

Chapter 1 : Resuscitation at birth and cognition at 8 years of age: a cohort study

Problems at birth and resuscitation Paediatric assistance is requested at around a quarter of all deliveries and some form of support is required in 40% of these cases. Intensive resuscitation, respiratory support at least, is required at 3% of all deliveries.

Mercer, MD; Sean C. Grobman, MD; Jamie L. Resnik, MD; and Anthony C. This information is designed as an educational resource to aid clinicians in providing obstetric and gynecologic care, and use of this information is voluntary. This information should not be considered as inclusive of all proper treatments or methods of care or as a statement of the standard of care. It is not intended to substitute for the independent professional judgment of the treating clinician. Variations in practice may be warranted when, in the reasonable judgment of the treating clinician, such course of action is indicated by the condition of the patient, limitations of available resources, or advances in knowledge or technology. The American College of Obstetricians and Gynecologists reviews its publications regularly; however, its publications may not reflect the most recent evidence. Any updates to this document can be found on www.acog.org. ACOG does not guarantee, warrant, or endorse the products or services of any firm, organization, or person. Neither ACOG nor its officers, directors, members, employees, or agents will be liable for any loss, damage, or claim with respect to any liabilities, including direct, special, indirect, or consequential damages, incurred in connection with this publication or reliance on the information presented. This Obstetric Care Consensus is updated as highlighted to reflect updated supporting evidence regarding the spectrum of outcomes for infants born in the periviable period. When delivery is anticipated near the limit of viability, families and health care teams are faced with complex and ethically challenging decisions. Multiple factors have been found to be associated with short-term and long-term outcomes of periviable births in addition to gestational age at birth. These include, but are not limited to, nonmodifiable factors eg, fetal sex, weight, plurality, potentially modifiable antepartum and intrapartum factors eg, location of delivery, intent to intervene by cesarean delivery or induction for delivery, administration of antenatal corticosteroids and magnesium sulfate, and postnatal management eg, starting or withholding and continuing or withdrawing intensive care after birth. Antepartum and intrapartum management options vary depending upon the specific circumstances but may include short-term tocolytic therapy for preterm labor to allow time for administration of antenatal steroids, antibiotics to prolong latency after preterm premature rupture of membranes or for intrapartum group B streptococci prophylaxis, and delivery, including cesarean delivery, for concern regarding fetal well-being or fetal malpresentation. Whenever possible, periviable births for which maternal or neonatal intervention is planned should occur in centers that offer expertise in maternal and neonatal care and the needed infrastructure, including intensive care units, to support such services. This document describes newborn outcomes after periviable birth, provides current evidence and recommendations regarding interventions in this setting, and provides an outline for family counseling with the goal of incorporating informed patient preferences. Its intent is to provide support and guidance regarding decisions, including declining and accepting interventions and therapies, based on individual circumstances and patient values. Decision making often needs to adapt to changing clinical circumstances before and after delivery. Its intent is to provide support and guidance regarding decisions, including both declining and accepting interventions and therapies, based on individual circumstances and patient values. Background What is considered the periviable period? Numerous terms have been used to refer to newborns delivered near the limit of viability whose outcomes range from certain or near-certain death to likely survival with a high likelihood of serious morbidities. What is the spectrum of outcomes for infants born in the periviable period? From the 20s through 30s, newborn death was virtually ensured with delivery of an infant, even one that was appropriately grown, at or before 24 weeks of gestation 3, 4. However, a recent study demonstrated that wide variation in practices exists regarding the initiation of resuscitation and active treatment at these very early gestational ages and that this variation explains some of the between-hospital differences in survival and survival without impairment, particularly at 22 weeks and 23 weeks 6. At more advanced gestational ages, however, practices and outcomes are more consistent across

