

ETHICS CASE

Should Long-Term Consequences of NICU Care Be Discussed in Terms of Prognostic Uncertainty or Possible Harm?

Commentary by Genevieve Allen and Naomi Laventhal, MD, MA

Abstract

We will examine several ethical considerations in the resuscitation of infants born at the margin of gestational viability in analyzing a case of preterm labor. More specifically, we will discuss the obligations of physicians in characterizing expected outcomes, both mortality and long-term morbidity, for extremely premature infants and how potential adverse outcomes should be framed—as complications of prematurity itself or as iatrogenic complications of care. We will also explore how the concept of a “trial of therapy” can support parents and neonatologists in decision making concerning withholding or withdrawing care for periviable infants.

Case

Dr. Mattingly met Miriam and Thomas when Miriam arrived a week ago in preterm labor, which was successfully stopped with tocolytics. Suspecting that Miriam would again have preterm labor, that the baby would be born extremely prematurely, needing NICU care to survive, and that the baby’s prognosis might be poor, he has met with the couple over the last few days to determine which NICU interventions they might want.

Miriam and Thomas wanted to know what sort of life their baby would have if they committed to doing everything NICU staff could to help him live. Dr. Mattingly explained that there had been significant advancements in the care of premature infants, but that the future of their child was still uncertain. He discussed various risks premature infants might face including breathing difficulty related to immature lungs, which might necessitate a breathing tube and could result in long-term problems, and injury to the developing brain and eyes that could result in lifelong sensory, cognitive, and motor impairments. He discussed surgery their child might need for his heart, and the risk of intestinal injury and infections while in the NICU. He told the couple that their child might die early or late in his NICU course. “Of course,” Dr. Mattingly had said, “decisions about when and how much to intervene are up to you.” He also explained the option of comfort care, which would focus on keeping the infant comfortable after birth, without attempts at resuscitation; in this case, the focus would not be on survival, but on making sure the time he had would be as peaceful as possible.

Miriam and Thomas wanted more than anything for their child to live and to give their child the best chance possible, but they also wanted his life, however long or short, to be a happy one. They also wondered how having a child with severe disabilities would affect their four other children. They felt they could not truly grasp what awaited their child in terms of potential complications or disabilities, should they opt for full resuscitation. "Dr. Mattingly," Thomas began, "You see the sorts of futures these children have and the joy and pain the parents go through in either option. What would you counsel us to do?"

Commentary

Miriam and Thomas are in a difficult position. In a matter of hours, they must reconcile their values, their hopes for their child, and Dr. Mattingly's recommendations to decide on a course of action. As busy parents, in addition to considering what is best for their son, they are also evaluating how having a child born at the margin of gestational viability will affect their lives. They might wonder how they will be able to afford the care he could require. They might want to know how this will affect their careers or whether they will even be able to continue working. In addition to finances and their family dynamics, Miriam and Thomas worry about the suffering their son could experience. If they pursue resuscitation, is the chance of survival worth the potential immediate and long-term complications and disability he could suffer? What *is* the chance of survival? If he survives, what might his quality of life be like? Will he be able to go to school, get a job, be happy? In an ideal [shared decision-making](#) scenario, Dr. Mattingly and his team would help Miriam and Thomas assess their values, family circumstances, and medical information to determine whether resuscitation is in the best interest of their child.

Limited Epidemiologic Data Means Limited Prognostic Capacity

Right now, Miriam and Thomas have a lot of questions, but in order to make a decision, they need more information. Dr. Mattingly must present expected outcomes in relation to both mortality and long-term morbidity for an extremely premature infant to honor the autonomy of the parents who must receive enough information to make an informed decision. But which data should he use? Like most parents in this type of situation, Thomas and Miriam want information about the potential outcomes for their child, not the statistical outcomes at a population level [1]. Population-based data are not intended to predict a specific outcome for an individual patient; at best what can be said is something like, "Among a large group of babies more or less like yours, these were their outcomes."

