

Building Better Baby Brains



The 4B Project

A Nurse Driven Initiative to

Decrease the Incidence of IVH in Premature Infants

During the First 72 hours of life.

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The 4-B Project focuses on the impact NICU Nurses can have during direct patient care at delivery and in the first 72 hours of life to effectively reduce the likelihood of an IVH (Intraventricular Hemorrhage) occurrence in premature infants. Integrating science based, potentially best practices into routine nursing care of this vulnerable population can change the trajectory of an infant's life.

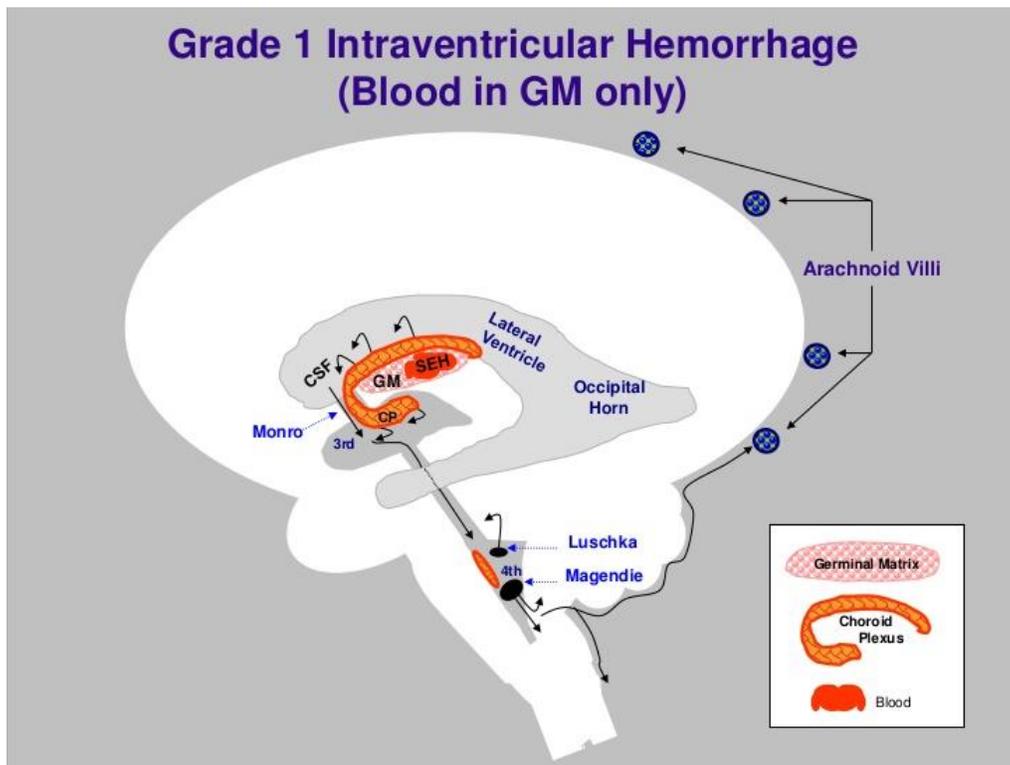
IVH Background

The incidence of IVH in premature infants has held at a steady rate of around 20% for the last two decades down from 50% occurrence rate in previous decades. IVH can be devastating to the quality of life of infants and their families. The ramifications encompass varying degrees of life-long intellectual, physical and psychiatric/behavioral disabilities. It places a huge emotional and financial burden on children and their families, healthcare systems, education, and government resources. Based on data from the U.S. Census Bureau, the NICHD Neonatal Network and the Centers for Disease Control, there are over 3,600 new cases of intellectual disability attributable to IVH in the United States each year, and the lifetime care costs for these children exceeds 3.6 billion dollars.

Attempts to define a single therapy that can directly eradicate this vulnerability in premature infants to-date have been unsuccessful and therefore, it is imperative that we shift our focus to multi-factorial prevention techniques. There are many conditions and situations that are suspect in contributing to the incidence of IVH. Participation from all disciplines will be required to tackle this persistent complication of prematurity. Obstetrics, Perinatal Medicine, Neonatology, Pharmacology, NICU Nursing and Respiratory Therapy will each play a role in the reduction of this devastating complication.