tertiary care institutions. A review of studies published over the past three decades reveals a progressive increase in the rate of survival for infants born at 22, 23, 24, and 25 weeks of gestation Fig. Long-term outcomes are summarized in Figure 2. A follow-up study of a cohort of infants born at 22–26 weeks of gestation in England in found a progressive decrease in the proportion of children at age 30 months with severe or moderate impairment defined as cerebral palsy, blindness, profound hearing loss, or developmental quotient 2 SDs or more below the mean with increasing gestational age at birth: Similarly, a recent systematic review found that the incidence of moderate-to-severe neurodevelopmental impairment among survivors at 4–8 years decreased progressively with each week gained in gestational age at birth: In , a study described survival and neurologic outcomes among more than 4, births from to that were between 22 weeks and 24 weeks of gestation at 11 centers in the United States. The authors reported that the rate of survival and survival without neurodevelopmental impairment increased over this period whereas the rate of survival with such impairment did not change, arguing that the observed overall increase in survival was not simply a tradeoff for life with significant impairment. Percentage of survival by gestational age. Short term outcomes after extreme preterm birth in England: Neonatal Research Network, Japan. Survival and neurodevelopmental outcomes among periviable infants. N Engl J Med ; Percentage of surviving neonates with severe or moderate disability by gestational age. Between-hospital variation in treatment and outcomes in extremely preterm infants. Neurologic and developmental disability after extremely preterm birth. Neurologic and developmental disability at six years of age after extremely preterm birth. Clinical Considerations and Management What tools are available to obstetrician–gynecologists, other obstetric providers, and families to predict outcomes of periviable birth? Because of the wide range of outcomes associated with periviable birth, counseling should attempt to include accurate information that is as individualized as possible regarding anticipated short-term and long-term outcomes. Nevertheless, it is important to realize that outcomes that have been reported in the medical literature may have some biases because of a variety of factors, including study inclusion criteria eg, whether studies include all births or are limited to liveborn infants, nonanomalous newborns, liveborn resuscitated newborns, or neonatal intensive care unit [NICU] admissions only , variation in management between centers, and changes in NICU practices over time eg, administration of antepartum steroids, resuscitative efforts, NICU admission criteria; see Table 1 5, 9–11, 15– Multiple factors have been found to be associated with short-term and long-term outcomes of periviable births in addition to gestational age at birth Table 1. These include, but are not limited to, nonmodifiable factors eg, fetal sex, weight, plurality , potentially modifiable antepartum and intrapartum factors eg, location of delivery [21], intent to intervene by cesarean delivery [22] or induction of labor, administration of antenatal corticosteroids and magnesium sulfate , and life-sustaining interventions and postnatal management eg, starting or withholding and continuing or withdrawing intensive care after birth. Birth weight and gestational age, alone or in combination, often have been used as predictors of outcome and as criteria for offering resuscitation. However, in recognition of the effect of other clinical factors and in an attempt to create a better prediction tool, the NICHD Neonatal Research Network developed a tool to estimate outcomes among liveborn infants that was based on prospectively collected information for live births at 22–25 weeks of gestation in 19 academic NICU centers available at <https://www.nichd.nih.gov/health/monitoring/Pages/estimating-outcomes.aspx>: Using these data, the combination of five variables— 1 gestational age, 2 birth weight, 3 exposure to antenatal corticosteroids, 4 sex, and 5 plurality—was found to be more predictive of outcomes than gestational age and birth weight alone. The NICHD estimator estimates frequencies of outcomes for all live births and for resuscitated newborns receiving mechanical ventilation. In addition to NICHD data and estimates, other organizations may have access to data from their own networks that can be useful for counseling, and they should be encouraged to use available contemporary data to develop and evaluate alternative prediction tools. After delivery, a number of initial illness severity scoring systems have been used in newborn care to predict death or adverse neurologic outcomes American College of Obstetricians and Gynecologists. What are the limitations of these tools and how should this information be incorporated into family counseling? Prediction models for estimating neonatal outcomes after periviable birth were developed based on populations of neonates born during a given period, but as medical care advances, these models if not updated based on more recent information may not provide estimates with an accuracy equivalent to that