It can be intellectually difficult to understand and apply epidemiologic outcomes to high-stakes decision making for one's own child. Even for those who find value in population-based outcomes, which cohort is used for counseling determines the outcomes used as a basis of comparison, as well as how they are interpreted. In a large study of extremely preterm infants, Rysavy et al. found that among the most premature infants (those born

at 22 and 23 weeks), roughly three-quarters of the variation in survival and in survival without severe impairment were accounted for by differences in rates of resuscitation at birth at different hospitals; the impact of between-hospital variation was diminished by 24 weeks and no longer relevant by 25 weeks of gestation [2]. If Miriam and Thomas's hospital does not routinely offer resuscitation at a given gestational age, an infant born there is dramatically less likely to survive than if he is born at a hospital that more routinely resuscitates infants at that gestational age. That information, in and of itself, however, does not mean that Miriam and Thomas's child will not survive if resuscitated—individual characteristics beyond his gestational age and hospital outcomes will contribute to his likelihood of survival.

To aid in counseling, it is necessary to consider additional factors beyond gestational age, as gestational age alone is an unreliable factor in [predicting long-term outcomes](#) [3–5]. Online, user-friendly, population-based outcome prediction tools exist. For example, the National Institute of Child Health and Human Development (NICHD) Neonatal Research Network “calculator” uses three patient characteristics—gender, administration of maternal steroids, and multiplicity [6]—that are often known before birth to produce the estimated survival outcome for an infant with a given profile. These tools are widely used by neonatologists despite uncertainty about their usefulness and impact [7]. In addition to the NICHD, other research and quality improvement groups have developed algorithms to predict morbidity and mortality that take into account a wide range of variables [8, 9]. These variables include gender, gestation size, gestational age, surfactant administration, mechanical ventilation, and parental education level, among others. While more helpful than gestational age alone, these algorithms also rely on population-level data and variables that might be unknown while the infant is still in utero.

Advantages of Clinical Course Data

At each stage beyond delivery, more child-specific information is available, allowing physicians to move from predictions based on population-level statistics to predictions based on the clinical course of the child [1]. Resuscitating infants in the delivery room and pursuing a trial of therapy in the NICU open up multiple opportunities to reevaluate whether the burdens of invasive and potentially painful treatment outweigh the potential benefits to the child [10]. If the burdens of care appear to be greater than the benefits of aggressive NICU care, redirection of the goals of care towards palliative aims is an option. Because postnatal predictions of death and impaired survival based on factors such as illness severity, diagnostic tests (e.g., cranial ultrasounds), outcome-prediction calculators, and even clinicians' predictions of outcomes are inexact, by pursuing a trial of therapy in the NICU for their child, Thomas and Miriam will be able to make a more informed decision about whether to pursue aggressive care or to transition their child to palliative care based on the clinical course that develops over days or weeks. Although a trial of therapy opens up more decision points and more clinical data,

it is not the right course of action for all parents. A trial of therapy supports parents for whom not pursuing a chance for their child's survival is untenable. A trial of therapy in the NICU, however, might not support parents for whom their child's suffering without guaranteed survival would be an unacceptable option.

Another important implication of a decision to initiate resuscitative efforts after birth is that the resuscitation might not be successful and that the infant will be denied a peaceful death in the arms of his or her parents. Although anticipatory guidance regarding this possibility is crucial to thorough prenatal consultation, those concerned about a "bad death" following aggressive but unsuccessful resuscitation might be assuaged by two considerations. The first is that, although long term survival is by no means guaranteed, in most cases, neonatologists are able to provide at least a short period of stabilization, allowing time for parents to meet the baby and participate in ongoing decision making [11]. Second, if viewed as part of the continuum of NICU care that follows a decision to initiate intensive care after birth, early and compassionate recognition of medical futility can be integrated throughout the infant's NICU course.

