Placental or umbilical cord blood is an underused resource for obtaining NICU admission labs. Premature infants are at risk for hypovolemia, IVH and anemia. Iatrogenic blood loss increases these risks. Obtaining placental or umbilical cord blood for NICU labs is simple and reliable.

Fetal blood, placental blood, umbilical cord blood, neonatal blood cultures

Using Placental or Umbilical Cord Blood for NICU Admission Labs

Purpose and Goal: CNEP # 2063

- Learn about using placental or umbilical cord blood for labs.
- Learn about the complications of iatrogenic NICU blood loss.

None of the planners, faculty or content specialists has any conflict of interest or will be presenting any off-label product use. This presentation has no commercial support or sponsorship, nor is it co-sponsored.

Requirements for successful completion:

- Successfully complete the post-test
- Complete the evaluation form

Date
Learning Objectives

- Describe the benefits of using placental or umbilical cord blood.
- Describe the risk factors for using neonatal blood for NICU labs.
- Describe the method used to collect placental or umbilical cord blood.

Introduction

- Placental blood is an underused resource
  - It can provide critical information
  - Without invasive neonatal procedures
  - Without painful neonatal procedures
- It can be safely used for NICU admission labs
  - Including reliable blood cultures
- Using placental blood has several benefits
  - It can decrease stressful procedures
  - It can decrease risk of blood transfusions
  - It can improve VLBW neonatal outcomes

Current State of Neonatal Intensive Care

- Survival rates for infants continue to increase
  - Antenatal steroids improve outcomes
  - Surfactant improves outcomes
- Smaller premature infants are routinely saved
  - The lower limit of viability has decreased
  - Lower birthweights have become common
- VLBW infants remain at risk for significant complications
  - Necrotizing enterocolitis
• Intraventricular hemorrhage
• Retinopathy of prematurity
• Most VLBW infants require initial blood sampling
  • To guide identification of illness
  • To guide early management of illness
• VLBW infants have small circulating blood volumes
• Necessary NICU labs can readily deplete VLBW volumes
  • They require 10-20% of infant blood volume
    • Increasing risks of hypovolemia
    • Increasing risks of hypotension
    • Increasing risks of anemia
  • These risks are compounded further by:
    • Inadequate red blood cell production
    • Shortened red blood cell lifespan
• Delayed cord clamping (DCC) at birth is supportive
  • So is umbilical cord milking
  • Both can provide extra blood volumes
• Yet blood transfusions are still frequently required
  • For infants born at 24-28 weeks gestation
    • 94% receive transfusions
  • For infants born at 28-20 weeks gestation
    • 62% receive transfusions
  • For infants born at 30-32 weeks gestation
    • 35% receive transfusions
• This same pattern exists for birthweights
  • For infants <1000 grams
    • 90% receive transfusions
  • For infants 1000-1499 grams
    • 58% receive transfusions
  • For infants 1500-1999 grams
    • 28% receive transfusions
• Transfusions are not without risks
  • Acute immune mediated reactions
  • Acute non-immune mediated reactions
  • Potential viral infections from blood
  • Potential bacterial infections from blood
  • Transfusion associated NEC
  • Transfusion related acute gut injury
Placental or Umbilical Cord Blood

- Before birth, the fetus depends on the placenta
  - For oxygen
  - For nutrients
  - For survival
- Umbilical cord blood is fetal blood
  - Blood that remains in the umbilical cord
  - Blood that remains in placental circulation
- Umbilical cord blood is not maternal blood
- Placental or umbilical blood sampling
  - Is also known as PUBS
- The use of placental or umbilical cord blood
  - Is not a new concept or practice
  - It has been used for decades
    - To obtain blood type
    - To obtain blood Rh
    - To obtain antibody tests
- PUBS can be readily used for NICU admission labs
  - Glucose screen
  - Blood culture
  - Complete blood count
    - With differential
    - With platelet count
  - State metabolic screen
  - Other labs as needed:
    - Blood type
    - Antibody screen
    - Coagulation labs
    - Chromosomal karyotype
    - Genomic microarray
**Fetal Placental Blood Volumes**

- The volume of placental circulating blood
  - Has been extensively studied
  - Has been evaluated for standard volumes
- The mean volume of blood in the placenta
  - Before birth
    - Ranges between:
      - 115 ± 40 ml/kg
      - 162 ± 21 ml/kg
  - After birth
    - Ranges between:
      - 22 ml/kg
      - 34 ml/kg
- Mean blood volumes decrease with gestational age
  - In infants <32 weeks gestation:
    - Birthweight >1250 grams
      - 20 ml/kg
    - Birthweight 1000-1250 grams
      - 18 ml/kg
    - Birthweight <1000 grams
      - 15 ml/kg

