TITLE: **HEPARIN INFUSION IN THE NEONATE/PEDIATRIC CARDIAC POST-SURGICAL or POST-TRANSCATHETER INTERVENTION POPULATION GUIDELINE**

PURPOSE: To prevent the development of thrombus within the vascular system and/or implanted device(s). This is a new guideline.

APPLICABLE AREAS

Pediatric Congenital Cardiac Unit

LEVEL OF RESPONSIBILITY

1. Cardiac Intensivist
2. Cardiac Nurse
3. Pharmacy
4. Laboratory

NURSING COMPETENCIES

- Attendance of UHS Cardiac Specialty Course unless previous pediatric cardiac experience within the last 18 months
- Completed Competency Validation Checklist indicating care of patients requiring heparin infusion for the prevention of thrombus.

PATIENT OUTCOMES

The cardiac patient will be given the best opportunity for a positive outcome in part due to the ability of the Cardiac Team to prevent thrombus formation through the appropriate use of heparin.

POPULATION

Patients admitted to the PCCU who have a cardiac lesion and/or a palliative procedure that requires a Heparin infusion. Examples of patients needing a heparin infusion follow but are not limited to:

Aorto-Pulmonary Conduit	Central Shunt Blalock-Taussig (BT) Shunt Modified BT Shunt
Ventricle-to-Great Vessel Conduit (excludes RV-to-Pulmonary artery Conduit or Homograft)	Sano Shunt
Cavo-Pulmonary Anastomosis	Glenn or Hemi Fontan Palliation Fontan Palliation (all modifications)
Implanted Devices	Mechanical Valve Vascular Stent Closure Devices (e.g. VSD, ASD, PDA)
Miscellaneous	Extensive Aortic Suture Lines Coronary artery intervention or manipulation with risk of coronary spasm and secondary thrombosis

Heparin to maintain an intravascular catheter is a unique use that is addressed below. *

DOSING and MONITORING

Group 1: Prophylactic Heparin Infusion without intent to anti-coagulate
Heparin infusion starts approximately 4 to 6 hours post-surgical palliation or immediate post cardiac catheterization at 10 units/kg/hour. Since the intent is not to achieve therapeutic anti-coagulation, the dose is not changed. If there is concern that cumulative Heparin infusions may place a patient at risk for bleeding or if there is evidence of bleeding, assessment of anti-Xa level is recommended. The Heparin infusion is discontinued when anti-platelet therapy (usually aspirin) is started.

Group 2: Prophylactic Heparin infusion for low target anti-coagulation (PTT < 70 seconds / anti-Xa ≤ 0.2 U/mL)
Heparin may be initiated as a drip with or without an initial bolus. Anti-coagulation state will be regularly monitored by PTT with goal PTT ~ 40-69 seconds. With a confirmed PTT ≥ 70 seconds, a follow-up anti-Xa is recommended. Please refer to **Appendix I: Heparin Dose Adjustment using PTT monitoring.**

Group 3: Therapeutic anti-coagulation Heparin infusion with intent to fully anti-coagulate (PTT ≥ 70 seconds / anti-Xa ≥ 0.3 U/mL)

Heparin may be initiated as a drip with or without an initial bolus. Anti-coagulation state will be regularly monitored by anti-Xa with goal anti-Xa ~ 0.3-0.7 units/mL. Please refer to **Appendix II: Heparin Dose Adjustment using anti-Xa monitoring.**

NOTE: This Guideline is **not** intended to address therapeutic anti-coagulation to manage an existing thrombus (e.g., DVT). A Hematology consult is recommended.

Monitoring:

- Baseline CBC with Platelets, PTT and/or anti-Xa, and PT /INR (if indicated)
- Daily CBC with Platelets to monitor for Heparin Induced Thrombocytopenia (HIT)
- PTT or Anti-Xa to be checked 4 hours after initiation and after each dose change
- PTT or Anti-Xa can be monitored daily once therapeutic level achieved
- Please see Appendix III for reversal of Heparin with evidence of hemorrhage

***** Heparin use for maintenance of intra-vascular catheters (e.g. central venous or arterial) is a categorically different use of Heparin infusion that is dependent on catheter and site. This use does not require monitoring. The following suggestions are not intended to supersede other policies that directly address such catheters.

Catheter	Heparin Concentration	Infusion Rate (mL / Hr)
Umbilical Arterial	0.5 to 1 unit / mL	1
Umbilical Venous[+]	0.5 to 1 unit / mL	1
Peripheral Arterial	2 units / mL	1
Central Venous	2 units / mL	1
PICC[+] (Neonate 2 or 3 Fr)	0.5 to 1 units / mL	1
PICC (Pediatric 3 Fr or larger)	2 units / mL	1

[+] Heparin 0.5 unit / mL may be added to TPN fluid infused in neonate UVC or PICC

Appendix I: Heparin Dose Adjustment using PTT monitoring

1. Initial bolus (optional): 75 units/kg over 10 minutes
2. Initial infusion rate:
    a. ≤ 12 months old – 25 (20-30) units/kg/hour
    b. > 12 months old – 20 (20-30) units/kg/hour

aPTT (sec)	Bolus (units/kg)	Hold (min)	Rate Change	Repeat aPTT (hrs)
< 40	50	0	+ 10 %	4
40 - 69	**0**	**0**	**0**	**Next day**
70 - 90	0	0	- 10 %	4
> 90	0	30 minutes	- 10 %	4

Appendix II: Heparin Dose Adjustment using anti-Xa monitoring

1. Initial bolus: 75 units/kg over 10 minutes
2. Initial infusion rate:
    a. ≤ 12 months old – 25 (20-30) units/kg/hour
    b. > 12 months old – 20 (20-30) units/kg/hour

Anti-Xa (units/ml)	Bolus (units/kg)	Hold (min)	Rate Change	Repeat Anti-Xa (hrs)
< 0.15	50	0	+ 10 %	4
0.15-0.29	0	0	+ 10 %	4
0.3-0.7	**0**	**0**	**No Change**	**Next Day**
0.71-1	0	0	- 10 %	4
> 1	0	30 minutes	- 10 %	4

Appendix III: Reversal of Heparin with Protamine Sulfate

NOTE: Protamine Sulfate administration MUST BE APPROVED by PCCU attending and/or CT Surgery attending.

Include heparin dose given over the previous 2 hours from hemorrhage to calculate Protamine dose. Administer slow IV push not to exceed 50 mg over 10 minutes. Multiple doses may be required.

Time Elapsed	Dose of Protamine (mg)
Immediate	1 mg per 100 units of Heparin
30-60 minutes	0.5 – 0.75 mg per 100 units of Heparin
60-120 minutes	0.375 – 0.5 mg per 100 units of Heparin
> 2 hours	0.25 – 0.375 mg per 100 units of Heparin

Guideline Authorization and Review Form

Guideline Title: HEPARIN INFUSION IN THE NEONATE/PEDIATRIC CARDIAC POST-SURGICAL or POST-TRANSCATHETER INTERVENTION POPULATION GUIDELINE

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Reference: Holbrook A, Schulman S, Witt DM, Vandvik PO, Fish J, Kovacs MJ, Svensson PJ, Veenstra DL, Crowther M, Guyatt GH. Evidence-based management of anticoagulant therapy: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. Chest. 2012 Feb;141(2 Suppl):e152S-84S.

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