnancy and the there is a well described peak in VTE at the end of the first trimester, prior to routine booking visits.

Recommendations

57. **Patients should be screened for post thrombotic syndrome and post PE syndromes in a similar way to non-pregnant patients (*See NCG-VTE).* (Grade Best Practice)**
58. **Safe contraceptive options should be documented. (Grade Best Practice)**
59. **Future pregnancies should be discussed in terms of risk of recurrence, thromboprophylaxis plan and how to access specialist care. (Grade Best Practice)**
60. **Use of hormone replacement therapy (HRT) in the future should be discussed. (Grade Best Practice)**

Chapter 3: **Development Of Clinical Practice Guideline**

3.1 Literature search strategy

A comprehensive literature review was undertaken which included national and international publications identified using electronic databases PUBMED and Google Scholar. These databases were searched using the main keywords "venous thromboembolism", "VTE", "thrombosis", "deep veinous thrombosis", "DVT", "pulmonary embolism", "PE" in combination with "pregnancy", "pregnancy associated", "gestation", "birth", "risk assessment", "prevention", "prophylaxis", "diagnosis", "management", "anticoagulation" and "anaesthesia". Searches were limited to articles published between 1970 – December 2023 in the English language. The results yielded from these searches included relevant guidelines, meta-analyses, systematic reviews, randomised control trials and qualitative studies.

3.2 Appraisal of evidence

Following a comprehensive literature review the quality, validity and relevance of the evidence gathered were critically appraised by the Guideline developers under the following headings:

a. Study design

b. Relevance of primary and secondary outcomes

c. Consistency of results across studies

d. Magnitude of benefit versus magnitude of harm

e. Applicability to practice context.

A number of evidence-based recommendations for the prevention, diagnosis, management, peripartum care and postnatal care of women with PA-VTE were agreed upon. They have been adapted to reflect care in the Irish healthcare setting.

3.3 AGREE II process

While being developed, the Guideline was assessed using the AGREE II checklist (Appendix 3) as recommended by the Department of Health in the 'How to Develop a National Clinical Guideline: a manual for guideline developers', 2019[22]. The purpose of AGREE II is to provide a framework to:

a. Assess the quality of guidelines.

b. Provide a methodological strategy for the development of guidelines; and

c. Inform what information and how information ought to be reported in guidelines

22 Department of Health (2019). How to develop a National Clinical Guideline: a manual for guideline developers. Available at: https://www.gov.ie/en/collection/cd41ac-clinical-effectiveness-resources-and-learning/

3.4 Literature review

Details of supportive evidence-based literature for this Guideline are reported in chapter two. The literature was reviewed by members of the Guideline committee depending on their speciality.

The following steps were taken to ensure a comprehensive review of the literature with continuous input and discussion between committee members:

1. The guideline committee met to consider the clinical questions to be addressed.
2. Committee members were divided into groups and performed literature reviews to address the questions.
   I. Prevention: Dr F O'Shaughnessy, Dr N Mayer, Dr A Lutfi
   II. Diagnosis: Professor F Ni Áinle, Dr P MacMahon
   III. Management of PA-VTE: Dr A Lutfi, Professor JR Higgins, Dr Geraldine Gaffney
   IV. Peripartum Care: Dr A Spring
   V. Postnatal Care and Post-VTE Long Term Management: Dr N Mayer, Dr M Crowley, Ms Patricia Byrne.
3. The Guideline committee met regularly to discuss the recommendations for each area.
4. Where there was no evidence to support certain recommendations, these were made based on group consensus and committee expertise.
5. An in-person meeting was convened on 30/4/2025 in NWIHP in Dublin with key stakeholders (Professor Keelin O Donoghue, Dr Maeve Crowley, Professor Fionnuala Ni Ainle, Dr Kevin Ryan, Dr Ruth Gilmore, Dr Karen Murphy, Dr Carmen Regan, Dr Cliona Murphy and Ms Nicolai Murphy) to advance the guideline.
6. Given the need for early risk assessment in pregnancy, Professor Keelin O Donoghue and Dr Maeve Crowley met GP representatives (Dr Ciara McCarthy and Dr Laura Cullen) on 18/6/2025.
7. All committee members reviewed the final draft of the Guideline.

3.5 Grades of recommendation

GRADE offers a transparent and structured process for developing and presenting evidence summaries and for carrying out the steps involved in developing recommendations[23]. While we acknowledge that for this particular work an extensive GRADE approach is not possible, we have used the suggested language set out in the GRADE table when making recommendations (Appendix 4)[24].

23 Guyatt, Gordon, *et al.* "GRADE Guidelines: 1. Introduction – GRADE Evidence Profiles and Summary of Findings Tables." Journal of Clinical Epidemiology, vol. 64, no. 4, 2011, pp. 383-94, https://doi.org/10.1016/j.jclinepi.2010.04.026.

24 SMFM adopts GRADE (Grading of Recommendations Assessment, Development, and Evaluation) for clinical guidelines. Society for Maternal-Fetal Medicine (SMFM), Chauhan SP, Blackwell SC. Am J Obstet Gynecol. 2013 Sep;209(3):163-5. doi: 10.1016/j.ajog.2013.07.012.

3.6 Future research

An important outcome of the Guideline development process is in highlighting gaps in the evidence base. The questions of relevance to this Guideline include:

a. How do individual VTE risk factors interact to determine overall VTE risk and risk duration in the antenatal and postpartum periods?

b. Are clinical depression, anxiety, and psychotropic medications independent risk factors for VTE in pregnancy?

c. What is the best VTE prevention strategy through pharmaceutical thromboprophylaxis in the postnatal period in patients with prior VTE or at very high risk of VTE?

d. What do patients what to know about PA-VTE and how could this information be incorporated into patient education materials and awareness programmes?

e. Which clinical decision rules are most effective in ruling out PA-VTE?

f. Is a low-dose CTPA protocol for the evaluation of suspected PE effective in ruling out PE in pregnancy and the postpartum period?

g. How should neuraxial anaesthesia be managed in patients receiving intermediate doses of LWMH in pregnancy?

h. How do you reduce the risk of long-term complications of PA-VTE?

i. What is the optimal physical and psychological recovery programme following PA-VTE?

Chapter 4: Governance and Approval

4.1 Formal governance arrangements

This Guideline was written by the Guideline developers under the direction of the Guideline Programme Team (GPT). An Expert Advisory Group was formed to review the Guideline prior to submission for final joint approval with the National Women and Infants Health Programme and National VTE Programme. The roles and responsibilities of the members of each group and their process were clearly outlined and agreed.

4.2 Guideline development standards

This Guideline was developed by the Guideline Developer Group (GDG) within the overall template of the HSE National Framework[25] for developing Policies, Procedures, Protocols and Guidelines (2023) and under supervision of the Guideline Programme Team.

A review was conducted by a group of experts, specialists and advocates (the EAG) prior to approval by the Clinical Advisory Group (CAG) of the National Women and Infants Health Programme (NWIHP) and the National VTE Programme with final sign off for publication by CAG Co-Chairs, the Clinical Director of NWIHP, the Chair of the IOG and the Clinical Lead, National VTE Programme. See appendix 5 and 6 for list of CAG members.

25 Health Service Executive (2023). How to develop HSE National Policies, Procedures, Protocols and Guidelines (PPPGs).

Chapter 5: Communication and Dissemination

A communication and dissemination plan for this Guideline has been developed by the GPT and endorsed by NWIHP and NVTEP.

Effective ongoing clear communication is essential in explaining why the Guideline is necessary and securing continued buy-in. It provides an opportunity to instil motivation within staff, helps overcome resistance to change and gives an opportunity for feedback[26].

The Clinical Guideline will be circulated and disseminated through the Guideline Programme Team as well as through the professional networks who participated in developing and reviewing the document.

Senior management within the maternity units are responsible for the appropriate dissemination of new and updated guidelines. Local hospital groups including Guideline committees are also instrumental in the circulation of new and updated guidelines and promoting their use in the relevant clinical settings.