Risks Associated with Extremely Preterm Births and Resuscitation

While the initial question for most parents, including Miriam and Thomas, is, "Will my baby survive?," physicians must also counsel parents on the potential complications that can arise from resuscitating extremely premature infants. Dr. Mattingly must convey the benefits as well as the short- and long-term burdens of aggressive treatment in the delivery room and, later, in the NICU. For these extremely premature infants, it is impossible to separate complications arising from the interventions from complications of prematurity. For the most extremely premature infants, without interventions, the chance of survival is negligible [3]. Babies, such as Miriam and Thomas's, born at 23 weeks and 3 days, will need invasive respiratory support to survive, such as mechanical ventilation with provision of surfactant [12]. They will also need IV access to deliver glucose, medications, and parenteral nutrition and to draw labs [12]. These life-supporting interventions, however, are not without risk.

In thinking about potential harms of neonatal resuscitation after extremely preterm birth, it is helpful to distinguish between risks and immediate implications of the resuscitation itself, on the one hand, and the long-term implications of the decision to initiate intensive care after birth, on the other. There are specific and known complications of the procedures that are performed during a resuscitation event. Manual mechanical ventilation can result in pneumothorax, which can be a fatal event, or necessitate additional procedures such as chest tube placement [13, 14]. Endotracheal intubation might result in injury to the vocal cords or trachea [15], which again can be lethal or negatively impact quality of life for survivors. Mechanical complications of cannulation of peripheral or central arteries and veins might also occur [16]. Protracted and aggressive resuscitation can include chest compressions which can cause bruising to

the skin, although chest compressions are rare when contemporary resuscitation algorithms are followed [11]. All of these procedures of course have the potential to be painful to the infant [17]. Exploration of these risks in the larger context of a NICU hospitalization for an extremely preterm infant is a daunting but necessary task in antenatal consultation. Moreover, further complications of interventions and extended NICU stays are possible after initial resuscitation at delivery. Mechanical ventilation can increase the risk for intraventricular hemorrhage and bronchopulmonary dysplasia, which is associated with poor neurodevelopmental outcomes [18, 19]. Hyperoxia from supplemental oxygen has been attributed to inhibition of angiogenesis, leading to retinopathy of prematurity, a common cause of blindness in premature infants [20, 21]. Extended stays in the NICU with central lines and IVs put infants with already vulnerable immune systems at risk for sepsis [22]. Kidney and liver injury can result from nonsteroidal anti-inflammatory drugs (NSAIDs), antibiotics, and total parenteral nutrition (TPN) [23, 24]. Cholestasis, osteopenia of prematurity, and vascular thrombosis from the central line can result from a prolonged requirement for TPN [24, 25]. As these complications can be attributable to interventions that are part of the current standard of care for resuscitated infants born at the margin of viability, they can be considered iatrogenic complications, that is, complications of the interventions themselves.

If parents decide to pursue resuscitation, the interventions are not elective in the sense that they are essential for survival. Although parents might be asked to provide individual informed consent for discreet procedures, consent for admission to and care in the NICU is general and implicitly includes provision of numerous routine interventions. As there are advances in the care of infants born at the margin of viability, currently unavoidable consequences of care will hopefully become preventable. Some recent and proposed advances include less invasive methods for delivering surfactant, better ways to identify infants that need continuous positive airway pressure (CPAP) alone rather than mechanical ventilation, shorter NICU stays, fewer central line days, and newer TPN lipid preparations that reverse cholestasis, among others [19, 25, 26].

Shared Decision Making in the Perinatal Period

Dr. Mattingly and the medical team's position is more difficult than solely presenting research data to Miriam and Thomas. They must also be conscious of how they deliver the information about potential risks and benefits. Physicians can unwittingly influence parental decisions by how they frame information. For example, survey respondents were more likely to elect resuscitation when a hypothetical prognosis was presented positively (i.e., survival without disability) than negatively (i.e., probability of death and disability) [27]. It is important for Dr. Mattingly to present information in terms of both mortality and survival to Miriam and Thomas so his own bias toward either optimism or pessimism does not unduly influence their parental decision making. Many people also struggle with interpreting statistics. Checking for comprehension, using visual aids, and tailoring presentations to parents' learning styles are also vital components of delivering

effective counseling [28], which would enable Miriam and Thomas to make informed decisions.

