Guidelines for Management of Venous Thromboembolism Prophylaxis in those Under 16 Years of Age

Title:	**Guidelines for Management of Venous Thromboembolism Prophylaxis in Those Under 16 Years of Age**
Version:	**1**
Supersedes:	n/a
Application:	The guideline is intended for use by any hospital team caring for infants, children and young people under 16 years age across the Paediatric Critical Care Network in the North-West (England) & North Wales region.

Originated /Modified By: Designation:	**Originated By**: North-West (England) and North Wales Paediatric Critical Care Operational Delivery Network **Guideline authors:** Joe Brennan, ST7 Anaesthetic trainee, RMCH Nasser Khan, ST6 Anaesthetic trainee RMCH Mary-Ann Bentham, Anaesthetic & Paediatric Critical Care Transport Consultant, NWTS Kate Parkins, PICM Consultant, NWTS
Reviewed by:	1. North-West & North Wales Paediatric Critical Care Operational Delivery Network 2. Sophina Mahmood, Paediatric Pharmacist, PCC ODN & RMCH
Ratified by:	1. North-West & North Wales Paediatric Critical Care Operational Delivery Network 2. RMCH (Host Trust): Paediatric Policies & Guidelines & Pharmacy & Medicines Management Committees
Date of Ratification:	1. PCC & SiC Oversight: PCC 08.05.24 SiC 07.06.24 2. PMMC: 4.12.24 3. P&G Committee: 14.02.25

Issue / Circulation Date:	February 2024
Circulated by:	PCC, SiC & LTV ODN
Dissemination and Implementation:	Via PCC, SiC & LTV ODN
Date placed on the websites (NWTS / PCC, SiC & LTV ODN) + MFT intranet	

Planned Review Date:	3 years
Responsibility of:	Clinical lead North West & North Wales Paediatric Critical Care Network & NWTS guideline lead consultant

Minor amendment (if applicable) notified to:	
Date notified:	

EqIA Registration Number:	EQIA 2024-124

1. Detail of Procedural Document

Guidelines for Management of Venous Thromboembolism Prophylaxis in Those Under 16 Years of Age.

2. Equality Impact Assessment

Equality Impact Assessment Please record the decision whether the policy, service change or other key decision was assessed as relevant to the equality duty to: Eliminate discrimination and eliminate harassment Advance good relations and attitudes between people	
RELEVANT: Flagged heparin derived from animals. Statement below included in guideline	
Statement: 'All LMWHs mentioned in this guideline are produced from porcine derived heparin sodium therefore there is a risk of contamination from animal sources. For patients for whom risk of contamination from animal sources is not acceptable, alternatives such as mechanical methods should be used in the first instance and for high-risk patients' pharmacological prophylaxis should be discussed with the paediatric haematology'	
EqIA registration Number for RMCH:	2024-124

3. Consultation, Approval and Ratification Process

This guideline was developed with input from:
- North-West (England) and North Wales Paediatric Transport Service (NWTS).
- North-West and North Wales Paediatric Critical Care Operational Delivery Network
- Representatives from the District General Hospitals within network above.

These guidelines were circulated amongst the North-West and North Wales Paediatric Critical Care and Surgery in Children's Operational Delivery Network for comments on the 9th April 2024.
All comments received have been reviewed and appropriate amendments incorporated.
These guidelines were signed off by the PCC ODN oversight committee on 08.05.24 and Surgery in Children 07.06.24
For ratification process for network guidelines see appendix 1.

4. Disclaimer

These clinical guidelines represent the views of the North-West (England) and North Wales Paediatric Transport Service (NWTS) and the North-West and North Wales Paediatric Critical Care Operational Delivery Network (PCCN). They have been produced after careful consideration of available evidence in conjunction with clinical expertise and experience.
It is intended that trusts within the Network will adopt this guideline and educational resource after review and ratification (including equality impact assessment) through their own clinical governance structures.
The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.
Clinical advice is always available from NWTS on a case-by-case basis.
Please feel free to **contact NWTS (01925 853 550)** regarding these documents if there are any queries.

Venous Thromboembolism (VTE) prophylaxis assessment should be conducted on **all admissions > 13 years or post-pubertal patients**.

A VTE and bleeding risk assessment should be done within 24 hours of admission and repeated at least weekly or whenever their clinical situation changes or on transfer. A final reassessment should be completed on discharge to assess the need for on-going prophylaxis in the community.
Always complete a new risk score for each assessment
Thrombosis risk and bleeding risk should be considered together for each individual patient (see pages 5 & 6)

BACKGROUND

Patients under 16 years of age are 10 times less likely to develop VTE than adults. In those hospitalised the incidence is 8/10,000.
80% of children who develop VTE will have at least 1 recognised risk factor; in comparison 50% of adults with VTE have no identified risks.
There are 2 peaks of incidence of paediatric VTE: under 2 years of age and adolescent or post puberty.
The reasons children are relatively protected from VTE are discussed elsewhere [1]
As VTE is so rare before adolescence this guideline only describes management of post pubertal children.