The HSE will make this Guideline available to all employees through standard networks as well as storing it in the online PPPG repository. Electronic versions available on NVTEP and RCPI websites (https://www.rcpi.ie/faculties/obstetricians-and-gynaecologists/national-clinical-guidelines-in-obstetrics-and-gynaecology/) and other communication means can be used to maximise distribution.

26 Department of Health (2018). NCEC Implementation Guide and Toolkit. Available at: https://health.gov.ie/national-patient-safety-office/ncec/

Chapter 6: Implementation

6.1 Implementation plan

Implementation was considered at the beginning, and throughout the Guideline development process. The local multidisciplinary clinical team, senior executive and clinical management in each maternity and gynaecology unit are ultimately responsible for the appropriate structured adoption and implementation of the Guideline within their area of responsibility. They must ensure that all relevant personnel under their supervision have read and understood the Guideline and monitor both its effectiveness and adoption.

Within each site, local multidisciplinary teams are responsible for the clinical implementation of Guideline recommendations and ensuring that their local clinical practices and processes reflect and are aligned with the Guideline recommendations.

The following have been put in place to help facilitate the implementation of this Guideline.

a. Quick Summary Document (QSD) for clinical staff (includes key recommendations, auditable standards, algorithms, and recommended reading)

b. Clinical Guideline mobile application

c. Plain language summary

6.2 Education plans required to implement the Guideline

It is acknowledged that this Guideline should be complemented by ongoing education, training and assessment where required.

6.3 Barriers and facilitators

To ensure successful implementation of guidelines, it is first necessary to look at potential barriers and facilitators. Taking these into account when developing the implementation plan should improve levels of support from relevant users (DOH 2018, 2019). Barriers may be categorised as internal (specific to the Guideline itself) or external (specific to the clinical environment).

For example:

1. Limited resources can hinder the implementation the guideline, such as the cost of training for HCPs in both primary and secondary care services, updating technologies, or acquiring necessary equipment (e.g. diagnostic imaging). Specific to primary care, current capacity constraints and the current suboptimal resourcing for maternity care in general practice, may impede the implementation of some recommendations.

2. Difficulties integrating the Guideline recommendations into existing workflows can be a significant barrier. Clear and timely referral pathways need to be developed so that women identified as requiring LMWH can commence treatment without delay. Such pathways need to be communicated at a local level to all HCPs involved in the care of pregnant and post-partum women.

3. A hierarchical organisational structure and poor communication channels can impede the flow of information about the Guideline. Healthcare professionals may not be aware of the existence of the Guidelines or referral pathways relevant to the recommendations.
4. Inconsistencies or conflicts between different healthcare policies and regulations can create confusion and hinder adherence (e.g. D-dimer testing in pregnancy).
5. The Guideline may not always cater to the diverse needs of patients, leading to challenges in application across different populations.
6. Inadequate understanding of Guideline content, especially in terms of the evidence behind recommendations, can hinder proper interpretation (e.g. concerns regarding radiation exposure). Inadequate training on how to interpret and apply the Guidelines can hinder effective implementation.
7. Without effective feedback on guideline adherence, healthcare professionals may not be aware of the impact of their practices. Inadequate monitoring systems can make it challenging to track adherence to the Guideline and identify areas for improvement.
8. The woman's preferences and values may sometimes conflict with the Guideline recommendations, making adherence challenging.

In the case of this Guideline, it will be necessary to examine possible barriers and consider implementation strategies to address them. By example, this may include discussion with relevant management groups with regards budgetary impact or providing training to the relevant staff.

6.4 Resources necessary to implement recommendations

The implementation of this Guideline should be undertaken as part of the quality improvement of each hospital. Hospitals and primary care services should review existing service provision against this guideline, identifying necessary resources required to implement the recommendations in this Guideline.

In the case of this Guideline:

a. The complete guideline should be made available to reference in all clinical areas.
b. Hospitals may consider printing VTE risk assessment tools, patient information resources, clinical decision rules and algorithms.
c. Resources are required to develop and monitor the auditable standards and for any data set that may be developed to monitor PA-VTE.

Chapter 7: Audit and Evaluation

7.1 Introduction to audit

It is important that both implementation of the Guideline and its influence on outcomes are audited to ensure that this Guideline positively impacts on the care of the woman. Institutions and health professionals are encouraged to develop and undertake regular audits of Guideline implementation. Personnel tasked with the job of conducting the audit should be identified on receipt of the most recent version of the Guideline.

7.2 Auditable standards

Audit using the key recommendations as indicators should be undertaken to identify where improvements are required and to enable changes as necessary. Audit should also be undertaken to provide evidence of continuous quality improvement initiatives.

Auditable standards for this Guideline include:

1. The percentage of women who underwent VTE risk assessment in early pregnancy or at the antenatal booking visit (100%).
2. The percentage of women who underwent VTE risk assessment following hospital admission (100%).
3. The percentage of women who underwent VTE risk assessment following delivery (100%).
4. The percentage of women at risk of PA-VTE who received patient information resources on PA-VTE signs, symptoms and prevention (100%).
5. The percentage of women at risk of PA-VTE who received appropriate pharmaceutical thromboprophylaxis (100%).
6. The percentage of women suspected of PE who had a chest x-ray and ECG (100%).
7. The percentage of pregnant or postnatal women with suspected DVT who underwent diagnostic imaging (100%).
8. The percentage of women with PA-VTE with a documented antenatal, peripartum and postpartum anticoagulation management plan (100%).
9. The percentage of women with PA-VTE who were offered evaluation for the long-term complications of DVT and/or PE (100%).

7.3 Evaluation

Evaluation is defined as a formal process to determine the extent to which the planned or desired outcomes of an intervention are achieved[27].

Implementation of this Guideline will be audited periodically at national level, with standards for this set by the NWIHP. Evaluation of the auditable standards should also be undertaken locally by senior hospital clinical management to support implementation.

27 Health Information Quality Authority (2012). National Standards for Safer Better Healthcare [Internet]. Available from https://www.hiqa.ie/reports-and-publications/standard/national-standards-safer-better-healthcare

Chapter 8: Revision Plan

8.1 Procedure for the update of the Guideline

It may be a requirement to amend, update or revise this Guideline as new evidence emerges. This Guideline will be reviewed at national level every three years, or earlier if circumstances require it, and updated accordingly[28].

The Guideline Development Group will be asked to review the literature and recent evidence to determine if changes are to be made to the existing Guideline. If the Guideline Development Group are unavailable, the GPT along with the NWIHP senior management team will select a suitable expert to replace them.

If there are no amendments required to the Guideline following the revision date, the detail on the revision tracking box must still be updated which will be a new version number and date.

The recommendations set out in this Guideline remain valid until a review has been completed.

8.2 Method for amending the Guideline

As new evidence becomes available it is inevitable that Guideline recommendations will fall behind current evidence based clinical practice. It is essential that clinical guidelines are reviewed and updated with new evidence as it becomes available.

In order to request a review of this Guideline one of the following criteria must be met:

a. 3 years since the Guideline was published

b. 3 years since last review was conducted

c. Update required as a result of new evidence

Correspondence requesting a review of the Guideline should be submitted to the National Women and Infants Health Programme and/or the National VTE Programme (as appropriate to the nature of the correspondence). Any such requests should be dealt with in a timely manner.

