MANAGEMENT OF
VASCULAR EMERGENCIES AND NEONATAL THROMBOSIS

Introduction

- Thrombotic disease is uncommon in newborns but can cause serious morbidity or be life threatening. It is most common in babies receiving intensive care with indwelling central lines.

Approach to management

Conservative

- The approach to an individual infant must balance the risks and benefits. Asymptomatic thrombosis which does not threaten organ or limb viability may be managed by close monitoring of the size of the thrombus and by providing supportive care. E.g. unilateral renal vein thrombosis with normal renal function.

Anticoagulation

- Severe symptomatic thromboembolic events typically are treated with anticoagulation and/or fibrinolytic agents. However, these strategies have not been studied in clinical trials and data on outcome are sparse. E.g. renal vein thrombosis (bilateral) / right atrial thrombus / arterial thrombosis.

Thrombolysis

- E.g. right atrial thrombus and impaired cardiac function / Arterial thrombosis threatening organ or limb viability

Surgical thrombectomy

- This is rarely is performed in newborns. In general, this procedure is limited by the small size of blood vessels and the clinical instability of newborns with thrombosis.

Management

Assessment

- Clinical:
  - Clinical examination and an assessment of the consequences of the suspected thrombus
  - Assess evidence of end-organ function
  - All acute thrombotic events are clinical emergencies and must be discussed with a Consultant.
  - Vascular surgery team or vascular technician may be useful in assessing limb viability and with Doppler assessment. However, this should not delay assessment and treatment.
- Imaging - investigations should be discussed with Consultant Radiologist:
  - Ultrasound / echocardiography with Doppler (current linear probe may be used in 'thyroid difficult' setting)
  - CT with contrast
  - Cranial USS
- Baseline investigations:
  - Activated partial thromboplastin time (aPTT)
  - Prothrombin time (PT) and INR
  - Plasma fibrinogen concentration
  - Platelet count

Treatment and monitoring

- Advice can be sought from the GOSH vacular team or local Paediatric Orthopaedic Surgeon

GTN

- This may be applied to the proximal part of the affected limb in arterial thrombus.
- Dose: 1/8th of a 5mg (release over 24h) patch
- Deponit patch may be cut (see formulary for guidance)

Epoprostenol

- This may be used to treat vasospasm in an acutely ischaemic limb
- Dose: 5 nanograms/kg/min (see formulary for guidance)

Unfractionated Heparin (UFH)

- This is the treatment of choice for initial anticoagulation. The therapeutic action of heparin requires antithrombin which may be increased by the concomitant administration of FFP.
- Loading dose: 75 Units/kg IV over 10 minutes
- Maintenance dose:28 Units/kg/h
- Monitoring: Maintain APTT 60-85s / ratio 2.5

Heparin monitoring and adjustment:

APTT ratio	APTT (sec)	Bolus (units / kg) Or Hold	Rate Change	Repeat APTT
< 1.7	<50	Bolus 50	+10%	4 hrs
1.7–1.9	50-59	-	+10%	4 hrs
2–2.7	60-85	-	-	24 hrs
2.8–3.2	86-95	-	-10%	4 hrs
3.3–4	96-120	Hold 30 mins	-10%	4 hrs
> 4	>120	Hold 60 mins	-15%	4 hrs

- May require monitoring of Anti-Xa levels (0.35 – 0.7 IU/ml), D/W Haematology
- Side effects: Haemorrhage, heparin induced thrombocytopenia (HIT), osteoporosis (long term use only)
- There can be up to a halving of the APTT when on GTN as well as heparin, and there can be a rebound rise of the APTT on stopping the GTN, despite continuing the same dose of heparin infusion.
- Reversal: Protamine sulphate injection - 1 mg IV (over 5 minutes) for every 100 units of heparin given in the previous 2 hours.

Low molecular weight heparin

- This is the treatment of choice if anticoagulation is required beyond 2 weeks. Advantages include subcutaneous administration, predictable response not requiring monitoring and reduced incidence of HIT and osteoporosis.
- Dalteparin - loading dose: 150 Units/kg OD subcutaneously
- Monitoring : Maintain anti-factor Xa 0.5-1.0 IU/ml

LMWH monitoring and adjustment:

Anti Xa level	Dose Change	Next anti Xa level
< 0.35	↑ 25%	24 hours
0.35–0.49	↑ 10%	24 hours
0.5–1.0	-	Weekly
1.1–1.5	↓ 20%	24 hours
1.6–2.0	↓ 30%	24 hours
> 2.0	redose only when anti Xa <0.5 ; ↓ 40%	24 hours

- Reversal: Protamine sulphate injection - 1 mg per 100 Units IV if given within 4h of injection
- Lower doses may be given if > 4h from time of last injection

Thrombolysis

- This is the treatment of choice for life threatening or organ threatening thrombosis. It should be used only after a trial of UFH (2-4h). If using Alteplase, then continue UFH thereafter.
- Contraindications should be assessed in the context of the clinical threat and a decision to treat based on an individualised risk benefit analysis: Surgery or haemorrhage within 10 days, neurosurgery within 21 days, asphyxia within 7 days, invasive procedure within 3 days,

convulsions within 48h, prematurity <32 weeks gestation, current sepsis/bleeding, thrombocytopenia <100.000/microliter, Fibrinogen < 1 g/dl.

- Alteplase is the agent of choice. If using Alteplase, then continue UFH.
- Dose: 500 micrograms/kg/hr IV for 4h. Dose may be titrated against clinical or Doppler improvement within 100-600 micrograms/kg/hr. Reassess at 4h and stop if clinical improvement.
- Monitoring: Maintain Fibrinogen >1g/dl. Check after 2h and 4hrly thereafter. The therapeutic action of t-PA requires plasminogen. Its affect may be improved by the administration of FFP.
- Reversal: Treat haemorrhage by stopping infusion (if possible) and administering FFP and platelets.