Consensus Guidelines for Partial Exchange Transfusion for Polycythemia in Neonates

UCSF (NC)^2 (Northern California Neonatal Consortium)

Executive summary

Objectives

- Standardize the approach to screening and management of polycythemia in infants ≥ 34 weeks gestation using current practice standards and best available evidence
- Improve quality and safety of care for neonates ≥ 34 weeks GA with possible polycythemia; specifically:
    - Improve recognition of infants showing symptoms of polycythemia
    - Decrease unnecessary screening
    - Provide recommendations on how to perform partial exchange transfusion safely and effectively
    - Decrease morbidity associated with unnecessary partial exchange transfusions

Recommendations

- Who to Screen
    - Asymptomatic patients should *not* be routinely screened regardless of risk factors
    - Only screen *symptomatic* patients for polycythemia
- Who Should Receive Partial Exchange Transfusion
    - Do NOT perform PET in asymptomatic infant with Hct <=75%
    - Consider PET in infants with Hct >65% who are demonstrating signs listed in Section A or B on page 3
    - Consider PET in asymptomatic infants with Hct >75%, but note there is minimal data for benefit of PET in asymptomatic infants.
- Timing of Partial Exchange Transfusion
    - PET should be performed as soon as possible in symptomatic infants

Methods

This guideline was developed through local consensus based on published evidence and expert opinion as part of the UCSF Northern California Neonatal Consortium.

Metrics Plan

UCSF NC^2 (Northern California Neonatology Consortium). Originated 7/2018, last revised 1/2019.
Approved by UCSF ICN Patient Safety Committee: 9/17/2019
Approved by UCSF BCH Medication Committee: 8/13/19
Approved by UCSF Pharmacy and Therapeutics Committee:5/12/2021

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Part I: Background

- Definition
  - Venous hematocrit >65% or hemoglobin >22 in term infant
  - Venous hematocrit >2 SD for gestational and post-natal age
- Epidemiology
  - 1-4% of Term Infants
  - More common in SGA (IUGR), LGA, IDM, T21, twin-twin transfusion, Beckwith-Wiedemann syndrome, otherwise normal infants with excessive placental transfusion
- Pathophysiology
  - Hct is the main determinant of blood viscosity and is used as a proxy for measuring viscosity, though Hct does not correlate directly with viscosity because it is affected by other factors (e.g., flow rate in small vessels, plasma protein concentrations, acidosis, red blood cell deformability)
    - Hyperviscosity occurs in ~47% of infants with Hct ≥ 65
  - As Hct increases, viscosity increases, elevating vascular resistance and decreasing blood flow at any given perfusion pressure
  - The effects of increased Hct on viscosity are greater in the pulmonary circulation
  - Increased viscosity results in slowing of blood flow and sludging of red blood cells
  - Occlusion of small vessels may result in ischemia and consumption of platelets
- Literature
  - No studies have been done to evaluate only symptomatic infants
  - Several RCTs have evaluated only asymptomatic infants, and found no difference in neurodevelopmental outcomes with or without partial exchange transfusion
    - Limitations
      - None with long-term follow up that took into account underlying etiology
      - CNS damage may have already occurred by the time PET took place (peak Hct at 2HOL)
  - Cochrane Review 2010
    - There is no clinically significant short and long-term benefit of PET in clinically well newborn with polycythemia. No difference in thrombocytopenia, jaundice, or hypoglycemia.
    - PET may increase the risk of NEC

Note: Parts II&III apply to infants meeting the following inclusion criteria:
All Infants >=34 weeks gestational age