Chapter 9: References

28 Health Service Executive (2023). How to develop HSE National Policies, Procedures, Protocols and Guidelines (PPPGs).

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Supporting Evidence

GRADE: http://www.gradeworkinggroup.org/

AGREE: http://www.agreetrust.org/agree-ii/

Glossary

AGREE Appraisal of Guidelines for Research and Evaluation

ACCP American College of Chest Physicians

ACOG American College of Obstetricians and Gynaecologists

ANZJOG Australian and New Zealand Journal of Obstetrics and Gynaecology

ASH American Society of Haematology

ASRA American Society of Regional Anaesthesia

CAG Clinical Advisory Group

CCDSS Computerised Clinical Decision Support Systems

CTEPD Chronic Thromboembolic Pulmonary Disease

CTPEH Chronic Thromboembolic Pulmonary Hypertension

CTPA Computed Tomography Pulmonary Angiography

CUS Compression ultrasonography

DOACs Direct oral anticoagulants

DVT Deep venous thromboembolism

EAG Expert Advisory Group

ECS Elastic compression stockings

ESC European Society of Cardiology

ESA European Society of Anaesthesiology

ESRA European Society of Regional Anaesthesia

GIN Guidelines International Network

GPT Guideline Programme Team

GRADE Grading of Recommendations, Assessments, Developments and Evaluations

GTH Gesellschaft für Thrombose und Hämostaseforschung

HIQA Health Information and Quality Authority

HSE Health Service Executive

IOG Institute of Obstetricians and Gynaecologists

FIGO International Federation of Gynaecology and Obstetrics

LMWH Low molecular weight heparin

NICE The National Institute for Health and Care Excellence

NCEC National Clinical Effectiveness Committee

NVTEP National VTE Programme

NWIHP National Women and Infants Health Programme

PA-VTE Pregnancy associated venous thromboembolism

PE Pulmonary embolism

PPH Postpartum haemorrhage

PPPG Policy, Procedures, Protocols and Guidelines

PTS Post Thrombotic Syndrome

QSD Quick Summary Document

RCOG Royal College of Obstetricians and Gynaecologists

RCPI Royal College of Physicians of Ireland

RCT Randomised controlled trial

SOGC Society of Obstetricians and Gynaecologists of Canada

SOAP Society for Obstetric Anaesthesia and Perinatology

UFH Unfractionated heparin

VKA Vitamin K antagonists

VTE Venous thromboembolism

Appendix 1:
Expert Advisory Group Members 2021-

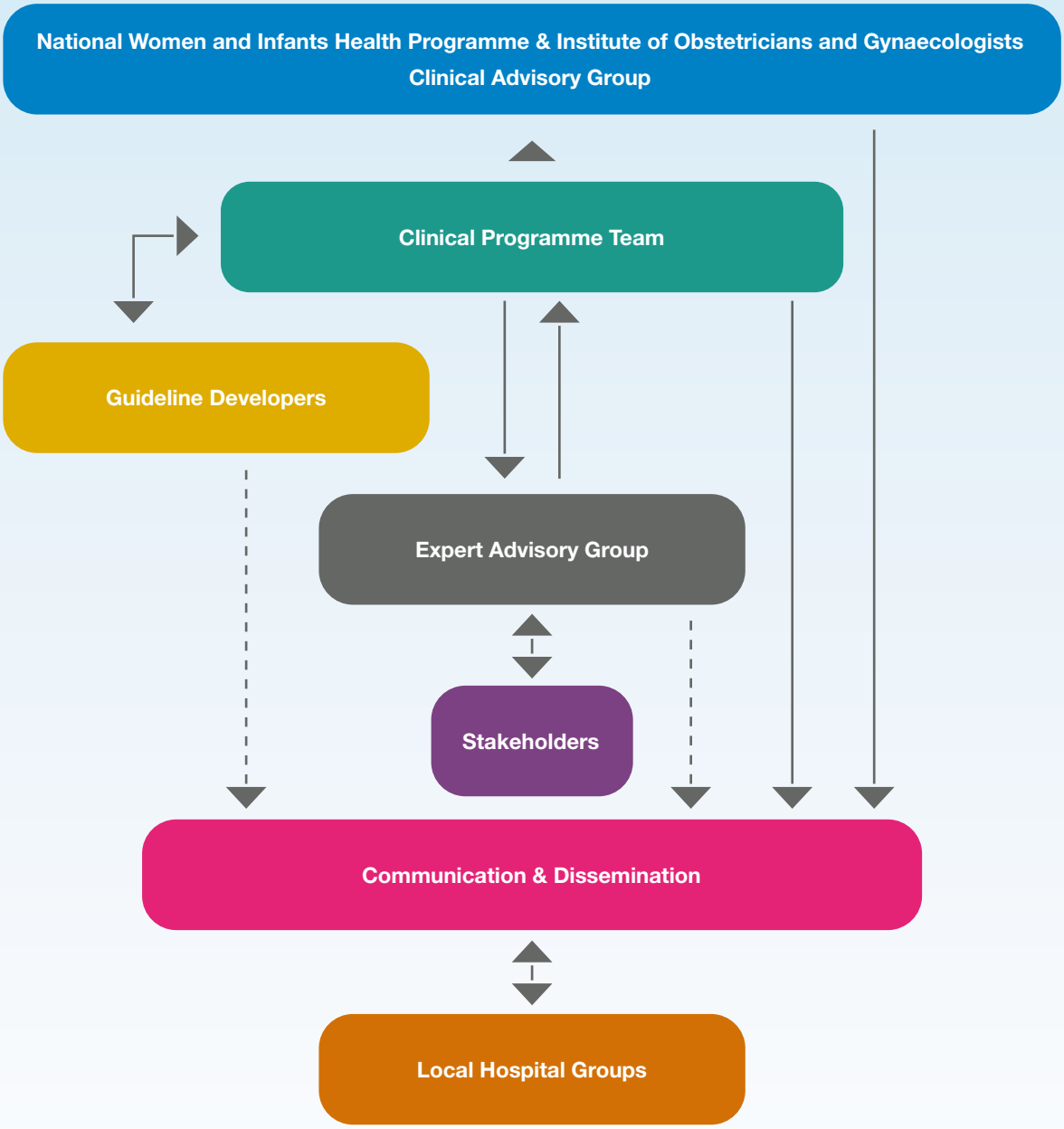
Member	Profession	Location
Dr Mairead Butler	Consultant Obstetrician and Gynaecologist	University Hospital Waterford
Dr Nicholas Barrett	Consultant Anaesthesiologist, Lead for Obstetric Anaesthesiology services	Limerick University Hospital
Dr Venita Broderick	Consultant Obstetrician and Gynaecologist	National Maternity Hospital Dublin
Ms Siobhan Canny	Group Director of Midwifery	Saolta University Health Care Group
Ms Triona Cowman	Director of the Centre for Midwifery Education	Centre for Midwifery Education, Coombe Women & Infants University Hospital
Ms Marie Culliton	Lab Manager/Chief Medical Scientist	National Maternity Hospital Dublin
Ms Niamh Connolly-Coyne *And* Ms Mandy Daly *(Shared nomination)*	Board of Directors Members	Irish Neonatal Health Alliance
Ms Jennifer Dempsey	Clinical Tutor in Midwifery	University College Dublin
Ms Sinéad Curran	Dietician Manager	National Maternity Hospital
Dr Niamh Conlon	Consultant Histopathologist	Cork University Hospital
Ms Georgina Cruise	National Manager	Patient Advocacy Service
Dr Orla Donohoe	Specialist Registrar, Obstetrics and Gynaecology and SWEC Fellow	St George Hospital, Sydney, Australia
Ms Alana Dineen	Senior Clinical Pharmacist	Cork University Maternity Hospital
Prof. Maeve Eogan	Consultant Obstetrician and Gynaecologist National Clinical Lead SATU (HSE)	Rotunda Hospital Dublin
Dr Brendan Fitzgerald	Consultant Perinatal Pathologist	Cork University Hospital

