Drawing Placental Blood for Admission Labs in Very Low Birth Weight Infants: A Process Change that May Reduce Early Transfusion

Background:

Very low birth weight (VLBW) premature neonates are routinely phlebotomized within the first hours of life. Routine admission labs include CBC, BC, Type and Screen, and PKU (state metabolic screen). Initial phlebotomies might equal up to 10% of a VLBW infant’s blood volume (3). About 90% of all VLBW infants will require 3-5 blood transfusions within the first 3-4 weeks of life (3). Transfusion often occurs in the first 72 hours of life, which has been associated with the development of Grade III and IV Intraventricular Hemorrhage (IVH), which has been well documented in the neonatal literature.

Intraventricular hemorrhage is defined as bleeding into the fluid-filled areas (ventricles) inside the brain. The condition occurs most often in babies that are born premature. IVH is rarely present at birth, and occurs most often in the first several days of life. The condition is also rare after the first month of age, even if the baby was born premature. IVH is detected during scheduled head ultrasounds, performed at specific intervals in the NICU setting. IVH is graded I-IV, with Grade IV being the most severe. The prognosis of the infant depends on the severity of the hemorrhage and the degree of prematurity. Less than half of babies with lower-grade bleeding have long term problems. However, severe bleeding (grade III-IV) often leads to developmental delays and/or cerebral palsy. The mortality associated with IVH may be very high.

Project Description

Premature infants born at less than 1500 grams are at risk for multiple morbidities and mortality. Conserving the infant’s blood volume by drawing baseline blood work from the placenta after birth may help reduce early transfusion in the first 3 days of life. There has been an association of early transfusions and severe IVH noted in the literature. Therefore, we hope to decrease the incidence of intraventricular hemorrhage in this high risk population.

Sinai Hospital of Baltimore is a Level III NICU with approximately 250 admissions each year. Approximately 20% of those may have a birth weight of less than 1500 grams. In 2015, the NICU and the L&D staff collaborated to design a new, efficient, and effective process to obtain placental blood after delivery and use it to process all the admission laboratories. We used resource information, including videos posted by Intermountain Health Care System, to bundle
supplies and train the staff. The rest of 2015 was spent perfecting techniques and refining the process.

For 2016 to date, we have a success rate of 89% for placental blood draws on infants less than 1500 grams. We are currently collecting data to determine if rates of transfusion and IVH have been altered by our intervention. Preliminary data suggests a significant decrease in the rate of early transfusions.

**Goal Statement:**

The goal of this project is to obtain placental blood specimens from at least 75% of infants <1500 grams. This will be achieved by establishing clinical guidelines to obtain a placental blood specimen in place of phlebotomizing the infant. In addition, we hypothesize that a decreased incidence of IVH in preterm infants will be due to the decreased need for blood transfusions in the first seven days of life.

**Process:**

A review of literature suggested areas for improvement with our current approach to early transfusions and IVH. A research project was started to determine feasibility of changes to our current practice. This lead to process changes in initial collection of laboratory samples from our most fragile preemie population. Evidence suggests no difference in lab values between samples obtained from placenta versus infant (3). Obtaining blood from the placental may reduce the need for early blood transfusions in neonates < 30 weeks gestation and can be done at no additional cost. It may reduce cost by using less donor blood and may reduce the use of vasopressors in the first days of life due to improved hemodynamic stability.

Stakeholder input was obtained from all impacted services prior to initiation of this project. After completing an evidenced-based literature review, project leaders provided education regarding the change in procedure and the rationale for the change. This was provided to all impacted services, including Birthplace, NICU, Laboratory Service, and Blood Bank. A guideline was created and implemented detailing the new placental blood drawing process and procedural training was completed for all involved staff. We performed ongoing project assessment using quality improvement standards and re-evaluated/re-designed based on those assessments, following the Plan Do Study Act (PDSA) cycle evaluation. This ensured project functionality, assessed project flow, and rectified errors.

**Solution:**

Upon delivery of the preterm infant, L&D nursing awaits delivery of the placenta, and draws blood sample directly from the placenta while the infant is being cared for by the NICU team. Pre-admission labels are generated for the specific laboratory tests required for NICU admission. Laboratory tubes are filled with appropriate blood volumes, labeled as placental
specimens, and sent to the lab. This prevents direct blood drawing from the premature infant, thereby saving up to 10% of blood volume on admission (1).

**Solution Development:**

Neonatal Intensive Care Unit (NICU) team generates pre-admission labels prior to VLBW birth.

Labor & Delivery nurse uses sterile technique to draw placental blood for initial admission laboratory studies, including complete blood count, blood culture, and type and screen.

NICU nurse present at the delivery sends the bloodwork to the laboratory.

