

Fellows Column: The 0/0/0 “Miracle”: Overcoming Multifactorial Birth Trauma in a Preterm Neonate

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Abstract:

An APGAR score of 0 at 10 minutes is usually associated with high mortality and poor outcomes for the neonate, including lifelong deficits, severe hypoxic brain injury, and even death. Additionally, neonatal exposure to substances such as methamphetamines plays a role in developmental delays and meeting neurobehavioral milestones. In this case of a baby with APGARs of 0 at 1, 5, and 10 minutes, as well as in utero exposure to methamphetamines and complicated delivery, the risk of early demise was high. The aggressive resuscitation at birth and continued care in the NICU resulted in significantly less damage than what was expected. It is important to note that despite multiple factors contributing to the prediction of poor outcomes, early and attentive care of the newborn can play a vital role in recovery and a fighting chance.

Introduction:

The APGAR score to evaluate a newborn is a universally accepted tool that collects data about the coloring, heart rate, reflex irritability, muscle tone, and respiratory effort to determine the neonate's health and whether immediate attention is necessary (1). The APGAR is scored out of 10, assigning 2 points for each of the five standards above. A score of 7–10 is reassuring, 4–6 is moderately abnormal, and 0–3 is severely abnormal (1). It is standard to assess the neonate and assign an APGAR score at 1 and 5 minutes of life and at 5-minute intervals if the score remains below 7 for up to 20 minutes. Mortality is high among neonates who have an APGAR score of 0 at 10 minutes (2), but individual cases of aggressive interventions can change this outcome.

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Case Report:

A baby girl was born at 31⁰/₇ weeks to a G₆P₃ mother who came into the emergency department in severe abdominal pain. Maternal history was positive for methamphetamine use, lack of consistent prenatal care, and maternal immunology labs, including HIV, RPR, Rubella, Hepatitis B, and GBS, were all unknown at the time of delivery. The decision was made to proceed via cesarean section due to a history of three prior cesarean deliveries, and upon opening of the abdominal cavity, it was found that the lower uterine section had ruptured. The rupture was extended so that the infant could be delivered, and it was discovered that the placenta had also detached and was delivered along with the child. The surgical team stabilized the mother, and the NICU team took over care of the newborn.

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The infant was limp and apneic and was immediately started on chest compressions and was intubated with positive pressure ventilation within 90 seconds. By two minutes of life, the infant had received their first dose of epinephrine. By 10 minutes of life, the infant had received four doses of epinephrine and two boluses of normal saline and was continually getting chest compressions with no improvement. The infant's first pulse was palpated in the low 40s at 15 minutes of life. A PIV and UVC were placed for central access, an additional unit of epinephrine was dosed, and chest compressions were continued. The baby's final APGARs were 0¹, 0⁵, 0¹⁰, 2¹⁵, 3²⁰, 5²⁵, 5³⁰. She was stabilized and transferred to the NICU.

Discussion:

Though there are some recommendations and guidelines (3) for discontinuing resuscitation at 10 minutes of life with no pulse due to the likelihood of severe hypoxic injury, there is still merit to the decision made by this care team. The landscape of neonatal survival after resuscitation at birth is improving, in part due to more aggressive resuscitation efforts and the inclusion of therapeutic hypothermia (4) but also due to the understanding that outcomes are dependent on individual cases and are primarily determined by the individual care teams. The large majority of babies with 0 APGARs at 10 minutes do not survive resuscitation in the delivery room, and the other majority do not survive the first week of life due to severe ischemic brain injury (2). However, of those that do make it to 8 days of life, the likelihood of survival past one year is much higher (2).

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It is clear to us that the baby girl featured in this case report is an example of a particularly resilient and “miraculous” recovery. Her triple zero APGARs were an early indicator of high mortality risk, and yet here she is at almost 70 days of life, able to feed by nipple at her full capacity and breathe on just one liter of oxygen by nasal cannula without significant difficulty. She was diagnosed with a grade III germinal matrix hemorrhage by head ultrasound at 12 days of life. She was additionally started on prophylactic anti-seizure medication, but repeat head ultrasounds have reported a moderate de-escalation to a grade II GMH with ventriculomegaly paired with a brain MRI that reports signs of periventricular leukomalacia. Given these findings, the most pressing concern would be the development of cerebral palsy or long-term intellectual and developmental deficits secondary to the hypoxic injury at birth (5), but the degree of her future deficits is currently unknown.

We are also wary of the long-term effects that intrauterine exposure to methamphetamines may have on her development. Because methamphetamines can cross the placental barrier, there are risks for placental insufficiency and abruption along with neurotoxicity, among other complications in other organs for the offspring. Prenatal meth exposure may disrupt the excitation/inhibition balance in the brain, which is associated with emotional and stress-related impairments (6). A systematic analysis of studies reviewing the effects of methamphetamine use on brain structure and activity reports that there is a high correlation between the patterns of cortical damage associated with exposure and a decrease in task-related efficiency, decreased working memory,

altered attention, and an increase in risk-taking activity (7). There is also an association between poor quality motor activity and lower arousal and higher lethargy scores, as well as increased risk for anxiety, depression, attention disorders, and withdrawn behavior that are significant by the age of 5 years (6).