initially reported. Prediction of outcome frequencies based on gestational age, birth weight, or both in combination with other predictors provides only a point estimate reflecting a population average and cannot predict with certainty the outcome for an individual newborn. Further, gestational age is a key component of any predictive model and may not be known accurately in all cases. Furthermore, before delivery, newborn birth weight can only be estimated. The inherent inaccuracy of ultrasound-estimated fetal weight introduces a degree of uncertainty to the prediction of newborn outcomes. In addition, how parents weigh and value these potential outcomes ie, death, degree of neurodevelopmental impairment can vary widely, and individual values need to be incorporated into decision making. Finally, the response of an individual neonate to resuscitation can never be known with certainty before delivery. Thus, when a specific estimated probability for an outcome is offered, it should be stated clearly that this is an estimate for a population and not a prediction of a certain outcome for a particular patient in a given institution. These limitations highlight the need for further research and development of improved prediction models and counseling tools. What are the considerations of periviable delivery for maternal health? The effect of periviable delivery on maternal health is an important consideration that should be incorporated into counseling. In the setting of possible periviable birth, interventions intended to delay delivery or to improve newborn outcomes often are undertaken but may affect maternal outcomes. Although some interventions eg, antenatal corticosteroid administration or magnesium sulfate for neuroprotection pose relatively low risk to the pregnant woman and offer the prospect of a fetal benefit, others eg, emergent cerclage placement or classical cesarean delivery may result in significant short-term and long-term maternal morbidity. Because preterm birth frequently is associated with fetal malpresentation, whether to undertake a cesarean delivery for malpresentation is a relatively common question related to periviable gestation. Earlier cesarean delivery is associated with a higher likelihood that the needed hysterotomy will be a vertical uterine incision classical hysterotomy extending into the upper muscular portion of the uterus. Hysterotomy that involves the muscular portion of the uterus has been associated with more frequent perioperative morbidities than low transverse cesarean delivery and also leads to the recommendation for repeat cesarean delivery in future pregnancies because of the increased risk of uterine rupture with labor. In addition, recent data indicate that regardless of incision type, periviable cesarean delivery results in an increased risk of uterine rupture in a subsequent pregnancy. Finally, cesarean delivery is associated with future reproductive risks, which increase further with each additional repeat cesarean delivery. Maternal morbidity and mortality may arise not just with interventions surrounding periviable pregnancy management but also with decisions not to intervene. What obstetric and pediatric resources should be available in institutions that provide care for periviable birth? When should transport occur, if needed? Periviable infants do not survive without life-sustaining interventions immediately after delivery. Delivery of a pregnancy in the periviable period at a center with a level III–IV NICU, level III–IV maternal care designation, or both, allows for immediate resuscitation with additional needed ancillary supports eg, respiratory technology, newborn imaging 24 hours daily and advanced maternal care to optimize outcomes for the neonate and woman. Accordingly, whenever possible, periviable births for which maternal or neonatal intervention is planned should occur in centers that offer expertise in maternal and neonatal care and the needed infrastructure, including intensive care units, to support such services.²⁸ Efforts should be made to transfer women before delivery, if feasible, because antenatal transfer has been associated with improved neonatal outcome when compared with transport of a neonate after delivery.³¹ It similarly stands to reason that transfer of a parturient for advanced care before her condition worsens may improve her outcome as well. To facilitate needed transfers, hospitals without the optimal resources for maternal, fetal, and neonatal care needed for periviable birth should have policies and procedures in place to facilitate timely transport to a receiving hospital. Protocols with guidelines for the initial management and safe transport of the periviable gestation should include recommendations for such treatments as antenatal corticosteroids, magnesium sulfate for neuroprotection, tocolytic therapy, antibiotics for latency after preterm PROM, and group B streptococci prophylaxis. In some cases, circumstances may preclude antenatal maternal transport because of a rapidly evolving clinical situation or because of maternal instability due to severe illness. In such cases, neonatal transport after delivery may be needed, and protocols also should be in place to facilitate postpartum