The laboratory staff processes laboratory samples received and assigns their source as placental.
Project Timeline:

- Sept 2014: Creation of Guideline: "Drawing Fetal Blood from the Placenta on Very Low Birth Weight Infants"
  (Allowed for pre-printing of labels for labs).
- June 2015: Increased contamination rates reported by Lab. NICU & L&D staff.
- July 2015: Lab unable to provide data that NICU created report for data.
- Aug 2015: Met with Lab to discuss issue with specimen receiving, reporting, and improved accuracy of sample.
- Sept 2015: Lab instituted a "milking technique" to increase sample's volume.
- Oct 2015: Placental Blood draws are implemented.
- Nov 2015: Placental Blood draws are implemented.
- Dec 2015: Placental Blood draws are implemented.
- Jan 2016: Placental Blood draws are implemented.
- Feb 2016: Placental Blood draws are implemented.
**Challenges & Barriers:**

- Sample loss from improper blood drawing technique
- Technical difficulties with computerized (Cerner) order sets: construction and flow of printing lab labels
- Incorrect source reported from laboratory (peripheral versus placental reporting skewed data results)
- Small sample size (originally only attempting to obtain placental blood from <1500 gram infants, about 20% of yearly admissions, or about 40 babies/year)
- Prolonged gaps between VLBW infant births and therefore prolonged time for skill development
- Contaminated specimens
- “Difficult” placentas

**Preterm Placenta:**

**Term Placenta:**

![Images of placenta](image_url)

**Measureable Outcomes:**

Overall placental blood draw completion rates have improved over the course of the project. We have successfully reached and exceeded our initial goal of 75% success rate. In addition, data continues to be collected in an attempt to correlate the rates of transfusions and IVH. As of this date, we have been successful in reducing transfusions in patients included in this project. See graphs below.
Measurable Outcomes: (Goal Line= 75%)

% of Successful Placental Blood Draws (ALL Weights)

% of Successful Placental Blood Draws (<1500 grams)
Measurable Outcomes: Are We Making a Difference in <1500 gram Patients?

2016: Any IVH, <1500 grams

- # of Successful Placental Blood Draws
- Any IVH

2016: Severe IVH, <1500 grams

- # of Successful Placental Blood Draws
- Severe IVH (Grade III/IV)
Measurable Outcomes: Are We Making a Difference in <1500 gram Patients?

### 2016: Transfusions (≤ DOL3) and Any IVH, <1500 grams

- # of Infants Transfused by DOL 3
- Any IVH

### 2016: Transfusions (≤ DOL3) and Severe IVH, <1500 grams

- # of Infants Transfused by DOL 3
- Severe IVH (Grade III/IV)
Measurable Outcomes: Are We Making a Difference in <1500 gram Patients?

2016: Transfusions (≤ DOL 7) and Any IVH, <1500 grams

- # of Infants Transfused by DOL 7
- Any IVH

2016: Transfusions (≤ DOL 7) and Severe IVH, <1500 grams

- # of Infants Transfused by DOL 7
- Severe IVH (Grade III/IV)
Measureable Outcomes: Are we decreasing the amount of transfusions in the <1500 gram population?

**Admissions vs. RBC Transfusions (≤ DOL 7) for Infants < 1500 grams**

- Blue: # of Patients <1500 grams
- Red: # of Patients <1500 grams requiring RBC Transfusion
- Green: # of RBC Transfusions

* Data through 9/30/2016

**RBC Transfusions for Infants <1500 grams**

- Green: # of RBC Transfusions

* Overall: 22% decrease

28% decrease

+7.5%
**Sustainability:**

- Process is in place
  - Guideline/protocol established and followed
- Data collection is part of the NICU CQI committee
  - Continuous monitoring and reporting occurs
- Based on results, changes are made as necessary using Plan Do Study Act (PDSA) cycle
- Continue to evaluate cost savings as related to patient quality care

**Role of Collaboration and Leadership:**

This was a multi-disciplinary collaborative approach across specialties and departments within the hospital. Key stakeholders included resident physicians, neonatologists, obstetricians, NICU nursing, L&D nursing, laboratory staff, blood bank, and IT. Because leadership was supportive of this QI project, they were able to facilitate meetings between the various departments and units. Leadership also supported the development of new computerized order sets, blood bank resources, and staff training.

**Role of Collaboration:**

- Created Cerner order-set with pre-admission labels
- Placental blood draws
- Attending deliveries to assist in the process
- Project Leader
- IT/Cerner Staff
- Labor and Delivery Nursing
- NICU Nursing
- Laboratory Staff
- Reported distinction of sample source
- Placental blood draws
Innovation, Culture of Safety, Patient and Family Integration:

It is difficult to implement a process change between two departments and among disciplines. It took almost two years to overcome barriers and to refine the process of placental draws. We are the only hospital in the state of Maryland currently involved in this innovative initiative.

Administering blood products is not without risk. Based on our current data, we have successfully decreased transfusions within the first week of life for infants <1500 grams by 22%. This leads to a significant decrease in supplies, donor blood, nursing care hours, and pathology services. Furthermore, the infant experiences a reduction in painful procedures due to less intravenous access requirements.

L&D has perfected the placental draw process and uses this skill for other applications, such as obtaining genetics screening. This practice helps eliminate unnecessary blood draws from the mother. Safety implications include less intravenous access, which leads to less chance of needle stick injuries, infection, and decreased painful procedures for the family.

We started with a process improvement initiative to reduce blood transfusions and severity of intraventricular hemorrhage in small neonates. This innovative quality improvement project was also successful in improving the culture of safety for our labor and delivery patients, infants, and their families.

Data collection will continue until this performance improvement project gathers enough data to attempt to definitively correlate reduction in early transfusion and intraventricular hemorrhage. The benefits of ongoing process analysis will allow for refinements and further multi-disciplinary collaboration.

Related Tools and Resources:

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