What NICU Nurses Need To Know

The Anatomy: The Germinal Matrix sits just below the ependymal layer under the lateral ventricles of the brain and houses neuronal and glial precursors. It is densely cellular and highly vascular with fragile vessel walls and hairpin turns. It is a temporary structure utilized for neuronal migration in the developing brain and virtually disappears by the 36th week of gestation. The majority of IVH in the premature infant is found to originate in the Germinal Matrix.



The Physiology: Blood vessels in the Germinal Matrix are fragile and prone to rupture due to several factors:

- Hypoxia events can damage and weaken the already fragile capillary walls.
- Venous congestion can distend the vessels. This can begin a cascade of pressure on other fragile vessels causing further exacerbation of the distention and congestion which can lead to rupture or progression of an existing rupture.

The Physiology (continued):

- Blood flow velocity fluctuations can cause rapid distention of blood vessels.
- Cerebral blood flow (CBF) auto-regulation, in reaction to systemic blood pressure changes, may be absent or inconsistent in the distressed premature newborn.
- CBF autoregulation increases as an adaptive process during the first 3 days of life as left ventricular cardiac output improves.

Bleed Origination:

- IVH may result from *venous* rupture and is believed to account for over half of all ruptures as suggested by autopsy evaluations.
- An existing low-grade IVH can progress to a higher grade IVH over time if conditions are favorable.
- As the IVH progresses it will push through the ependymal layer and flood the ventricles.

The Timing:

- Fifty percent of all IVH occurs in the first day of life
- Eighty-five to ninety percent of all IVH occurs in the first 3 days of life.
- The incidence of IVH is directly inverse to gestational age and weight. The earliest and smallest infants have the greatest risk.

What NICU Nurses Can Do

Nursing's bedside care can minimize the effects of the deficit in CBF auto-regulation. Thoughtful positioning and handling and utilizing gentle, calculated approaches in nursing practice can minimize environmental stressors to reduce blood flow fluctuations and turbulence.

Positioning and Handling:

- Maintain a neutral head position, midline in relation to the umbilicus, whether supine or side-lying. Utilizing the Turtle Midliner, an infant can be supported with head midline while in the supine position. Makeshift linen rolls provide uneven support and poor head stabilization. All respiratory support and O2 delivery apparatus can be easily secured to the Turtle Midliner to decrease skin injury and infant discomfort.
- Maintain head of bed elevation at 15-30 degrees during transport and for the first 72 hours of life.
- Repositioning the infant to the side can be easily accomplished by loosening the forehead strap of the Turtle Midliner, gently log-rolling the infant to the intended side, then securing the strap to stabilize the head to keep the nose/chin in midline position as related to the umbilicus. A linen support roll can be placed along the infant's back and hips for side-lying support.
- Diaper changes can be accomplished from the side-lying position or if necessary by gently lifting the hips while in supine position. Avoid lifting the legs higher than the abdominal level to minimize central venous pressure increases.
- Avoid Trendelenburg and prone positions (as well as any positioning which compresses the ipsilateral internal jugular vein) to decrease venous congestion to the head.



Environmental Stimuli:

- Limit light stimuli by covering the eyes (a bili-mask works well and can be secured to the Turtle Midliner) as premature infants have sluggish pupillary responses and can be stressed by sudden changes in light intensity which can cause sudden changes in blood pressure.
- Limit noise exposure by placing infant in a private room or on a solid wall away from other monitors and NICU traffic if in a bay style NICU. Cover the ears to muffle noises from the environment which can cause stress and fluctuating blood pressure. Simple sterile cotton balls are an economical choice and can be secured over the ears by placing under the edges of the Turtle Midliner.
- Educate families regarding IVH prevention and guide them in quiet, gentle approaches for containment/comfort interactions limited to times care is being performed.