consultation and transfer. Final decisions regarding interventions to be initiated before transfer, as well as the optimal timing and method of transport, should be individualized and made in consultation with the accepting physician. What are the benefits and risks of obstetric interventions for anticipated or inevitable periviable birth? As in any pregnancy, obstetric interventions should be undertaken only after a discussion with the family regarding individual risks and benefits of management options in addition to alternate approaches. In order to facilitate informed decision making, this discussion should include an unbiased presentation of data related to the chance of both survival and long-term neurodevelopmental impairment. This discussion also should present the option of nonintervention. In light of the high likelihood of death and the significant degree of neurodevelopmental impairment that may result from periviable birth, the American Academy of Pediatrics has stated that parents should be given the choice for palliative care alongside the option to attempt resuscitation. Clinicians should recognize that parental goals of care may be oriented toward optimizing survival or minimizing pain and suffering and should formulate an antenatal plan of care in accordance with these parental goals. Rather than treat patients based upon algorithms organized solely by gestational age, a plan of care should be informed primarily by whether the goal is to optimize the chance of survival or minimize the likelihood of suffering. Given the potential for maternal and perinatal morbidity and mortality, the option of pregnancy termination should be reviewed with the patient. Individual obstetrician-gynecologists and other obstetric providers or institutions may have objections to discussing or providing this option, but in the case of such objections, there should be a system in place to allow families to receive counseling about their options and access to such care. The management plan for ongoing pregnancies should be reassessed and follow-up counseling should be provided as the clinical situation develops and gestational age increases. Initiation of interventions to help improve outcome eg, administration of antenatal antibiotics or corticosteroids does not mandate that all other interventions eg, cesarean delivery or newborn resuscitation subsequently be undertaken. Further interventions should be considered in the context of clinical circumstances at that time. Accurate pregnancy dating is of particular importance in the periviable period, and the best estimate of gestational age should be used for counseling and decision making.

Chapter 2 : Problems at birth and resuscitation | Clinical Gate

About 10% of neonates require some respiratory assistance at birth. Less than 1% need extensive resuscitation. Causes are numerous (see Table: Problems in the Neonate That May Require Resuscitation), but the common pathway involves asphyxia or respiratory depression. The incidence rises.

The CTG is abnormal with marked decelerations to 40 and a baseline bradycardia. She is taken immediately to theatre for an emergency caesarean section, and the baby is born 15 minutes later. At delivery the baby is white, floppy, and the heart rate is very slow. There is no respiratory effort, the heart rate is 20 bpm, and the baby is white and floppy. The baseline heart rate remains at around 20 bpm. Good chest movement continues. You insert an umbilical venous catheter. You decide to give resuscitation drugs. What will you use? How much will you give? What order will you give them in and what is your rationale for doing so? With the drugs you have administered, the heart rate rises to approximately 60 bpm but no further. The blood tests you send from umbilical venous blood are reported back as: The heart rate rises a little further to 75 bpm. The baby remains very white and floppy. Further blood results come back with a haemoglobin from the umbilical venous sample of What else might you consider? What action would you take? The baby remains floppy and does not respond to stimulation. Half an hour after admission, the following results are obtained from an arterial line: The nursing staff report oxygen desaturations on the monitor. They are uncertain as to whether there are associated abnormal movements. The baby remains extremely floppy. CFAM is commenced and the following trace is obtained. What key features have led to your conclusion? What is your first line medication for this condition? What dose would you prescribe the baby weighs approximately 3. The CFAM at this point is shown below. As part as a more detailed assessment, cranial ultrasonography is performed with Doppler studies of the anterior cerebral artery. At 24 hours of age, the baby is anuric, urea 9. Blood pressure is persistently low with a mean BP of 28â€”30 mmHg despite inotropic support. Echocardiography shows very poor myocardial contractility. Assessment of liver function shows markedly elevated transaminases and gamma-GT. The baby is profoundly hypotonic and unresponsive to painful stimuli. A formal EEG is performed and the following trace obtained. What immediate measure can be taken to minimise heat loss? On examination the baby is noted to be floppy and has normal tendon reflexes. There are spontaneous anti-gravity movements. There is no fasciculation.

Chapter 3 : Periviable Birth - ACOG

Per Robin L Bissinger, PhD, APRN, NNP-BC, author of a study performed on neonatal resuscitation, nearly half of all newborns deaths occur within the first 24 hours of birth, and in many cases, asphyxia and respiratory problems are the cause.

Chapter 4 : WHO | Management of newborn illness and complications

Resuscitation and support of transition of babies at birth. Resuscitation ; Wyllie J, Perlman JM, Kattwinkel J, et al. International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations.

Chapter 5 : Neonatology/Newborn Issues - American Family Physician

The proportion of individuals with low IQ scores that might be attributable to the need for resuscitation at birth was 3.4% (95% CI 0.3-4.3) for asymptomatic infants and 1.2% (0.2-2) for those who developed symptoms of encephalopathy.