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Occupational therapists assessed baby girl at day of life 9, and she was found to have mild to moderate hypotonicity, inattentiveness, tremors, low level of arousal, inconsolable, inability to quiet herself, and inability to follow or focus on stimuli. Occupational therapy was continued throughout her stay in the NICU. At 57 days of life, occupational therapy signed off on her, and their final assessment reflected hypertonicity, intact reflexes, and postural and motor development for gestational age. Neurobehavioral deficits were noted, including an inability to self-console or self-quiet, irritability, low arousal, tremors, and decreased cuddliness. The occupational therapist does not suspect cerebral palsy based on her motor development at this time, but the neurobehavioral delays, likely secondary to methamphetamine exposure in utero, could lead to potential future challenges in frontotemporal development.

Conclusion:

As mortality is known to be high among newborns with an APGAR score of 0 at 10 minutes, this case presents valuable data on potential survival and outcomes with aggressive management. While APGAR scores alone are insufficient to predict outcomes, they are essential data points to analyze within the scope of the whole clinical picture. Neonatal growth and development status post cardiopulmonary resuscitation at birth provides insight

into the long-term effects of cardiac arrest and the potential outcomes of prompt and continued interventions. Additionally, many maternal variables exist in this case that contribute to the neonate's health, including the mother's lack of prenatal care, methamphetamine use, uterine rupture, unknown Rubella/RPR/HIV/HepB/GBS status, lack of antenatal steroid administration, preterm birth, and complex psychosocial factors. It is valuable to look at this clinical case and consider that while a multitude of contributing factors present challenges to the health of the neonate, standard protocols of clinical care have helped support this newborn and give her the best chance at the most optimal outcome. While maternal factors were out of our control in this case, it highlights the value of diligent care for a neonate who had the odds stacked against her from the start. Continued follow-up on this patient will provide further insight into the outcome as she grows and develops.

We commend the multidisciplinary team involved in this neonate's case from the perspective of efficient and thorough clinical management and their empathetic and devoted attention to her care. At the end of her stay in the NICU, the unit hosted a baby shower to celebrate her transition out of acute clinical care. The Department of Child and Family Services is handling placement with a foster family who will be able to manage her continued medical needs.

References:

1. Apgar V. A proposal for a new method of evaluation of the newborn infant. *Curr Res Anesth Analg.* 1953;32:260–7. https://journals.lww.com/anesthesia-analgia/fulltext/2015/05000/a_proposal_for_a_new_method_of_evaluation_of_the.22.aspx
2. Billimoria, Z., Chabra, S., Patel, A. et al. Apgar score of 0 at 10 min and survival to 1 year of age: a retrospective cohort study in Washington state. *J Perinatol* 39, 1620–1626 (2019). <https://doi.org/10.1038/s41372-019-0454-2> <https://www.nature.com/articles/s41372-019-0454-2>
3. Wyckoff MH, Aziz K, Escobedo MB, Kapadia VS, Kattwinkel J, Perlman JM, et al. Part 13: neonatal resuscitation: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation.* 2015;132:S543–60.
4. Natarajan G, Shankaran S, Laptook AR, Pappas A, Bann CM, McDonald SA, Das A, Higgins RD, Hintz SR, Vohr BR; Extended Hypothermia Subcommittee of the Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network. Apgar scores at 10 min and outcomes at 6–7 years following hypoxic-ischaemic encephalopathy. *Arch Dis Child Fetal Neonatal Ed.* 2013 Nov;98(6):F473–9. doi: 10.1136/archdischild-2013-303692. Epub 2013 Jul 29. PMID: 23896791; PMCID: PMC4166405. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4166405/>
5. Lie KK, Grøholt EK, Eskild A. Association of cerebral palsy with Apgar score in low and normal birthweight infants: population based cohort study. *BMJ.* 2010 Oct 6;341:c4990. doi: 10.1136/bmj.c4990. PMID: 20929920; PMCID: PMC2952090. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2952090/>
6. Li J-H, Liu J-L, Zhang K-K, Chen L-J, Xu J-T and Xie X-L (2021) The Adverse Effects of Prenatal METH Exposure on the Offspring: A Review. *Front. Pharmacol.* 12:715176. doi: 10.3389/fphar.2021.715176. <https://www.frontiersin.org/articles/10.3389/fphar.2021.715176/full>
7. Moghaddam HS, Abadi NN, Dolatshahi M, Ershadi SB, Abasi-Feijani F, Rezaei S, Cattarinussi G, Aarabi MH. Effects

of Prenatal Methamphetamine Exposure on the Developing Human Brain: A Systematic Review of Neuroimaging Studies. *ACS Chemical Neuroscience* 2021 12 (15), 2729–2748 DOI: 10.1021/acscchemneuro.1c00213 <https://pubs.acs.org/doi/10.1021/acscchemneuro.1c00213>

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