Pediatric Non-traumatic Limb Ischemia

Clinical Practice Guidelines

FINAL
04/28/2020

Monroe Carell Jr. Children's Hospital at Vanderbilt

Provider has concern for possible abnormal limb perfusion due to: arterial thrombosis, catheter infiltration, infection or other **non- traumatic conditions**

Remove indwelling vascular access if present at site

Consult appropriate teams using standard language: **"I am concerned about an ischemic limb, and I need you to see the patient as soon as possible."**

Upper extremity

Primary team consults:
- Hand team
- There must be a clear understanding of the available attending or fellow from consulting services.

Attending or fellow point person, resident only not sufficient

Lower extremity

Primary team consults:
- Pediatric surgery
- There must be a clear understanding of the available attending or fellow from consulting services.

Attending or fellow point person, resident only not sufficient

Primary team consults **Hematology** Regardless of body region

Management

Imaging:
- Order stat bedside duplex ultrasound

Labs:
- Obtain baseline labs: CBC, PT, PTT, fibrinogen

Medication Management:
- Order and initiate unfractionated Heparin (while consideration of surgical and medical therapies is ongoing)
- Load 75units/kg over 10 minutes (max 5,000 units)
- Maintenance
  - <1 year of age: 28 units/kg/hr
  - >=1 year of age: 20 units/kg/hr (maximum initial rate 1,000 units/hr
- Titrate for goal heparin level (anti-Factor Xa level) of 0.35-0.7 units/mL. This is ordered as "unfractionated heparin lvl" in eSTAR. Heme recommends monitoring predominantly with anti-Factor Xa levels but encourage daily PTT (drawn at same time as anti-FXa) surveillance. Please discuss with Hematology service.

In certain clinical scenarios, consideration may be given to the use of thrombolytic therapy, but this should be discussed with Hematology service who can assist in ordering and appropriate monitoring during thrombolysis.

Primary team and consultant teams evaluate patient and consider:
- Completeness of obstruction
- Degree of tissue ischemia
- Compensatory collateral flow
- Serial exams
- Serial duplex ultrasounds (consider every 4 hours)

Primary team and consultant teams continue to reassess and perform serial exams. Combined clinical assessment and decision about degree of critical tissue ischemia

*Must be clear understanding of available attending or fellow from consulting services if input is needed.

Clinical improvement?

Yes

Continue Heparin therapy for 7-10 days (Hematology guides duration and possible conversion to LMWH)

No

Likely proceed to surgery (arteriotomy, thrombectomy, possible thrombolysis, microvascular recontruction, fasciotomy)

Inclusion criteria:

This clinical pathway is for children with symptoms of abnormal limb perfusion due to:
- Arterial thrombosis
- Catheter infiltration
- Infection
- Other non-traumatic conditions

Exclusion criteria*see Traumatic ischemic CPG:

Abnormal limb perfusion due to:
- Blunt trauma
- Penetrating trauma
- Fractures

Additional Notes

Diagnostic Indicators

- Limb pallor
- Degree of tissue ischemia
- Damped doppler wave or obstruction
- Slow or absent capillary return (more than 6 seconds)
- Decreased or absent pulse oximetry
- Loss of distal pulses
- Tight muscle compartments
- Paralyzed limb
- Pregangrenous changes (changes in skin color, skin temperature, numbness, swelling, pain, skin breakdown)
- Damped doppler wave
- Doppler obstruction with no distal flow
- Pain in excess of that typically expected

***All of these criteria are not required for the diagnosis**

Symptoms often evolve – something is abnormal with perfusion and is at risk for progressing to complete ischemia.

High Risk Patient Factors

- Low-birth weight neonates
- Generalized sepsis
- Hypotension/inotropes
- Patients with arterial access
- Multiple arterial cannulations
- Low-output states
- Hyperviscosity

***This guideline does not take into account individual patient situations, and does not substitute for clinical judgment**

Monroe Carell Jr. Children's Hospital at Vanderbilt

Monitoring with aPTT

aPTT	Hold Infusion	Dose Titration	Next Level Check
≤ 55 seconds	No	Bolus 50 Units/kg and increase infusion rate 10%	4 hours
56 - 64 seconds	No	Increase infusion rate 10%	4 hours
65 - 100 seconds	No	None	Next AM and daily if stable x 2
100 - 110 seconds	No	Decrease infusion rate by 10%	4 hours
110 – 120 seconds	Yes, Hold infusion for 30 minutes	Decrease infusion rate by 10%	4 hours
>120 seconds	Yes, Hold infusion for 60 minutes	Decrease infusion rate by 15%	4 hours (If possible contaminated sample, repeat immediately)

Monitoring with Anti-FXa level

Anti-Factor Xa level	Hold Infusion	Dose Titration	Next Level Check
≤ 0.24 Units/mL	No	Bolus 50 Units/kg and increase infusion rate by10%	4 hours
0.25 – 0.34 Units/mL	No	Increase infusion rate by 10%	4 hours
0.35 – 0.7 Units/mL	No	None	Next AM and daily if stable x 2
0.71 - 0.8 Units/mL	No	Decrease infusion rate by 10%	4 hours
0.81 – 1 Units/mL	Yes, Hold infusion for 30 minutes	Decrease infusion rate by 10%	4 hours
> 1 Units/mL	Yes, Hold infusion for 60 minutes	Decrease infusion rate by 15%	4 hours (if possible contaminated sample repeat immediately)

Additional Considerations:

This pathway is intended to evaluate children with acute changes in limb perfusion where rapid diagnosis, supportive care with heparin, and sometimes surgery, are thought improve outcomes. Children have excellent ability to develop collateral circulation, and conservative management with heparin is often most beneficial. However, sometimes surgery is indicated and urgent / emergent. Initiate heparin while decisions are being made about if and when surgery is indicated.

References:

Coombs CJ, Richardson PW, Dwoling GY, Johnstone BR, Monagle P. Brachial Artery Thrombosis in Infants: An Algorithm for Limb Salvage. Plast Reconstr Surg 2006; 117:1482-8.

Sadat U, Hayes P, Varty K. Acute Limb Ischemia in Pediatric Population Secondary to Peripheral Vascular Cannulation: Literatu re Review and Recommendations. Vasc and Endovasc Surg 2015;49(5-6)142-147.

Gupta A, Leaker M, Andrew M, Massicotte P, Liu L, Benson L, McCrindle B. Safety and outcomes of thrombolysis with tissue plasminogen activator for treatment of intravascular thrombosis in children. J Pediatr 2001; 139:682-8.

Raffini, L. Thrombolysis for intravascular thrombosis in neonates and children. Curr Opin Pediatr 2009; 21:9-14.