Member	Profession	Location
Dr Daniel Galvin	Specialist Registrar, Obstetrics and Gynaecology	Cork University Maternity Hospital
Ms Stacey Grealis	Patient Research Partner	Independent Living Movement Ireland
Ms Fiona Hanrahan	Director of Midwifery and Nursing	Rotunda Hospital Dublin
Ms Laura Harrington	Principal Medical Social Worker	National Maternity Hospital Dublin
Dr Caroline Joyce	Principal Clinical Biochemist Adjunct Clinical Lecturer PhD Candidate	Cork University Hospital University College Cork
Dr Chaitra Jairaj	Consultant Perinatal Psychiatrist	Coombe Women & Infants University Hospital, Dublin Midland Regional Hospital Portlaoise
Dr Cathy Monteith	Consultant Obstetrician and Gynaecologist	Our Lady of Lourdes Hospital Drogheda
Oana Marian	PhD, Post-Doctoral Researcher	Pregnancy Loss Research Group, INFANT Centre, University College Cork
Prof. John Murphy	Consultant Neonatologist Clinical Lead for the National Clinical Programme for Paediatrics and Neonatology	National Women and Infants Health Programme
Ms Janet Murphy	Advanced Midwifery Practitioner	University Hospital Waterford
Dr Jill Mitchell	Specialist Registrar, Obstetrics and Gynaecology	Cork University Maternity Hospital
Dr Aisling McDonnell	Specialist Registrar, Obstetrics and Gynaecology	Mater Misericordiae University Hospital Dublin
Dr Ciara McCarthy	General Practitioner ICGP and NWIHP Women's Health Lead	Irish College of General Practitioners
Ms Orla McCarthy	Clinical Specialist Physiotherapist in Pelvic Health	Cork University Maternity Hospital
Dr Sarah Nicholson	Locum Consultant Obstetrician and Gynaecologist	Sligo University Hospital

Member	Profession	Location
Dr Donough J. O'Donovan	Director Neonatal Intensive Care Unit Consultant Neonatologist/Paediatrician	University College Hospital Galway
Mr Fergal O' Shaughnessy *And* Dr Brian Cleary *(Shared nomination)*	Senior Pharmacist, Honorary Lecturer *And* Chief Pharmacist, Honorary Clinical Associate Professor and Medications Lead, Maternal & Newborn Clinical Management System	Rotunda Hospital Dublin Royal College of Surgeons in Ireland
Dr Gillian Ryan	Consultant Obstetrician and Gynaecologist	University Hospital Galway
Ms Nora Vallejo	Advanced Midwife Practitioner	Coombe Women & Infants University Hospital, Dublin

Member 2021-2025	Profession	Location
Dr Katherine Astbury	Consultant Obstetrician and Gynaecologist	University Hospital Galway
Dr Richard Duffy	Consultant Perinatal Psychiatrist	Rotunda Hospital Dublin
Ms Clare Farrell	Physiotherapy Manager	Coombe Women & Infants University Hospital, Dublin
Ms Marie Finn	Medical Social Work Counsellor	Saolta University Health Care Group
Prof. Declan Keane	Consultant Obstetrician, Gynaecologist, Professor of Obstetrics and Gynaecology	National Maternity Hospital Dublin, Royal College of Surgeons in Ireland
Ms Áine Kelly	Physiotherapy Manager	Coombe Women & Infants University Hospital, Dublin
Dr Fergus McCarthy	Consultant Obstetrician, Gynaecologist	Cork University Maternity Hospital, University College Cork
Dr Sarah Petch	Specialist Registrar, Obstetrics and Gynaecology	National Maternity Hospital Dublin
Ms Margaret Quigley	National Lead for Midwifery	Office of Nursing and Midwifery Services Director
Prof. Valerie Smith	Chair of Midwifery	University College Dublin
Ms Marita Hennessy	Post-Doctoral Researcher	Pregnancy Loss Research Group, INFANT Centre, University College Cork

Appendix 2:
Guideline Programme Process



Appendix 3: AGREE Reporting Checklist[29]

AGREE Reporting Checklist 2016

This checklist is intended to guide the reporting of Clinical Practice Guidelines.

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
DOMAIN 1: SCOPE AND PURPOSE		
1. OBJECTIVES *Report the overall objective(s) of the guideline. The expected health benefits from the guideline are to be specific to the clinical problem or health topic.*	☐ Health intent(s) (i.e., prevention, screening, diagnosis, treatment, etc.) ☐ Expected benefit(s) or outcome(s) ☐ Target(s) (e.g., patient population, society)	
2. QUESTIONS *Report the health question(s) covered by the guideline, particularly for the key recommendations.*	☐ Target population ☐ Intervention(s) or exposure(s) ☐ Comparisons (if appropriate) ☐ Outcome(s) ☐ Health care setting or context	
3. POPULATION *Describe the population (i.e., patients, public, etc.) to whom the guideline is meant to apply.*	☐ Target population, sex and age ☐ Clinical condition (if relevant) ☐ Severity/stage of disease (if relevant) ☐ Comorbidities (if relevant) ☐ Excluded populations (if relevant)	
DOMAIN 2: STAKEHOLDER INVOLVEMENT		
4. GROUP MEMBERSHIP *Report all individuals who were involved in the development process. This may include members of the steering group, the research team involved in selecting and reviewing/ rating the evidence and individuals involved in formulating the final recommendations.*	☐ Name of participant ☐ Discipline/content expertise (e.g., neurosurgeon, methodologist) ☐ Institution (e.g., St. Peter's hospital) ☐ Geographical location (e.g., Seattle, WA) ☐ A description of the member's role in the guideline development group	

29 AGREE Reporting Checklist is available on the AGREE Enterprise website, a free and open access resource to support the practice guideline field (www. agreetrust.org)