Part II: Screening and Monitoring for Polycythemia

- Who to Screen
    - Asymptomatic patients should *not* be routinely screened regardless of risk factors
    - Only screen *symptomatic* patients for polycythemia
        - Most infants (74-90%) have no symptoms
        - Symptoms are attributable to hyperviscosity and poor tissue perfusion or associated metabolic abnormalities
        - Often begin by 2 hours after birth, but may be delayed to 2 DOL or 3 DOL due to fluid loss, and may be difficult to distinguish from underlying etiology
        - Section A: Signs that may be associated with Polycythemia/ Hyperviscosity (could CONSIDER screening Hct)
            - Cardiovascular symptoms (cyanosis/tachycardia)
            - Respiratory symptoms (tachypnea, PPHN)
            - GI symptoms (vomiting, poor feeding, distension, blood in stool)
            - Metabolic - Hypoglycemia
            - Hematologic - Hyperbilirubinemia, thrombocytopenia, DIC
            - Genetic – Trisomy 21
            - Renal – hematuria, oliguria/anuria, renal vein thrombosis
            - CNS – lethargy, tremors, hypotonia, irritability, abnormal cry, seizures, apnea
            - Skin – plethora, prolong capillary refill
        - Section B: Signs for which HCT SHOULD be obtained
            - Persistent hypoglycemia requiring high GIR, rapid escalation, or central line
            - Persistent or severe respiratory distress unresponsive to routine therapies
            - Stroke or other evidence of venous thrombosis

- How to Screen
    - Site of sampling
        - Hct varies with source of blood
        - Capillary Hct (heel stick) is 5-15% >venous. Arterial Hct averages 6% <venous. Capillary Hct is a reasonable screening test. Values > 65% should be confirmed with a venous sample if considering treatment for polycythemia.
        - *Decisions regarding treatment of polycythemia should be made on the basis of venous Hct.*

Part III: Treatment/Performing Exchange Transfusion

- **If considering performing partial exchange transfusion, consult Neonatologist and consider transfer to tertiary institution**
- Who Should Receive Partial Exchange Transfusion
    - Do NOT perform PET in asymptomatic infant with Hct <=75%
    - Consider PET in infants with Hct >65% who are demonstrating signs listed in Section A or B above
    - Consider PET in asymptomatic infants with Hct >75%, but note there is minimal data for benefit of PET in asymptomatic infants.
- Timing of Partial Exchange Transfusion
    - PET should be performed as soon as possible in symptomatic infants
- How to Perform Partial Exchange Transfusion
    - Volume to be exchanged is calculated by the following equation:

      Volume (mL) = [(Initial Hct – Desired Hct)/Initial Hct] x Weight (kg) x 90 mL/kg

        - Desired Hct should be 50%.
        - Hypervolemia is common in polycythemia; use 90 mL/kg as estimated blood volume.
        - Volume to be exchanged in a term infant is almost always in the range of 20-40 mL/kg. If calculated volume is outside this range, re-check the calculations.

    - Use 0.9% NaCl (isotonic saline) for PET. It effectively maintains lowered Hct.
        - Fresh Frozen Plasma and 5% albumin contain proteins that may add to viscosity.
    - As soon as the decision has been made to lower the Hct, obtain informed consent from parents.
        - Risks of polycythemia/hyperviscosity include cerebrovascular accidents, renal vein thrombosis, hypoglycemia, necrotizing enterocolitis and jaundice.
        - Those outweigh the potential risks of PET (thrombosis, infection, vascular perforation, limb ischemia, hemorrhage), which are rare with PET.
    - Infant should be NPO throughout procedure
    - Technique of PET:
        - Use aliquots of 5 mL/kg; withdraw blood and infuse an equal amount of saline.
            - Pull-push technique: Blood is drawn off in a 5ml/kg aliquot then equal volume of saline is infused through the same line
                - Caution: this technique carries increased risk of air embolism; ensure provider has significant experience with multiport stopcocks

- Simultaneous technique: While simultaneously infusing an equal volume of saline through a peripheral vein (PIV), withdraw calculated volume of blood from UVC. UVC may need frequent flushing.

  - Routes of PET are:
    - Umbilical venous catheter (UVC): one of two ways
      - (a) Insert UVC only as far as needed to withdraw blood.
      - (b) Insert UVC so tip is at the IVC/RA junction.
      - Remove UVC at end of procedure.
    - Umbilical arterial catheter (UAC)
    - Peripheral arterial cannula: Use this for blood withdrawal and peripheral IV for simultaneous infusion of saline. This method is theoretically the safest. However, due to technical difficulties, it often prolongs the procedure unnecessarily.
  - Monitor vital signs throughout procedure and observe for catheter related problems. If these occur, discontinue procedure and remove catheter.
- Post Partial Exchange Transfusion Monitoring
  - Repeat Hct 4 Hours after procedure
- Considerations for Transfer to Tertiary Center and/or further consultation with Neonatologist
  - If PET indicated and center unable to perform
  - If unable to establish access for PET
  - If PET fails to alleviate symptoms

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