DIFFERENCES FROM ADULTS

Risk factors between adolescents and adults are mostly similar (see risk score). However, due to much lower incidence of VTE the threshold for pharmacological prophylaxis is much higher. Due to the complexity of patients seen in RMCH and Alder Hey, the incidence in adolescent patients is similar to that observed in young adults
66% of all VTE cases in those under 16 years age are associated with all central lines (including PICC lines) regardless of site. Femoral sites carry the highest risk followed by subclavian and then internal jugular.
For this reason, the distribution of VTE site in those under 16 years is equal between upper and lower limbs.
In those with inherited thrombophilic conditions the majority do not have their 1st VTE until adulthood.
HIT can occur in patients under 16 years age, but incidence is 2.3%, i.e. half that of adult patients. [1]

COVID -19

Evidence for thromboprophylaxis in children with COVID is poor. Studies are small or based on case reports and have not given firm guidance [2]. In those under 16 years age hospitalised, requiring oxygen and with other risk factors, (excluding incidental infection) Low Molecular Weight Heparin (LMWH) should be considered.
A high level of suspicion of VTE should be taken for such cases as well as general measures described later.
Discussion with tertiary centres and haematology should be considered.

TRAUMA

Unsurprisingly evidence for VTE prophylaxis in children suffering trauma is also poor. Incidence of trauma related VTE is <0.3% although it is likely there are a reasonable number of asymptomatic and undiscovered cases.
In pre-pubertal children without other risk factors pharmacological prophylaxis is rarely recommended.
In adolescent cases there is no agreed threshold for the severity of injury that requires LMWH.
More detail can be found in APA guidance [3]

FOR EACH PATIENT CONSIDER THE FOLLOWING:

- There is little evidence to support the use of specific measures, including LMWH, to reduce the risk of VTE
- Physical methods to reduce the risk of VTE will not be suitable in some patients due to co-existing morbidity. In such situations consider LMWH until risk factors resolve or physical prophylaxis is feasible.

RISK ASSESSMENT

STEP 1: Review the patient and admission related risk factors shown on the assessment score sheet below, scoring each box that applies (all boxes must be scored). The risk factors identified are not exhaustive and clinicians may consider additional risks in individual patients and offer thromboprophylaxis as appropriate.
NB Score one point for each risk factor identified in medical co-morbidities*.
STEP 2: Review patient related and admission related bleeding risk factors and mark each box that applies.
Thromboprophylaxis with **LMWH is relatively contraindicated** if any bleeding risk factor is identified, unless recommended by Paediatric Haematologist. **If an increased risk of bleeding is documented on the risk assessment thromboprophylaxis with LMWH should not be administered unless approved by senior paediatric haematologist.**

Guidelines for Management of Venous Thromboembolism Prophylaxis in those Under 16 Years of Age

RISK ASSESSMENT

PATIENT'S FULL NAME & DOB	
NHS or HOSPITAL NUMBER	

Step 1: THROMBOSIS RISK SCORE

PATIENT RELATED	SCORE	ADMISSION RELATED	SCORE
Central or PICC line in situ		Major Trauma	
Active cancer or cancer treatment		Total anaesthetic + surgical time > 90 minutes	
Medically confirmed dehydration (at least 5%), especially if hypernatraemic including that associated with DKA		Acute surgical admission with inflammatory or intra-abdominal condition	
Known high risk thrombophilia (congenital or acquired) eg Protein C, Protein S, ATIII or combination defects, antiphospholipid syndrome, & connective tissue disorder		Major or complex orthopaedic surgery: multiple fractures or > 2 hours surgery time	
Obesity: BMI >30 (wt (kg) / height^2 (m))		Intubated and ventilated	
Personal history of VTE		Sepsis	
First degree relative with history VTE under age 40 years		Likelihood of significantly ↓mobility ≥ 48 hours.	
Significant medical co-morbidities eg congenital heart disease, nephrotic syndrome, metabolic & endocrine diseases, hyperinsulinaemia, sickle cell disease, inflammatory bowel disease, low cardiac output state. *		Medication known to increase thrombotic risk* Use of oestrogen-containing contraceptive therapy, asparaginase, steroids, TPN.	
Pregnancy or < 6 weeks post-partum		Severe burns	
SCORE 1 POINT FOR EACH RISK FACTOR IDENTIFIED		TOTAL THROMBOSIS RISK SCORE =	