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
5. TARGET POPULATION PREFERENCES AND VIEWS *Report how the views and preferences of the target population were sought/considered and what the resulting outcomes were.*	☐ Statement of type of strategy used to capture patients'/publics' views and preferences (e.g., participation in the guideline development group, literature review of values and preferences) ☐ Methods by which preferences and views were sought (e.g., evidence from literature, surveys, focus groups) ☐ Outcomes/information gathered on patient/public information ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
6. TARGET USERS *Report the target (or intended) users of the guideline.*	☐ The intended guideline audience (e.g. specialists, family physicians, patients, clinical or institutional leaders/administrators) ☐ How the guideline may be used by its target audience (e.g., to inform clinical decisions, to inform policy, to inform standards of care)	
DOMAIN 3: RIGOUR OF DEVELOPMENT		
7. SEARCH METHODS *Report details of the strategy used to search for evidence.*	☐ Named electronic database(s) or evidence source(s) where the search was performed (e.g., MEDLINE, EMBASE, PsychINFO, CINAHL) ☐ Time periods searched (e.g., January 1, 2004 to March 31, 2008) ☐ Search terms used (e.g., text words, indexing terms, subheadings) ☐ Full search strategy included (e.g., possibly located in appendix)	
8. EVIDENCE SELECTION CRITERIA *Report the criteria used to select (i.e., include and exclude) the evidence. Provide rationale, where appropriate.*	☐ Target population (patient, public, etc.) characteristics ☐ Study design ☐ Comparisons (if relevant) ☐ Outcomes ☐ Language (if relevant) ☐ Context (if relevant)	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
9. STRENGTHS & LIMITATIONS OF THE EVIDENCE *Describe the strengths and limitations of the evidence. Consider from the perspective of the individual studies and the body of evidence aggregated across all the studies. Tools exist that can facilitate the reporting of this concept.*	☐ Study design(s) included in body of evidence ☐ Study methodology limitations (sampling, blinding, allocation concealment, analytical methods) ☐ Appropriateness/relevance of primary and secondary outcomes considered ☐ Consistency of results across studies ☐ Direction of results across studies ☐ Magnitude of benefit versus magnitude of harm ☐ Applicability to practice context	
10. FORMULATION OF RECOMMENDATIONS *Describe the methods used to formulate the recommendations and how final decisions were reached. Specify any areas of disagreement and the methods used to resolve them.*	☐ Recommendation development process (e.g., steps used in modified Delphi technique, voting procedures that were considered) ☐ Outcomes of the recommendation development process (e.g., extent to which consensus was reached using modified Delphi technique, outcome of voting procedures) ☐ How the process influenced the recommendations (e.g., results of Delphi technique influence final recommendation, alignment with recommendations and the final vote)	
11. CONSIDERATION OF BENEFITS AND HARMS *Report the health benefits, side effects, and risks that were considered when formulating the recommendations.*	☐ Supporting data and report of benefits ☐ Supporting data and report of harms/side effects/risks ☐ Reporting of the balance/trade-off between benefits and harms/side effects/risks ☐ Recommendations reflect considerations of both benefits and harms/side effects/risks	
12. LINK BETWEEN RECOMMENDATIONS AND EVIDENCE *Describe the explicit link between the recommendations and the evidence on which they are based.*	☐ How the guideline development group linked and used the evidence to inform recommendations ☐ Link between each recommendation and key evidence (text description and/or reference list) ☐ Link between recommendations and evidence summaries and/or evidence tables in the results section of the guideline	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
13. EXTERNAL REVIEW *Report the methodology used to conduct the external review.*	☐ Purpose and intent of the external review (e.g., to improve quality, gather feedback on draft recommendations, assess applicability and feasibility, disseminate evidence) ☐ Methods taken to undertake the external review (e.g., rating scale, open-ended questions) ☐ Description of the external reviewers (e.g., number, type of reviewers, affiliations) ☐ Outcomes/information gathered from the external review (e.g., summary of key findings) ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations (e.g., guideline panel considered results of review in forming final recommendations)	
14. UPDATING PROCEDURE *Describe the procedure for updating the guideline.*	☐ A statement that the guideline will be updated ☐ Explicit time interval or explicit criteria to guide decisions about when an update will occur ☐ Methodology for the updating procedure	
DOMAIN 4: CLARITY OF PRESENTATION		
15. SPECIFIC AND UNAMBIGUOUS RECOMMENDATIONS *Describe which options are appropriate in which situations and in which population groups, as informed by the body of evidence.*	☐ A statement of the recommended action ☐ Intent or purpose of the recommended action (e.g., to improve quality of life, to decrease side effects) ☐ Relevant population (e.g., patients, public) ☐ Caveats or qualifying statements, if relevant (e.g., patients or conditions for whom the recommendations would not apply) ☐ If there is uncertainty about the best care option(s), the uncertainty should be stated in the guideline	
16. MANAGEMENT OPTIONS *Describe the different options for managing the condition or health issue.*	☐ Description of management options ☐ Population or clinical situation most appropriate to each option	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
17. IDENTIFIABLE KEY RECOMMENDATIONS *Present the key recommendations so that they are easy to identify.*	☐ Recommendations in a summarized box, typed in bold, underlined, or presented as flow charts or algorithms ☐ Specific recommendations grouped together in one section	
DOMAIN 5: APPLICABILITY		
18. FACILITATORS AND BARRIERS TO APPLICATION *Describe the facilitators and barriers to the guideline's application.*	☐ Types of facilitators and barriers that were considered ☐ Methods by which information regarding the facilitators and barriers to implementing recommendations were sought (e.g., feedback from key stakeholders, pilot testing of guidelines before widespread implementation) ☐ Information/description of the types of facilitators and barriers that emerged from the inquiry (e.g., practitioners have the skills to deliver the recommended care, sufficient equipment is not available to ensure all eligible members of the population receive mammography) ☐ How the information influenced the guideline development process and/or formation of the recommendations	
19. IMPLEMENTATION ADVICE/TOOLS *Provide advice and/or tools on how the recommendations can be applied in practice.*	☐ Additional materials to support the implementation of the guideline in practice. For example: • Guideline summary documents • Links to check lists, algorithms • Links to how-to manuals • Solutions linked to barrier analysis (see Item 18) • Tools to capitalize on guideline facilitators (see Item 18) • Outcome of pilot test and lessons learned	

CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
20. RESOURCE IMPLICATIONS *Describe any potential resource implications of applying the recommendations.*	☐ Types of cost information that were considered (e.g., economic evaluations, drug acquisition costs) ☐ Methods by which the cost information was sought (e.g., a health economist was part of the guideline development panel, use of health technology assessments for specific drugs, etc.) ☐ Information/description of the cost information that emerged from the inquiry (e.g., specific drug acquisition costs per treatment course) ☐ How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
21. MONITORING/ AUDITING CRITERIA *Provide monitoring and/or auditing criteria to measure the application of guideline recommendations.*	☐ Criteria to assess guideline implementation or adherence to recommendations ☐ Criteria for assessing impact of implementing the recommendations ☐ Advice on the frequency and interval of measurement ☐ Operational definitions of how the criteria should be measured	
DOMAIN 6: EDITORIAL INDEPENDENCE		
22. FUNDING BODY *Report the funding body's influence on the content of the guideline.*	☐ The name of the funding body or source of funding (or explicit statement of no funding) ☐ A statement that the funding body did not influence the content of the guideline	
23. COMPETING INTERESTS *Provide an explicit statement that all group members have declared whether they have any competing interests.*	☐ Types of competing interests considered ☐ Methods by which potential competing interests were sought ☐ A description of the competing interests ☐ How the competing interests influenced the guideline process and development of recommendations	

From: Brouwers MC, Kerkvliet K, Spithoff K, on behalf of the AGREE Next Steps Consortium. The AGREE Reporting Checklist: a tool to improve reporting of clinical practice guidelines. BMJ 2016;352:i1152. doi: 10.1136/bmj.i1152.

For more information about the AGREE Reporting Checklist, please visit the AGREE Enterprise website at http://www.agreetrust.org.

Appendix 4: Grades of Recommendations[30]

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
1A. Strong recommendation, high-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Consistent evidence from well-performed randomised, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk	Strong recommendations can apply to most patients in most circumstances without reservation. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present	We strongly recommend… We recommend that …should be performed/ administered… We recommend that …. is indicated/ beneficial/ effective…
1B. Strong recommendation, moderate-quality evidence	Benefits clearly outweigh risk and burdens, or vice versa	Evidence from randomised, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate	Strong recommendation and applies to most patients. Clinicians should follow a strong recommendation unless a clear and compelling rationale for an alternative approach is present	We recommend… We recommend that … should be performed/ administered… We recommend that … is (usually) indicated/ beneficial/ effective…

30 SMFM adopts GRADE (Grading of Recommendations Assessment, Development, and Evaluation) for clinical guidelines. Society for Maternal-Fetal Medicine (SMFM), Chauhan SP, Blackwell SC. Am J Obstet Gynecol. 2013 Sep;209(3):163-5. https://pubmed.ncbi.nlm.nih.gov/23978245/

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
1C. Strong recommendation, low-quality evidence	Benefits appear to outweigh risk and burdens, or vice versa	Evidence from observational studies, unsystematic clinical experience, or from randomised, controlled trials with serious flaws. Any estimate of effect is uncertain	Strong recommendation that applies to most patients. Some of the evidence base supporting the recommendation is, however, of low quality	We recommend… We recommend that … should be performed/ administered… We recommend that … Is (maybe) indicated/ beneficial/ effective…
2A. Weak recommendation, high-quality evidence	Benefits closely balanced with risks and burdens	Consistent evidence from well-performed randomised, controlled trials or overwhelming evidence of some other form. Further research is unlikely to change our confidence in the estimate of benefit and risk	Weak recommendation: best action may differ depending on circumstances or patients or societal values	We suggest… We suggest that… may/might be reasonable...
2B. Weak recommendation, moderate-quality evidence	Benefits closely balanced with risks and burdens, some uncertainty in the estimates of benefits, risks and burdens	Evidence from randomised, controlled trials with important limitations (inconsistent results, methodologic flaws, indirect or imprecise), or very strong evidence of some other research design. Further research (if performed) is likely to have an impact on our confidence in the estimate of benefit and risk and may change the estimate	Weak recommendation; alternative approaches likely to be better for some patients under some circumstances	We suggest… We suggest that … may/might be reasonable...