Coordinated consultation of specialized obstetric and pediatric care clinicians can be supportive to parents facing possible or likely preterm delivery. High-risk obstetricians (maternal-fetal medicine specialists) can provide information and anticipatory guidance and support decision making for families facing premature birth. Joint consultations with obstetricians and neonatologists can help reduce redundancy of and inconsistencies in information that can occur in independent counseling [29]. The authors know of some institutions in which prenatal palliative care consultation is routine or even required at the earliest gestational ages. The training and experience required for neonatologists to provide compassionate, effective, and nonbiased prenatal consultation is an area of current investigation [30-32].

After receiving all this information on risks, possible outcomes, and complications, the question for Miriam and Thomas now is this: Do they want to pursue a trial of therapy in the NICU or palliative care for their child? As described in the vignette, Miriam and Thomas do not know what course is in the best interest of their child and are asking Dr. Mattingly to integrate his knowledge of their [values](#) with his clinical experience to make a recommendation for the care of their child. How should he respond? If he encourages shared decision making, Dr. Mattingly can integrate his medical knowledge with Miriam and Thomas's values to propose a course of treatment. However, Miriam and Thomas have asked his advice, and directed counseling, when solicited, is not paternalistic and provides an opportunity to lessen parents' emotional burden. For example, Miriam and Thomas might be less willing to elect palliative care or to withdraw care once initiated as it might feel like they are "giving up." At the point at which the burden of treatment is felt to outweigh the potential benefit, directive counseling and a clear recommendation of a transition to [comfort care](#) by the neonatologist could relieve both the emotional suffering of parents struggling with the burden of the decision and the physical suffering of the infant by facilitating prioritization of palliative, comfort-directed interventions.

In addition to discussing with Dr. Mattingly survival outcomes and potential complications their son might suffer, Thomas and Miriam might be thinking about and discussing how the decision to pursue aggressive care or palliative care would affect their family, such as who would take care of the children while they were at the hospital and what they would do if one or both of them needed to take extended leaves from work; they might ask Dr. Mattingly to help them work through these considerations. This approach only works, however, if Dr. Mattingly and the health care team have a good understanding of Miriam and Thomas's values, concerns, and circumstances—such as their financial status, their careers, their religious beliefs, and the fact that they have four other children.

Conclusion

Miriam and Thomas must reconcile their values, their family circumstances, and the medical information they receive from Dr. Mattingly to determine if resuscitation is in the best interest of their child. Before birth they have access to population-level risk or outcomes data predominantly based on gestational age. By initiating a trial of therapy in the NICU, Dr. Mattingly can combine child-specific clinical course data with population-level data to improve the diagnostic accuracy and prediction of the child's chances of survival and disability. A trial of therapy, however, is not without risks and potential complications and is not right for every family. Dr. Mattingly's role is to ensure that Miriam and Thomas have the information they need to make an informed decision and to provide guidance, when asked, based on an understanding of the family's values and circumstances and his medical knowledge.

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Genevieve Allen is a third-year medical student in the Ethics Path of Excellence at the University of Michigan in Ann Arbor.

Naomi Laventhal, MD, MA, is an assistant professor in the Department of Pediatrics and Communicable Diseases in the Division of Neonatal-Perinatal Medicine at the University of Michigan Medical School in Ann Arbor. She is also a clinical ethics faculty member in the Program in Clinical Ethics within the Center for Bioethics and Social Sciences and provides clinical ethics consultation throughout the University of Michigan hospital system. Her research interests are in neonatal bioethics and clinical research ethics.

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