

## THE LIMIT OF VIABILITY

# Should newborns at 22 or 23 weeks' gestational age be aggressively resuscitated?

At 22 weeks 0 days of gestation, pediatricians and parents should be cautious about choosing to aggressively resuscitate a newborn because survival is very unlikely. Toward the end of the 23rd week, survival becomes more likely, but severe morbidity occurs frequently.



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For many decades the limit of viability was believed to be approximately 24 weeks of gestation. In many medical centers, newborns delivered at less than 25 weeks are evaluated in the delivery room and the decision to resuscitate is based on the infant's clinical response. In the past, aggressive and extended resuscitation of newborns at 22 and 23 weeks was not common because the prognosis was bleak and clinicians did not want to inflict unnecessary pain when the chances for survival were limited. Recent advances in obstetric and pediatric care, however, have resulted in the survival of some infants born at 22 weeks' gestation, calling into question long-held beliefs about the limits of viability.

In 2 recent reports, investigators used data from the National Institute of Child Health and Human Development (NICHD) Neonatal Research Network to acquire detailed information about newborn survival and morbidity at 22 through 28 weeks'

gestation (TABLES 1 AND 2, page 6).<sup>1,2</sup> These data show that the survival of newborns at 23 through 27 weeks' gestation is increasing, albeit slowly. Survival, without major morbidity, is gradually improving for newborns at 25 through 28 weeks.<sup>1,2</sup> But what is the prognosis for a fetus born at 22 or 23 weeks?

There are several aspects of this issue to consider, including accurate dating of the gestational age and current viability outcomes data.

### Determining the limit of viability: Accurate dating is essential

The limit of viability is the milestone in gestation when there is a high probability of extrauterine survival. A major challenge in studies of the limit of viability for newborns is that accurate gestational dating is not always available. For example, in recent reports from the NICHD Neonatal Research Network the gestational age

was determined by the best obstetric estimate, or the Ballard or Dubowitz examination, of the newborn.<sup>1,2</sup>

It is well known that ultrasound dating early in gestation is a better estimate of gestational age than last menstrual period, uterine sizing, or pediatric examination of the newborn. Hence, the available data are limited by the absence of precise gestational dating with early ultrasound. Data on the limit of viability with large numbers of births between 22 and 24 weeks with early ultrasound dating would help to refine our understanding of the limit of viability.

### At 23 weeks, each day of in utero development is critical

The importance of each additional day spent in utero during the 23rd week of gestation was demonstrated in a small cohort in 2001.<sup>4</sup> Overall, during the 23rd week of gestation the survival of newborns to discharge

**TABLE 1** Newborn mortality before discharge<sup>1</sup> and up to 120 days<sup>2</sup> in the Neonatal Research Network from 2008 to 2012 and survival without major morbidity<sup>1</sup>

Gestational week	Newborns surviving to discharge per 100 births <sup>1</sup>	Newborns surviving to approximately 120 days of life per 100 births <sup>2</sup>	Newborns surviving to discharge without major morbidity per 100 births <sup>1</sup>
22	7	6.2	0
23	32	30.9	5
24	62	61.0	11
25	77	75.7	22
26	85	83.2	32
27	90	89.0	48
28	94	93.5	60

was 33%.<sup>4</sup> This finding is similar to the survival rate reported by the NICHD Neonatal Research Network in 2012.<sup>1</sup> However, survival was vastly different early, compared with later, in the 23rd week<sup>4</sup>:

- from 23 weeks 0 days to 23 weeks 2 days: no newborn survived
- at 23 weeks 3 days and 23 weeks 4 days: 40% of newborns survived
- at 23 weeks 5 days and 23 weeks 6 days: 63% of newborns survived (a similar survival rate of 24-week gestations was reported by the NICHD Neonatal Research Network<sup>1</sup>).

The development of the fetus across the 23rd week of gestation appears to be critical to newborn survival. Hence, every day of in utero development during the 23rd week is critically important. A great challenge for obstetricians is how to approach the woman with threatened preterm birth at 22 weeks 0 days' gestation. If the woman delivers within a few days, the likelihood of survival is minimal. However, if the pregnancy can be extended to 23 weeks and 5 days, survival rates increase significantly.

**TABLE 2** Morbidity among newborns at 22 to 28 weeks' gestation<sup>1,\*</sup>

Neonatal complications of severe prematurity	Approximate % of newborns with complication
Bronchopulmonary dysplasia	40%
Late onset sepsis	20%
Severe intracranial hemorrhage	15%
Severe retinopathy of prematurity ≥ Stage 3	10%
Necrotizing enterocolitis	9%
Periventricular leukomalacia	4%
Early-onset sepsis	2%

\*Gestational age greatly influences the rate of the neonatal complications of prematurity. Summarizing the data on neurodevelopmental outcomes is very complex and beyond the scope of this editorial. At 22 and 23 weeks gestation, newborns that survive to discharge have a high rate of neurodevelopmental morbidity.