Grade of recommendation	Clarity of risk/ benefit	Quality of supporting evidence	Implications	Suggested Language
2C. Weak recommendation, low-quality evidence	Uncertainty in the estimates of benefits, risks, and burdens; benefits may be closely balanced with risks and burdens	Evidence from observational studies, unsystematic clinical experience, or from randomised, controlled trials with serious flaws. Any estimate of effect is uncertain	Very weak recommendation: other alternatives may be equally reasonable	We suggest … is an option We suggest that … may/might be reasonable.
Best practice	A recommendation that is sufficiently obvious that the desirable effects outweigh undesirable effects, despite the absence of direct evidence, such that the grading of evidence is unnecessary			We recommend… We recommend that … should be performed/ administered… We recommend that… Is usually) indicated/ beneficial/effective

Appendix 5: NWIHP/IOG CAG membership (2026-)

Dr Cliona Murphy (Chair, 2023-). Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital. Clinical Director, National Women and Infants Health Programme.

Dr Suzanne O'Sullivan (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Director of Education and Training, Obstetrics and Gynaecology, Institute of Obstetricians and Gynaecologists. Chair, Institute of Obstetricians and Gynaecologists.

Dr Venita Broderick (2024-). Clinical Lead Gynaecology, National Women and Infants Health Programme.

Dr Brian Cleary (2023-). Chief Pharmacist, Rotunda Hospital. Medications Lead, Maternal and Newborn Clinical Management System Project.

Angela Dunne (2023-). Director of Midwifery, National Women and Infants Health Programme.

Prof. Seán Daly (2023-). Master, Consultant Obstetrician and Gynaecologist, Rotunda Hospital.

Prof. Maeve Eogan (2023-). Consultant Obstetrician and Gynaecologist, Rotunda Hospital. Clinical Lead, Sexual Assault Treatment Units, National Women and Infants Health Programme.

Prof. Richard Greene (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Director, National Perinatal Epidemiology Centre, University College Cork.

Prof. John Higgins (2023-). Cork University Maternity Hospital, Consultant Obstetrician and Gynaecologist, Clinical Director, Ireland South Women and Infants Directorate.

Prof. Shane Higgins (2023-). Master, Consultant Obstetrician and Gynaecologist, National Maternity Hospital.

Dr Mendinaro Imcha (2023-). Clinical Director, Consultant Obstetrician and Gynaecologist, University Maternity Hospital Limerick.

Prof. John Murphy (2023-). Clinical Lead Neonatology, National Women and Infants Health Programme.

Dr Aoife Mullaly (2023-). Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital. Clinical Lead, Termination of Pregnancy Services, National Women and Infants Health Programme.

Prof. John Morrison (2023-). Consultant Obstetrician and Gynaecologist, University Hospital Galway. Clinical Director, Saolta Maternity Directorate.

Kilian McGrane (2023-). Director, National Women and Infants Health Programme.

Prof. Keelin O'Donoghue (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Lead, National Guidelines, National Women and Infants Health Programme.

Prof. Mike O'Connell (2023-). Master, Consultant Obstetrician and Gynaecologist, Coombe Women and Infants University Hospital.

Dr Vicky O'Dwyer (2023-). Consultant Obstetrician and Director of Gynaecology, Rotunda Hospital.

Dr Mairead O'Riordan (2024-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital.

Dr Fergal O'Shaughnessy (2025-) Senior Pharmacist, Rotunda Hospital.

Prof. Nóirín Russell (2023-). Consultant Obstetrician and Gynaecologist, Cork University Maternity Hospital. Clinical Director, Cervical Check.

Dr Carmen Regan (April 2024). Clinical Lead Obstetrics, National Women and Infants Health Programme.

Dr Orla Shiel (2024-). Consultant Obstetrician and Gynaecologist, National Maternity Hospital.

Ms Clare Thompson (2023-). Consultant Gynaecological Oncologist, The Mater, Dublin.

Appendix 6:
National VTE CAG Membership (2023)

Prof. Fionnuala Ni Ainle. Consultant Haematologist, Mater Misericordiae University Hospital, Rotunda Hospital. Clinical Lead for National Venous Thromboembolism (VTE) Patient Safety Programme. Director of the Irish Network for VTE Research.

Dr Denis O'Keefe. Consultant Haematologist, University Hospital Limerick.

Dr Barry Kevane. Consultant Haematologist, Mater Misericordiae University Hospital.

Dr Maeve Crowley. Consultant Haematologist, Cork University Hospital.

Dr Karen Murphy. Consultant Haematologist, St. Vincent's University Hospital.

Dr Karl Ewins. Consultant Haematologist, Beaumont Hospital.

Dr Beatrice Nolan. Consultant Paediatric Haematologist, Children's Health Ireland at Crumlin.

Dr Ruth Gilmore. Consultant Haematologist, Galway University Hospital.

Prof. Niamh O'Connell. Consultant Haematologist, St. James's Hospital. Director of National Coagulation Centre.

Ciara O'Rafferty. Consultant Haematologist, Tallaght University Hospital.

Su Maung. Consultant Haematologist, Our Lady's Hospital Navan.

Barry McDonagh. Consultant Haematologist, Our Lady of Lourdes Hospital Drogheda.

Virginia Silvari. Pharmacist, Cork University Hospital.

Aoife Delaney. Pharmacist, Cork University Hospital.

Claire Browne. Pharmacist, Midland Regional Hospital Mulligar.

Niamh O'Hanlon. Pharmacist, St. Vincent's University Hospital.

Helen Sheehy. Clinical Nurse Manager, University Hospital Limerick.

Caitriona O'Leary. Clinical Nurse Manager, Cork University Hospital.

Cathleen Moran. Clinical Nurse Manager, Galway University Hospital.

Dr Tomás Breslin. Consultant Emergency Medicine, Mater Misericordiae University Hospital.

Dr Ger McMahon. Consultant Emergency Medicine, St. James's Hospital.

Dr Bibi Bassa. Consultant Emergency Medicine, Mater Misericordiae University Hospital.

Dr Nigel Salter. Consultant Emergency Medicine, St. Vincent's University Hospital. Vice Chair of ACLS Council at Irish Heart Foundation.

Dr Patricia Cunningham. Consultant Radiologist, Our Lady of Lourdes Hospital Drogheda.

Dr Mike Watts. Consultant Acute Medicine, University Hospital Limerick.

Dr Bryan Renton. Consultant Acute Medicine, Mayo University Hospital.

Dr Conor Magee. Consultant Acute Medicine, St. James's Hospital.

Dr Yvonne Smyth. Consultant Cardiologist/Acute Medicine, University Hospital Galway.

Dr Hilary Cronin. Consultant Geriatrician, Midland Regional Hospital Mulligar.

Dr Patricia Byrne. Consultant Psychiatrist, St. James's Hospital.

Ms Mary Barry. Consultant Vascular Surgeon, St. Vincent's University Hospital. Chair of Irish Vascular Society.

Adrian Bradley. Quality Manager, South/South-West Hospital Group.

Kevin O'Malley. Joint Group Clinical Director, Ireland East Hospital Group.