Step 2: BLEEDING RISK: record each bleeding risk identified

Patient related	Yes / No	Admission related	Yes / No
Active bleeding		Neurosurgery or eye surgery	
Acquired bleeding disorders (eg acute liver failure)		Spinal surgery within previous 24 hours	
Concurrent use of anticoagulants known to increase the risk of bleeding		Lumbar puncture / epidural / spinal anaesthesia expected within next 12 hours	
Acute stroke		Other procedure with high bleeding risk	
Thrombocytopenia (platelets < 50 x 10^9 / L)		LP / epidural / spinal anaesthesia in previous 4 hrs	
Inherited bleeding disorders (eg haemophilia and von Willebrand's disease)		Significant head injury (skull #, intracranial haematoma or bleeding seen on scan)	
Uncontrolled systolic hypertension			

Thrombosis Risk Classification: Low / Medium / High	**BLEEDING RISK IDENTIFIED? Yes / No**

OUTCOME: tick all that apply	No thromboprophylaxis	Mechanical prophylaxis	Pharmacological prophylaxis

RISK ASSESSMENT COMPLETED ON DATE:	BY:
Nurse *(date/time, name, signature, NMC number):*	
Doctor/ACP *(date/time, name, signature, professional registration no.):*	
Document plan in medical & nursing notes: duration of treatment, date of review, & all discussions with paeds. haematology	

RECOMMENDED METHOD OF VTE RISK REDUCTION IN AT RISK PATIENTS:

Risk Classification and management for NON-SURGICAL patients	THROMBOSIS RISK SCORE NON-SURGICAL patients	
	1-3	**4+**
Not ventilated AND Immobile < 48 hrs	**LOW RISK** · Ensure good hydration · Early mobilisation	**Medium risk** · Anti-embolic or compression stockings or Intermittent Pressure Compression boots (eg Flowtrons) · Plus measures for low risk · Consider enoxaparin only if mechanical measures contra-indicated
Intubated and ventilated for < 48 hrs	**LOW RISK** · Ensure good hydration · Early mobilisation	**HIGH RISK** · Consider LMWH · Plus measures for medium and low risk
Intubated and ventilated > 48 hrs OR Immobile > 48 hrs	**MEDIUM RISK** · Anti-embolic or compression stockings or Intermittent Pressure Compression boots (eg Flowtrons) · Plus measures for low risk · Consider enoxaparin only if mechanical measures contra-indicated	**HIGH RISK** · Consider LMWH · Plus measures for medium and low risk

Risk Classification and management for SURGICAL patients	THROMBOSIS RISK SCORE: SURGICAL patients	
	1-3	**4+**
SURGERY < 30 MINUTES	**LOW RISK** · Ensure good hydration · Early mobilisation	
SURGERY > 30 MINUTES	**LOW RISK** · Ensure good hydration · Early mobilisation	**MEDIUM RISK** · Anti-embolic or compression stockings · Intermittent Pressure Compression boots (eg Flowtrons) in theatres · Plus measures for low risk · Consider LMWH only if mechanical measures contra-indicated
MAJOR SURGERY **MAJOR ORTHOPAEDIC SURGERY** **MAJOR OR COMPLEX ORTHOPAEDIC SURGERY** **(MULTIPLE # OR > 2 HRS SURGERY TIME)** **MAJOR TRAUMA**	**HIGH RISK** · Consider LMWH · Plus measures for medium and low risk	

METHODS TO REDUCE RISK OF VTE

FOR ALL PATIENTS: ALWAYS consider general measures to reduce the risk of VTE:

- Maintain adequate hydration
- Remove central venous lines / PICC lines / long-lines, particularly femoral lines, as soon as feasible.
- Mobilise early

IN ALL AT-RISK PATIENTS:

MECHANICAL PROPHYLAXIS

- Anti-embolic or compression stockings (eg TED stockings) can be used in patients with moderate or higher risks, however they must fit correctly so are not recommended in those under 40kg.
- Intermittent pressure compression boots are recommended for surgical patients with surgery > 60 minutes but again are not recommended in those under 40kg due to sizing.
- Intermittent pressure compression boots are contra-indicated in massive leg oedema, pulmonary oedema (congestive heart failure), severe peripheral vascular disease or neuropathy, any local condition where they would interfere, or extreme leg deformity.

PHARMACOLOGICAL PROPHYLAXIS

NB All LMWHs mentioned in this guideline are produced from porcine derived heparin sodium therefore there is a risk of contamination from animal sources. For patients for whom risk of contamination from animal sources is not acceptable, alternatives such as mechanical methods should be used in the first instance and for high-risk patients' pharmacological prophylaxis should be discussed with the paediatric haematology.

Enoxaparin is the Low Molecular Weight Heparin (LMWH) of choice in this guideline but alternative LMWHs can be used depending on local hospital formulary.
All LMWHs are administered via subcutaneous route. This can be achieved by either by rotating injection sites or by injecting into an InsuflonTM catheter (to reduce dead space and number of injections).
Caution: renal impairment due to reduced clearance, and therefore an increased risk of bleeding, seek paediatric haematology specialist advice.
Caution in extreme body weights (BMI < 2% centile or >98% centile).
Caution if considering use in neonates or under 5 kg, especially premature neonates. ALWAYS discuss this age group/size patient with paediatric haematology before starting LMWH.