## Aligning the actions of birth team, mother, and family

Factors that influence the limit of viability include:

- gestational age
- gender of the fetus (Females are more likely than males to survive.)
- treatment of the mother with glucocorticoids prior to birth
- newborn weight.

To increase the likelihood of newborn survival, obstetricians need to treat women at risk for preterm birth with antenatal glucocorticoids and antibiotics for rupture of membranes and to limit fetal stress during the birth process. Guidelines have evolved to encourage clinicians to treat women at preterm birth risk with glucocorticoids either at:

- 23 weeks' gestation or
- 22 weeks' gestation, if birth is anticipated to occur at 23 weeks or later.<sup>5</sup>

At birth, pediatricians are then faced with the very difficult decision of whether or not to aggressively resuscitate the severely preterm infant. Complex medical, social, and ethical issues ultimately guide pediatricians' actions in this challenging situation. It is important for their actions to be in consensus with the obstetrician, the mother, and the mother's family and for a consensus to be reached. Dissonant plans may increase adverse outcomes for the newborn. In one study when pediatricians and obstetricians were not aligned in their actions, the risk of death of an extremely preterm newborn significantly increased.<sup>6</sup>

Prior to birth, team meetings that include the obstetricians, pediatricians, mother, and family will help to set expectations about the course of care and, in turn, improve perceived outcomes.<sup>5</sup> If feasible, obstetricians and pediatricians should develop joint institutional guidelines about the general approach to

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## A neonatal outcomes predictor

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The National Institute of Child Health and Human Development provides a Web-based tool for estimating newborn outcomes based on gestational age (22 to 25 weeks), birth weight, gender, singleton or multiple gestation, and exposure to antenatal glucocorticoid treatment. The outcomes tool provides estimates for survival and survival with severe morbidity. It uses data collected by the Neonatal Research Network to predict outcomes. To access the outcomes data assessment, visit [https://www.nichd.nih.gov/about/org/der/branches/ppb/programs/epbo/Pages/epbo\\_case.aspx](https://www.nichd.nih.gov/about/org/der/branches/ppb/programs/epbo/Pages/epbo_case.aspx).

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pregnant women when birth may occur at 22 or 23 weeks' gestation.<sup>5</sup>

### Is aggressive management of preterm birth and neonatal resuscitation a self-fulfilling prophecy?

The beliefs and training of clinicians may influence the outcome of extremely preterm newborns. For example, if obstetricians and pediatricians focus on the fact that birth at 23 weeks is not likely to result in survival without severe morbidity, they may withhold key interventions such as antenatal glucocorticoids,

antibiotics for rupture of the membranes, and aggressive newborn resuscitation.<sup>7</sup> Consequently the likelihood of survival may be reduced.

If clinicians believe in maximal interventions for all newborns at 22 and 23 weeks' gestation, their actions may result in a small increase in newborn survival—but at the cost of painful and unnecessary interventions in many newborns who are destined to die. Finding the right balance along the broad spectrum from expectant management to aggressive and extended resuscitation is challenging. Clearly there is no “right answer” with these extremely difficult decisions.

### Future trends in the limit of viability

In 1963, Jacqueline Bouvier Kennedy, at 34 weeks' gestation, went into preterm labor and delivered her son Patrick at a community hospital. Patrick developed respiratory distress syndrome and was transferred to the Boston Children's Hospital. He died shortly thereafter.<sup>8</sup> Would Patrick have survived if he had been delivered at an institution capable of providing high-risk obstetric and newborn services? Would such modern interventions as antenatal glucocorticoids, antibiotics for ruptured membranes, liberal use of cesarean delivery, and aggressive neonatal resuscitation have

improved his chances for survival?

From our current perspective, it is surprising that a 34-week newborn died shortly after birth. With modern obstetric and pediatric care that scenario is unusual. It is possible that future advances in medical care will push the limit of viability to 22 weeks' gestation. Future generations of clinicians may be surprised that the medicine we practice today is so limited.

However, given our current resources, it is unlikely that newborns at 22 weeks' gestation will survive, or survive without severe morbidity. Consequently, routine aggressive resuscitation of newborns at 22 weeks should be approached with caution. At 23 weeks and later, many newborns will survive and a few will survive without severe morbidity. Given the complexity of the issues, the approach to resuscitation of infants at 22 and 23 weeks must account for the perspectives of the birth mother and her family, obstetricians, and pediatricians. Managing threatened preterm birth at 22 and 23 weeks is one of our greatest challenges as obstetricians, and we need to meet this challenge with grace and skill. 🍷



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