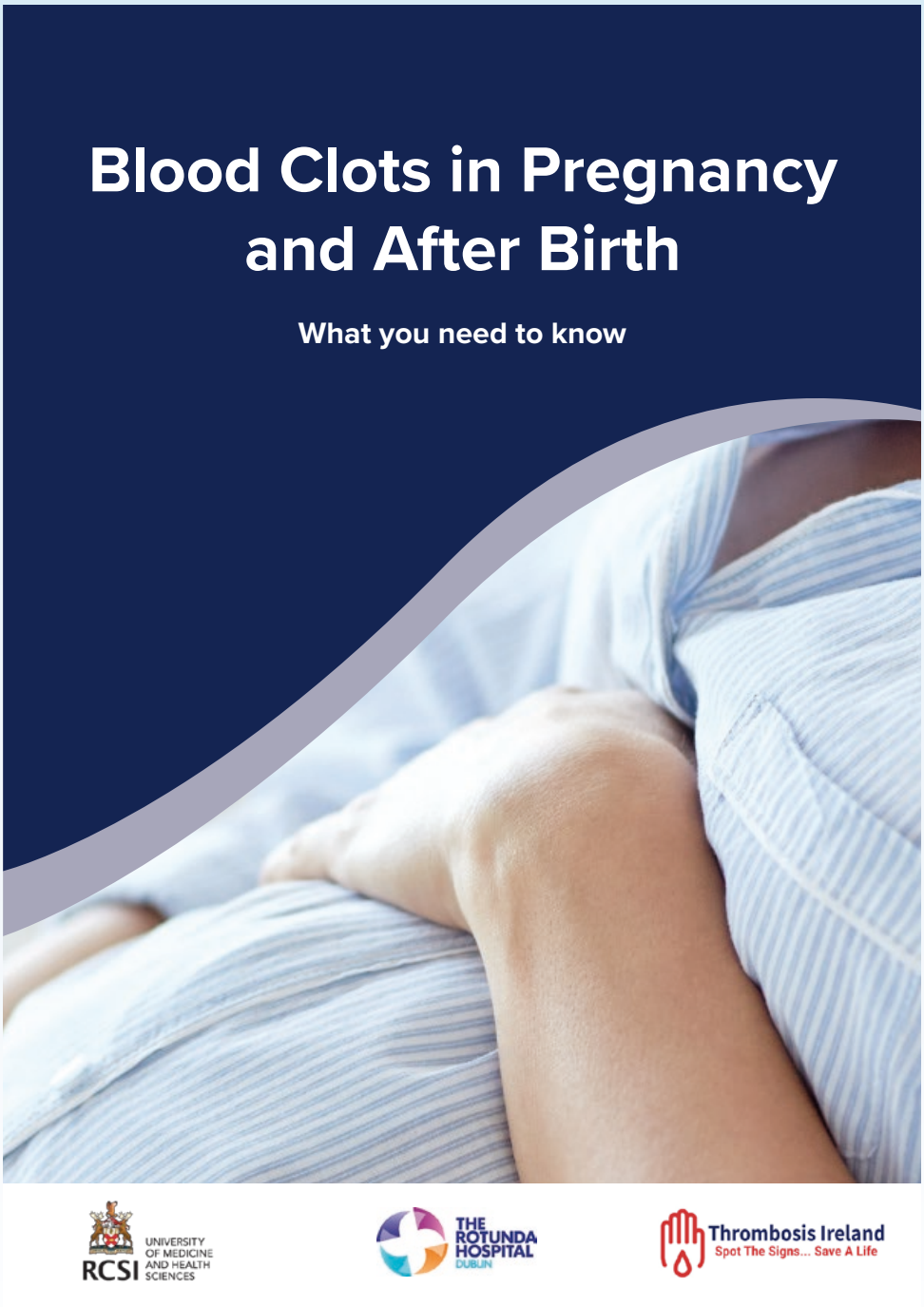
Nóirín Bannon. Ireland East Hospital Group.

Mick Fitzpatrick. Analyst, Ireland East Hospital Group.

Ciara Kirke. Clinical Lead of the National Medication Safety Programme.

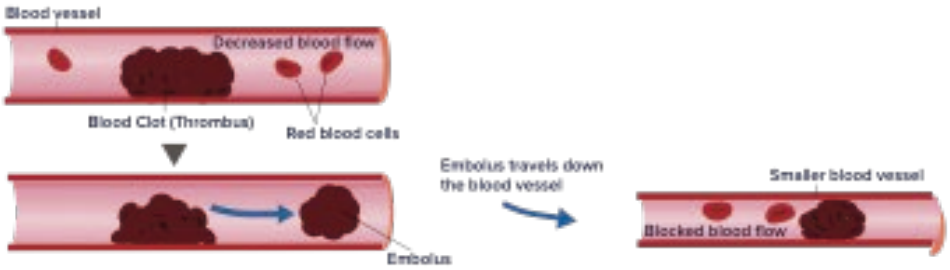
Appendix 7:
Patient information material

Booklet (available at NCP-VTE website)



What is a Blood Clot?

A blood clot is a semi-solid mass of blood cells and other substances that form inside a blood vessel, which obstructs the flow of blood and can have serious consequences.

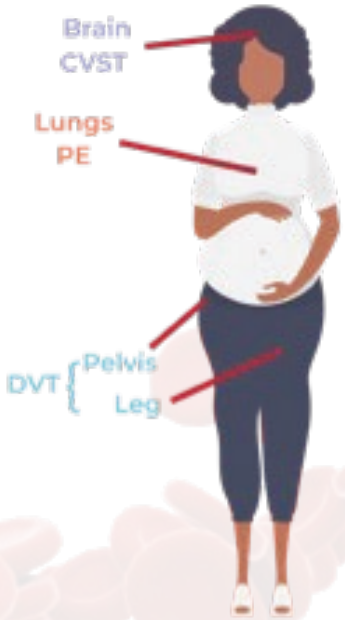


It usually forms in the deep veins of the leg or pelvis. This is called **DVT/deep vein thrombosis**.

A piece of this clot can break off and travel to the lungs. This is called **PE/Pulmonary Embolism**.

Together, DVT and PE make up venous thromboembolism (VTE): DVT + PE = VTE/Venous Thromboembolism.

In rare cases, venous blood clots can occur in the blood vessels of the brain. This is called **CVST, Cerebral Venous Sinus Thrombosis.**

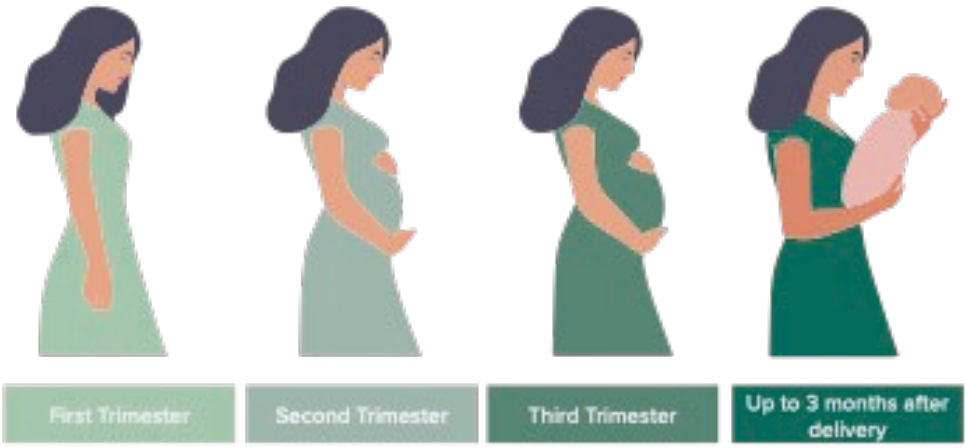


Am I at Risk of a Blood Clot?

Blood clots are more likely to happen when you are pregnant and in the six weeks after your baby is born.

When you are pregnant, DVT can form in the leg or pelvis (often in the left leg in pregnancy).

It's important to know that some women may experience symptoms of PE without any leg symptoms beforehand.



Be vigilant for the signs of a blood clot, as it is important to diagnose it rapidly, and to start treatment with a blood thinner as soon as possible. This can be lifesaving, as blood clots can be very treatable if diagnosed on time, but very dangerous if the signs are ignored.