Temperature and Blood Pressure:

- Maintain a stable temperature at delivery and through the first 72 hours of life by lowering the canopy on the isolette as soon as possible after delivery and only raising it in urgent situations. This will prevent cold stress which has been associated with incidences of IVH.
- Provide humidity as ordered.
- Utilize air boost/heat curtain on isolette when opening the isolette portals or sides for care.
- Report blood pressures that fall out of the range designated by the Neonatologist. Suggest steady support with a vasopressor drip if repeated saline boluses are required.

Infusions and Blood Draws:

- All infusions, blood draws and blood returns should be controlled at no faster than 1ml/1 minute to prevent blood flow turbulence.

The 4B Project

1. Admit infant to a private room or a bed space location against a solid wall in a low traffic area.	➤ Decreases noise stressors from other monitors and NICU traffic.
2. Report mean arterial blood pressures lower than gestational age to medical staff.	➤ To intervene and support to prevent further blood pressure fluctuation.
3. Maintain midline (neutral) head alignment when positioning or lifting infant for cares or procedures.	➤ Avoids jugular vein compression impeding venous drainage.
4. Maintain head of bed elevation at fifteen to thirty degrees. Avoid head down and prone positions.	➤ Promotes venous drainage and lowers intracranial pressure.
5. Provide strict thermal regulation with humidity set as ordered.	➤ Prevents cold stress which has been associated with IVH.
6. Rewarm infant no faster than 1 degree/hour.	➤ Prevents sudden vasodilation and hypotension.
7. Close the top of the isolette within one hour of admission and lift only for emergency interventions.	➤ Providing care and parent interaction via the side portals limits light, cold and noise.
8. Avoid routine endotracheal suctioning. Suction based on clinical signs and symptoms.	➤ Prevents hypertensive spikes and physical stress.
9. Organize care interventions to provide minimal handling. Gentle hands on care every 4-6 hours.	➤ Decreases noxious stimuli preventing infant stress.
10. Avoid rapid infusion of medications, fluid boluses and line flushes not to exceed 1 mL / 1 minute.	➤ Prevents spikes in blood flow resulting in CBF (cerebral blood flow) fluctuations.
11. Provide slow blood draws and blood returns not to exceed 1 mL / 1 minute.	➤ Prevents spikes of arterial hypertension and blood flow turbulence causing fluctuations in CBF.
12. Log roll or lift from the hips for diaper changes. Avoid lifting the legs from the ankles or knees.	➤ Avoids sudden increases in thoracic and abdominal pressures.
13. Control environmental noise and cover infant's ears.	➤ Prevents stress which can lead to spikes in arterial hypertension causing fluctuations in CBF.
14. Protect infant's eyes from the stress of bright or direct light.	➤ Premature infants have sluggish pupillary reflexes and cannot adjust for brightness.
15. Educate, inform and include parents in IVH risk reduction procedures.	➤ Involves parents by allowing them to understand the plan of care. It encourages and values their contribution of comfort measures guided by the bedside nurse allowing them to provide gentle touch, hand containment and voice comfort.

After One Year...

This protocol was established in 2016 at East Tennessee Children's Hospital and demonstrated a 50% decrease in IVH occurrences within the first year according to data compilation by the Vermont-Oxford Network.

2015 – 61 low birth weight infants, 13 experienced IVH (21.3%)

2016 – 68 low birth weight infants, 8 experienced IVH (10.3%)

In addition to the decrease in number of occurrences, the degree and severity of the IVH which did occur after the protocol was initiated decreased with fewer Grade IV bleeds diagnosed.

Nursing staff compliance with the protocol was monitored at 92% for the 2016 year.

IVH in premature infants can be a result of blood flow fluctuations within the germinal matrix. During the first 72 hours of life in a premature infant less than thirty-two weeks gestation, special attention needs to be given to prevention while accomplishing bedside nursing care.

Bedside nurses were engaged through education regarding the “bundle”, having visual cues such as the Turtle Midliner, bedside notecards and cheat sheets for reference as well as their desire to protect the NICU infant from this catastrophic complication.

Although IVH cannot be prevented by a single discipline or a single action, nursing interventions aimed to reduce these blood flow changes will impact the incidence of IVH in premature infants as we all work together in prevention!