**Neonatal Blood Volumes**

- The volume of neonatal circulating blood
  - Has been extensively studied
  - Has been evaluated for standard volumes
- The mean volume of blood in the neonate
  - Between 23 weeks and term gestation
    - 89 ml/kg in the first 12 hours
Volumes range between:
- 66 ml/kg
- 95 ml/kg

Most published studies report mean volumes
- Without delayed cord clamping

**Effect of Delayed Cord Clamping**

- The volume of neonatal circulating blood
  - Has been studied after DCC
  - Has been evaluated for standard volumes
- The mean volume of blood in the neonate
  - Between 24 and 32 weeks gestation
  - Following 30-90 seconds DCC
    - 63 ml/kg in the first 4 hours
  - Volumes range between:
    - 61 ml/kg
    - 80 ml/kg
- Studies show a difference between volumes
  - In vaginal births
    - 61-80 ml/kg
  - In Cesarean section births
    - 64-70 ml/kg
- Specific blood volumes in vaginal births
  - 5 seconds DCC in neutral position
    - 70 ml/kg
  - 180 seconds DCC in neutral position
    - 93 ml/kg
- Specific blood volumes in Cesarean births
  - Immediate cord clamping
    - 87 ml/kg
  - 180 seconds DCC 15 cm above abdomen
    - 67 ml/kg
• 180 seconds DCC 15 cm below abdomen
  • 106 ml/kg

Effect of Laboratory Phlebotomy

• Iatrogenic phlebotomy blood loss
  • Is a key contributor to anemia
  • Is a key cause of required transfusions
• In the first 6 weeks of NICU life:
  • Blood losses due to lab draws
    • Range from 11-22 ml/kg per week
    • Range from 15-30% of total volumes
• For perspective, 6-7 ml of neonatal blood
  • For a 1000 gram infant
  • Is equivalent to 450 ml of adult blood
• Approximately 70% of VLBW blood transfusions
  • Are given in the first 4 weeks of life
    • 44% are required in the first 2 weeks
• Minimizing blood draws is imperative
• Maximizing blood volumes is also important
  • Delayed cord clamping can help
  • Umbilical cord milking can help
  • PUBS can also help maximize volumes

Blood Loss in the Preterm Infant

• Premature infant brains are sensitive
  • To BP changes
  • To blood volume changes
• Maintaining adequate blood volume
  • Can stabilize BP changes
  • Can decrease use of pressors
• Can minimize risks of hypovolemia
• Can minimize risks of IVH
• Can optimize neonatal outcomes

• Studies have shown that DCC improves BPs
  • In the first 6 hours of life
• Studies have shown that PUBS improves BPs
  • Without PUBS at birth
    • 7.5 ± 5.2 ml/kg blood loss
  • With PUBS at birth
    • 1.5 ± 2.3 ml/kg blood loss

Procedure for PUBS Blood Sampling

• Adequate volumes of cord blood can be obtained
  • Even after umbilical cord stripping
  • Even after delayed cord clamping
  • Even after cord blood banking

• PUBS is a simple and straightforward procedure:
  • Gather necessary supplies
    • Clean gloves
    • Sterile gloves
    • Sterile gauze
    • Betadine sticks
    • Alcohol swabs
    • 18 g needle
    • 10 ml syringe
    • Blood transfer device
    • 25 g needle
    • Blood culture bottle
    • Type and screen tube
    • CBC with diff tube
    • Newborn screen card
- Optional tube for chromosomes
- Delayed cord clamping should still occur
- Remind the delivering provider
  - To clamp the distal end of the cord
- Dry the placenta / cord insertion site with gauze
- Perform hand hygiene and don sterile gloves
- Swab the base of the cord insertion site
  - Swab 3 times
  - On the placenta
  - Up to 8-10 cm of cord
  - Allow to dry 60 seconds
  - Cleanse with alcohol swab
- Grasp the umbilical cord
- Insert 18 g needle into umbilical vein
  - Insert bevel down
  - 6-8 cm above insertion site
  - Placental veins runs deep
  - Placental arteries run superficial
- Aspirate 10 ml of blood
- Remove needle from syringe
- Wipe blood culture bottle with alcohol
- Transfer 1-2 ml blood into culture bottle
- Transfer proper volume of blood into tubes
  - Type and screen
  - CBC with diff
  - Chromosomes
- Drip blood onto metabolic screen spots
- Label all specimens and send to lab
- Multiple births may be differentiated with clamps
  - One clamp for baby A
  - Two clamps for baby B
  - Three clamps for baby C
Summary

- Umbilical and placental blood is important
- It is also an underutilized resource
- Adopting the use of PUBS for NICU admission labs
  - Can decrease blood loss
  - Can decrease hypovolemia
  - Can decrease anemia
- Maximizing blood volumes in premature infants
  - Can lead to decreased risk of IVH
  - Can lead to decreased risks of anemia
  - Can lead to decreased use of transfusions
- PUBS is an increasingly common approach
  - That is simple to incorporate into practice
  - That can yield many benefits for NICU infants

References