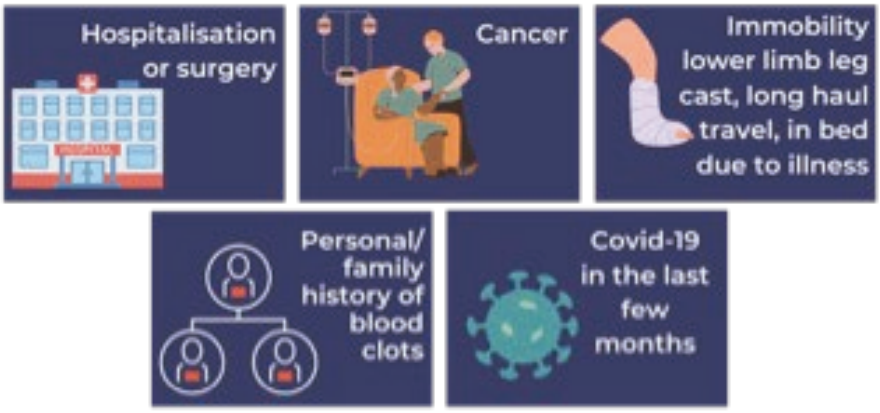
Spot the Signs

SIGNS AND SYMPTOMS OF A BLOOD CLOT

If you experience any of these symptoms you should seek medical attention immediately.

Risk Factors

If you experience the following while pregnant or for 6 weeks after giving birth, your risk of experiencing a blood clot may increase further:



Speak to your Nurse, Midwife or Doctor about preventative measures:

Ask for a blood clot risk assessment

Walk and move as much as possible

Keep hydrated, drink plenty of water

If using compression stockings or medication, follow instructions exactly

Translations

For translations, scan the QR codes below:

SCAN ME
Arabic

SCAN ME
Romanian

SCAN ME
Spanish

SCAN ME
Russian

Translations

SCAN ME

Portuguese

SCAN ME

Ukranian

SCAN ME

Chinese

SCAN ME

English

For more information go to:

www.thrombosisireland.ie
www.worldthrombosisday.org
www.thrombosisuk.org
www2.hse.ie/conditions/blood-clots-pregnancy

info@thrombosisireland.ie

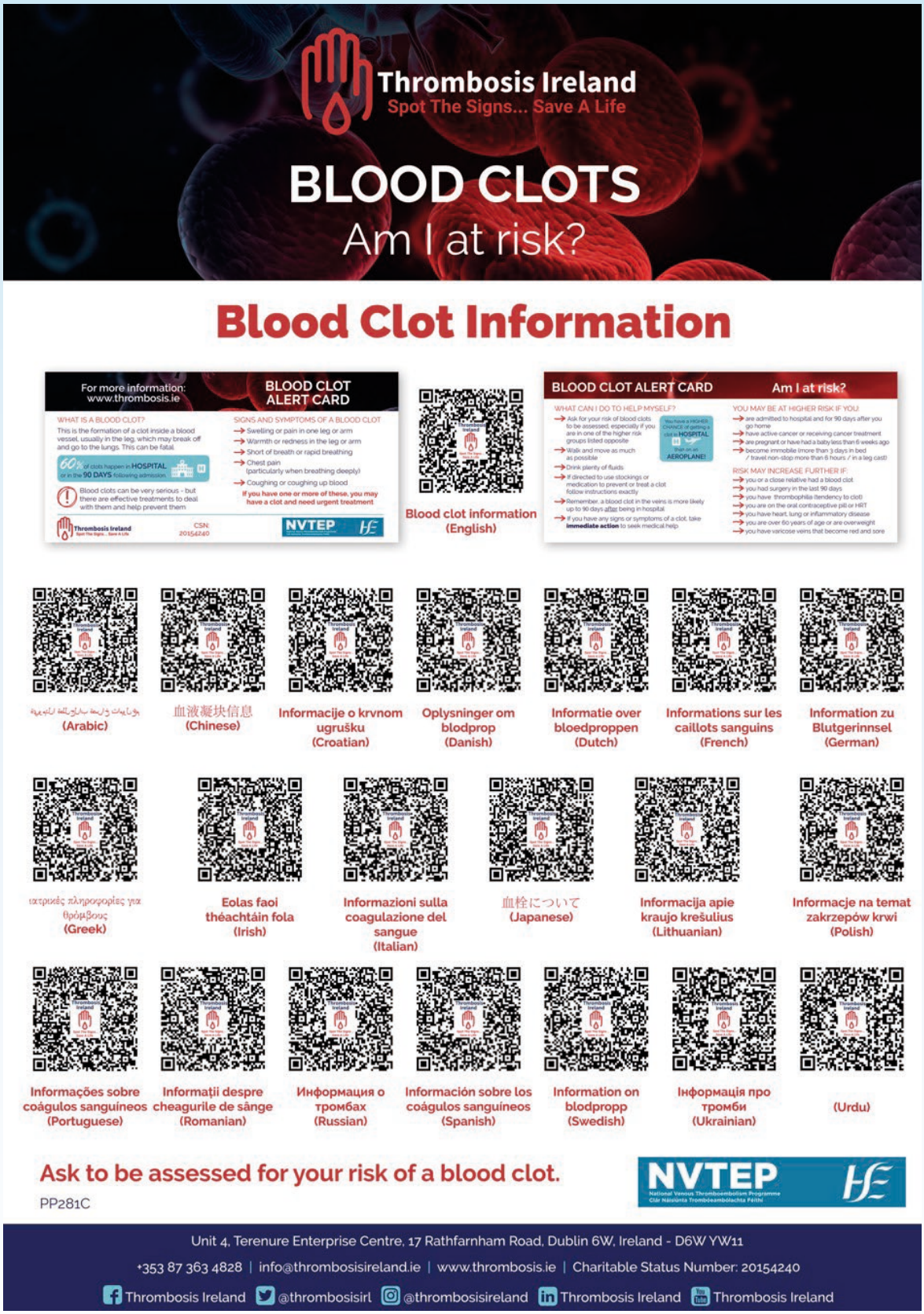
+353 87 3634828

RCSI UNIVERSITY OF MEDICINE AND HEALTH SCIENCES

THE ROTUNDA HOSPITAL DUBLIN

Thrombosis Ireland
Spot The Signs... Save A Life

Blood Clot Information Poster



Blood Clot Alert Card

For more information:
www.thrombosis.ie

BLOOD CLOT ALERT CARD

WHAT IS A BLOOD CLOT?

This is the formation of a clot inside a blood vessel, usually in the leg, which may break off and go to the lungs. This can be fatal.

60% of clots happen in **HOSPITAL** or in the **90 DAYS** following admission.

Blood clots can be very serious - but there are effective treatments to deal with them and help prevent them

SIGNS AND SYMPTOMS OF A BLOOD CLOT

- Swelling or pain in one leg or arm
- Warmth or redness in the leg or arm
- Short of breath or rapid breathing
- Chest pain (particularly when breathing deeply)
- Coughing or coughing up blood

If you have one or more of these, you may have a clot and need urgent treatment

Thrombosis Ireland
Spot The Signs... Save A Life

CSN: 20154240

NVTEP
National Venous Thromboembolism Programme
Clár Náisiúnta Tromboeambolachta Féithí

BLOOD CLOT ALERT CARD **Am I at risk?**

WHAT CAN I DO TO HELP MYSELF?

- Ask for your risk of blood clots to be assessed, especially if you are in one of the higher risk groups listed opposite
- Walk and move as much as possible
- Drink plenty of fluids
- If directed to use stockings or medication to prevent or treat a clot follow instructions exactly
- Remember, a blood clot in the veins is more likely up to 90 days after being in hospital
- If you have any signs or symptoms of a clot, take **immediate action** to seek medical help

You have a HIGHER CHANCE of getting a clot in **HOSPITAL** than on an **AEROPLANE!**

YOU MAY BE AT HIGHER RISK IF YOU:

- are admitted to hospital and for 90 days after you go home
- have active cancer or receiving cancer treatment
- are pregnant or have had a baby less than 6 weeks ago
- become immobile (more than 3 days in bed / travel non-stop more than 6 hours / in a leg cast)

RISK MAY INCREASE FURTHER IF:

- you or a close relative had a blood clot
- you had surgery in the last 90 days
- you have thrombophilia (tendency to clot)
- you are on the oral contraceptive pill or HRT
- you have heart, lung or inflammatory disease
- you are over 60 years of age or are overweight
- you have varicose veins that become red and sore