Reducing Intraventricular Hemorrhage Using a Care Bundle
Swedish Medical Center, Seattle WA USA

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Background: Intraventricular hemorrhage (IVH) is a significant factor in adverse long-term developmental outcomes of very low birthweight infants. In addition, the average cost of an IVH during the initial hospitalization has been estimated at 53,600. Reducing IVH will both improve outcomes and decrease costs.

Aim: Reduce IVH rates and severe IVH rates by 20% (beginning July 1, 2014, ending June 30, 2015) in inborn VLBW infants less than 30 weeks gestational age, compared to the rates in these infants in 2012-2013.

Setting: Swedish Medical Center NICU is a 76-bed level 4 unit with 900 total admissions per year and about 135 VLBW admissions per year. Rates for IVH and severe IVH tend to be below the mean for similar VON units.

Mechanisms:

- Immature germinal matrix: possibly improved by antenatal corticosteroids.
- Changes in cerebral blood flow: affected by delivery room management, early positioning, hypothermia, and rapid fluid infusions.
- Poorly understood association: magnesium neuroprotection.

Methods/Interventions:
Our VON team created a care bundle which includes prenatal, delivery room, and NICU practices extending through the first three days after birth to reduce IVH in our NICU by:

- Education of NICU clinical staff on IVH reduction program (completed June, 2014).
- Assure mothers receive antenatal corticosteroid and magnesium for neuroprotection.
- Delayed cord clamping and prevention of hypothermia in delivery room care.
- Midline head positioning from birth to 72h. Minimal handling and stimulation, no daily weights. Slow fluid infusions if boluses are given.

Measures:

- Outcome Measures: IVH and Severe IVH rates.
- Process Measures: antenatal steroid magnesium, delayed cord clamping, admission temperatures (1st three temperatures), compliance with neutral head positioning.
- Balancing measures: hyperthermia at admission, polycythemia.
- Cost surrogates: # of cranial sonograms, shunt placements, length of stay.

1 Bolisetty, Pediatrics 2014; 133: 55-62.
2 Malusky, Neonatal Network 2011; 30:381-96
3 Miller, Journal of Perinatology 2011; 31: S49-S56
**Results/Discussion:** The baseline IVH and severe IVH rates prior to implementation of the bundle were 24.6% and 7.4%, respectively, for infants under 30 weeks. After implementation, those rates were 29% and 6.4% in the first 62 infants admitted in the nine months following implementation. Process data showed that, compared to pre-implementation, we maintained high rates of corticosteroid and magnesium conditioning, and admission hypothermia dropped from 29% to 18%. Delayed cord clamping rates did not change. Adherence to correct positioning and avoidance of weighing the baby were excellent. Examination of balancing measures found no polycythemia and a modest increase in admission hyperthermia (from 16% to 24%). There were 3.6 cranial sonograms per patient in the two quarters prior to implementation and 3.3 per patient in the three quarters after. Gestational age at discharge was 40 2/7 ± 2 weeks prior to implementation and 39 3/7 ± 2 weeks after.

Of the four infants with severe IVH, three had no or incomplete corticosteroid conditioning, and three had abnormal admission temperatures. One did not have delayed cord clamping.

While others have been successful achieving significant reductions in IVH through implementation of a care bundle, we were unable to demonstrate significant reductions. Analysis of our severe IVH cases show that 75% (three of four) were unable to receive corticosteroid and magnesium preconditioning prior to their urgent deliveries, so we do recognize those infants as having been at higher risk. We continue to work on improving temperature management and delayed cord clamping rates.

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**Key Driver Diagram**

![Key Driver Diagram](image)

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Compliance with Bundle Items

IVH Rate Run Chart

Q1-Q3 Cumulative:
- Severe IVH: 6.4%
- Any IVH: 29%