ENOXAPARIN: **NB 1 mg is equivalent to 100 international units**		
AGE	**DOSE**	**FREQUENCY**
≥ 1 month old AND >5kg	0.75 mg/kg	Twice daily
2 months – 17 years	0.5 mg/kg (max 20 mg per dose)	Twice daily

DALTEPARIN		
AGE	**DOSE**	**FREQUENCY**
≥ 1 month old (AND >5kg) - 11 years	100 units/kg	Once daily
12 – 17 years AND over 40 kg	2500 – 5000 units	Once daily

Tinzaparin **NB** Do not use Tinzaparin for patients being transferred to Alder Hey Hospital		
AGE	**DOSE**	**FREQUENCY**
≥ 1 month old (AND >5kg) - 17 years	50 units/kg	Once daily

ROUTINE THERAPEUTIC DRUG MONITORING for LMWH used for prophylaxis is not essential but can be used to guide dosing for all patients especially those with renal impairment or with extremes of body weight.
Anti-factor Xa samples need to be taken from fast-flowing venous blood between 4-6 hours post dose.
Target anti-factor Xa level for prophylactic dosing is 0.1-0.4 units/mL.
Platelet count should be monitored weekly for first month.

RESOURCES

FOR DRUG DOSES: always check British National Formulary for Children

GUIDELINES FOR < 16 YEARS: ***www.nwts.nhs.uk/clinicalguidelines***

NWTS emergency drugs guide via NWTS website home page - for intubation drugs / sedation regime / inotropes etc ***https://www.nwts.nhs.uk***

Safe Transfer of Paediatric Patients (STOPP) tool which includes risk assessment prior to transfer, and checklists

NWTS LocSIPPS / Checklists includes sizes of ETT, suction, NGT, CVL & arterial lines

Guidelines include: intubation and difficult airway, sepsis, insertion of intraosseous line, collapsed neonate or infant, management of under 16 years outside PCC level 3 unit, and transfer

EDUCATION: ***www.nwts.nhs.uk/education-website***

Includes recordings of NWTS education eg time critical transfers, surgical abdomen etc

Login details for education site is available from your nursing and medical paediatric critical care (PCC) operational delivery network (ODN) links

References

1. Jinks S, Arana A. Venous thromboembolism in paediatrics. *BJA Educ* 2019; 19: 305-312. doi: 10.1016/j.bjae.2019.05.003. Epub 2019 Jul 10. PMID: 33456907; PMCID: PMC7807932.

2. Zaffanello M, Piacentini G, Nosetti L, Ganzarolli S, Franchini M. Thrombotic risk in children with COVID-19 infection: A systematic review of the literature. *Thromb Res* 2021; 205: 92-98. doi: 10.1016/j.thromres.2021.07.011. Epub 2021 Jul 16. PMID: 34293539; PMCID: PMC8284063.

3. Association of Paediatric Anesthetists Great Britain and Ireland 2020. *Prevention of peri-operative venous thromboembolism in paediatric patients* [Online]. Viewed 15th October 2022. Available from https://www.apagbi.org.uk/sites/default/files/inline-files/APA%20Thromboprophylaxis%20guidelines%20final.pdf

Contact numbers:

Regional Paediatric Intensive Care Unit Alder Hey Childrens Hospital 0151 252 5241

Regional Paediatric Intensive Care Unit Royal Manchester Childrens Hospital 0161 701 8000

NWTS (North West & North Wales Paediatric Transport Service) 01925 853 550

Guideline authors:

Joe Brennan, ST7 Anaesthetic trainee, RMCH

Nasser Khan, ST6 Anaesthetic trainee RMCH

Mary-Ann Bentham, Anaesthetic and Paediatric Critical Care Transport Locum Consultant, NWTS

Kate Parkins, PICM Consultant, NWTS

Consulted parties:

North-West (England) & North Wales Paediatric Transport Service (NWTS)

Paediatric Hematology teams at both Royal Manchester and Alder Hey Children's Hospitals

North-West (England) and North Wales Paediatric Critical Care Operational Delivery Network

PICU teams at both Royal Manchester and Alder Hey Children's Hospitals

Date of Review: TBC

Guideline team at NWTS:

kate.Parkins@nwts.nhs.uk or Nicola.longden@mft.nhs.uk

For the most up to date version of this guideline please visit PCC SiC LTV ODN website: https://northwestchildrensodnhub.nhs.uk/ or NWTS website: https://www.nwts.nhs.uk/clinicalguidelines/regionalguidelines-a-z

Ratification process: