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Nonmedically Indicated Early-Term Deliveries

ABSTRACT: For certain medical conditions, available data and expert opinion support optimal timing of delivery in the late-preterm or early-term period for improved neonatal and infant outcomes. However, for nonmedically indicated early-term deliveries such an improvement has not been demonstrated. Morbidity and mortality rates are greater among neonates and infants delivered during the early-term period compared with those delivered between 39 weeks and 40 weeks of gestation. Nevertheless, the rate of nonmedically indicated early-term deliveries continues to increase in the United States. Implementation of a policy to decrease the rate of nonmedically indicated deliveries before 39 weeks of gestation has been found to both decrease the number of these deliveries and improve neonatal outcomes; however, more research is necessary to further characterize pregnancies at risk for in utero morbidity or mortality. Also of concern is that at least one state Medicaid agency has stopped reimbursement for nonindicated deliveries before 39 weeks of gestation. Avoidance of nonindicated delivery before 39 weeks of gestation should not be accompanied by an increase in expectant management of patients with indications for delivery before 39 weeks of gestation. Management decisions, therefore, should balance the risks of pregnancy prolongation with the neonatal and infant risks associated with early-term delivery.

Historically, the American College of Obstetricians and Gynecologists (the College) and the Society for Maternal-Fetal Medicine have advocated delaying deliveries until 39 completed weeks of gestation or beyond. Further, the College has stated that a mature fetal lung maturity profile is not an indication for delivery in the absence of other clinical indications (1). Yet, the rate of nonmedically indicated early-term (37 0/7–38 6/7 weeks of gestation) deliveries continues to increase in the United States (2). In contrast, the late-preterm (34 0/7–36 6/7 weeks of gestation) birth rate, which increased 25% from 1990 to 2006, has leveled off and started a slow decrease from 9.1% in 2006 to 8.8% in 2008 (3). There are medical indications in pregnancy for which there is evidence or expert opinion to support expedient delivery in the early-term period versus expectant management (Box 1) (4). In contrast, suspected macrosomia, well-controlled gestational diabetes, and documented pulmonary maturity with no other indication are all examples of conditions that are not indications for an early-term delivery. This document will focus on neonatal and infant outcomes and the potential neonatal complications related to nonmedically indicated early-term delivery. In this document, 36 weeks of gestation means 36 0/7–36 6/7 weeks of gestation, 37 weeks of gestation means 37 0/7–37 6/7 weeks of gestation, 38 weeks of gestation means 38 0/7–38 6/7 weeks of gestation, 39 weeks of gestation means 39 0/7–39 6/7 weeks of gestation, and 40 weeks of gestation means 40 0/7–40 6/7 weeks of gestation.

Neonatal and Infant Morbidity and Mortality

The risk of adverse outcomes is greater for neonates delivered in the early-term period (37/38 weeks of gestation) compared with neonates delivered at 39 weeks of gestation (Box 2). Because pulmonary development continues well into early childhood, respiratory morbidity is relatively common in neonates delivered in the early-term period. A retrospective cohort study by the Consortium on Safe Labor, which included 233,844

Box 1. Examples of Medical Indications for Late-Preterm or Early-Term Deliveries

- Preeclampsia, eclampsia, gestational hypertension, or complicated chronic hypertension
- Oligohydramnios
- Prior classical cesarean delivery or prior myomectomy
- Placenta previa or placenta accreta
- Multiple gestations
- Fetal growth restriction
- Pregestational diabetes with vascular disease
- Pregestational or gestational diabetes—poorly controlled
- Placental abruption
- Chorioamnionitis
- Premature rupture of membranes
- Cholestasis of pregnancy
- Alloimmunization of pregnancy with known or suspected fetal effects
- Fetal congenital malformations

Box 2. Neonatal Morbidities Associated With Early-Term Delivery

- Respiratory distress syndrome
- Transient tachypnea of the newborn
- Ventilator use
- Pneumonia
- Respiratory failure
- Neonatal intensive care unit admission
- Hypoglycemia
- 5-minute Apgar score less than 7
- Neonatal mortality

births, found that among all infants delivered at 37 weeks of gestation, regardless of indication, there were higher rates of respiratory failure (adjusted odds ratio [OR], 2.8; 95% confidence interval [CI], 2.0–3.9) and ventilator use (adjusted OR, 2.8; 95% CI, 2.3–3.4) compared with infants delivered at 39 weeks of gestation (5). In addition, higher rates of respiratory distress syndrome, transient tachypnea of the newborn, pneumonia, and surfactant and oscillator use were reported for infants delivered at 37 weeks of gestation compared with those delivered at 39 weeks of gestation. Slightly higher rates of respiratory failure (adjusted OR, 1.4; 95% CI, 1.0–1.9) and ventilator use (adjusted OR, 1.2; 95% CI, 1.0–1.5) were reported for infants delivered at 38 weeks versus 39 weeks of gestation; however, the differences did not reach statistical significance and there was no commonly reported difference in any other measure of respiratory morbidity between these two groups (5).

In a secondary analysis of data from the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, neonates delivered during the early-term period by cesarean delivery, in the absence of indications for delivery, were associated with a higher risk of a composite outcome of neonatal respiratory and nonrespiratory morbidities compared with neonates delivered at 39 weeks of gestation (6). Of these nonmedically indicated deliveries, 35.8% were performed before 39 weeks of gestation. The rate of composite morbidity was higher for neonates delivered at 37 weeks of gestation (adjusted OR, 2.1; 95% CI, 1.7–2.5) and at 38 weeks of gestation (adjusted OR, 1.5; 95% CI, 1.3–1.7) compared with neonates delivered at 39 weeks of gestation. In addition, the morbidity for neonates delivered at 38 4/7–38 6/7 weeks of gestation remained significantly increased (relative risk, 1.21; 95% CI, 1.04–1.40). These findings suggest that scheduled cesarean delivery even a few days before 39 weeks of gestation should be avoided.

In a large cohort of *planned term deliveries* (defined as deliveries not initiated by labor or ruptured membranes) during a 3-month period in 27 hospitals across the United States, neonatal intensive care unit (NICU) admission rates were higher among neonates delivered in the early-term period (7). A comparison of NICU admission rates for neonates delivered at 37 weeks of gestation or 38 weeks of gestation with those for neonates delivered at 39 weeks of gestation revealed that 31% of 17,794 deliveries had no medical indication. Admission to the NICU, which can be dependent on a variety of factors, was required for 17.8% of infants delivered without medical indication at 37 weeks of gestation and for 8% delivered without medical indication at 38 weeks of gestation, compared with 4.6% of infants delivered at 39 weeks of gestation or beyond ($P<.001$ for deliveries at 38 weeks and 39 weeks of gestation).

Another large study found that although the rates of meconium aspiration were lower among neonates delivered at 37 weeks of gestation (adjusted OR, 0.62; 95% CI, 0.52–0.74) and 38 weeks of gestation (adjusted OR, 0.70; 95% CI, 0.62–0.79) compared with neonates delivered at 39 weeks of gestation, the rates of hyaline membrane disease were higher at 37 weeks of gestation (adjusted OR, 3.12; 95% CI, 2.90–3.38) and 38 weeks of gestation (adjusted OR, 1.30; 95% CI, 1.19–1.43) (8). When these two etiologies of pulmonary disease were examined as the combined metric of need for neonatal ventilation, the rates of disease were increased at both 37 weeks of gestation (adjusted OR, 2.02; 95% CI, 1.88–2.18) and 38 weeks of gestation (adjusted OR, 1.15; 95% CI, 1.08–1.23). Additionally, in this study, the risk of a 5-minute Apgar score less than 7 decreased from 1.01% at 37 weeks of gestation to 0.69% at 38 weeks of gestation and 0.61% at 39 weeks of gestation ($P<.001$). Alternatively, the risk of birth weight greater than 4,000 g increased from 2.0% at

37 weeks of gestation to 4.6% at 38 weeks of gestation and 7.9% at 39 weeks of gestation ($P<.001$).

Mortality rates are also higher among neonates and infants delivered during the early-term period compared with those delivered at full term (9). Using 39 weeks of gestation as the reference group, the relative risk of neonatal mortality is 2.3 (95% CI, 2.1–2.6) at 37 weeks of gestation and 1.4 (95% CI, 1.3–1.5) at 38 weeks of gestation (Table 1). Mortality rates are also significantly higher among infants delivered at 37 weeks of gestation and 38 weeks of gestation compared with those delivered at 39 weeks of gestation (Table 1). These increased mortality rates need to be balanced against the ongoing risk of stillbirth from week to week in the early-term pregnancy. In one recent study that compared the risk of neonatal mortality at a given week of gestation to the risk of expectant management, including stillbirth and neonatal mortality at the next week of gestation, there was an increased risk of mortality from delivery at 37 weeks of gestation (14.4 per 10,000 live births) compared with expectant management up to 38 weeks of gestation (12.6 per 10,000 live births, $P<.05$) (10). At 38 weeks of gestation, the risk of mortality was 10.5 per 10,000 live births compared with 11.6 per 10,000 live births from expectant management up to 39 weeks of gestation. This risk difference of 1.1 per 10,000 pregnancies reached statistical significance (95% CI, 0.03–2.18 per 10,000 deliveries), but would require 9,042 deliveries at 38 weeks of gestation to prevent one death.

Fetal Lung Maturity

The aforementioned current literature suggests that the rate of respiratory morbidity remains higher among neonates delivered during both the late-preterm and early-term periods when compared with neonates delivered at 39 weeks of gestation. However, because nonrespiratory morbidity also is increased, documentation of fetal pulmonary maturity does not justify early nonindicated delivery. A retrospective cohort study of 459 neonates delivered at 36 0/7 weeks of gestation up to 38 6/7 weeks of gestation after documented fetal lung maturity evaluated a composite outcome of respiratory and nonrespiratory complications. The researchers found that the incidence of the composite outcome decreased with increasing gestational age (P for trend <.001): 9.2% (CI=5.9–14.1%) at 36 weeks of gestation, 3.2% (CI=1.5–6.8%) at 37 weeks of gestation, 5.2% (CI=2.0–12.6%) at 38 weeks of gestation, and 2.5% (CI=2.2–2.8%) at 39–40 weeks of gestation (11). Thus, although fetal lung maturity testing may help identify fetuses at risk of respiratory distress syndrome, mature fetal pulmonary test results may not reliably predict adverse outcomes and should not justify a delivery without other indications.

The role of amniocentesis to determine fetal pulmonary maturity was discussed at the 2011 *Eunice Kennedy Shriver* National Institute of Child Health and Human Development and Society for Maternal-Fetal Medicine workshop entitled "Timing of Indicated Late-Preterm and

Table 1. Neonatal and Infant Mortality Rates Associated With Late-Preterm and Early-Term Deliveries ⇦

Gestational Age (wk)	Neonatal Mortality Rate (Per 1,000 Live Births)	Relative Risk (95% CI)	Infant Mortality Rate (Per 1,000 Live Births)	Relative Risk (95% CI)
34*	7.1	9.5 (8.4–10.8)	11.8	5.4 (4.9–5.9)
35*	4.8	6.4 (5.6–7.2)	8.6	3.9 (3.6–4.3)
36*	2.8	3.7 (3.3–4.2)	5.7	2.6 (2.4–2.8)
37*	1.7	2.3 (2.1–2.6)	4.1	1.9 (1.8–2.0)
38*	1.0	1.4 (1.3–1.5)	2.7	1.2 (1.2–1.3)
39	0.8	1.00†	2.2	1.00†
40	0.8	1.0 (0.9–1.1)	2.1	0.9 (0.9–1.0)

Abbreviation: CI, confidence interval.

*$P<.001$

†Reference group

Data from Reddy UM, Ko CW, Raju TN, Willinger M. Delivery indications at late-preterm gestations and infant mortality rates in the United States. Pediatrics 2009;124:234–40. [PubMed] [Full Text]

Early-Term Birth" (12). The consensus was that if there is significant maternal or fetal risk to warrant delivery, amniocentesis does not further aid in guiding management. The converse also is thought to be true: If delivery could be delayed to await pulmonary maturity, then the indication is less urgent, and prompt delivery is not likely indicated. As mentioned previously, documentation of fetal pulmonary maturity alone does not necessarily indicate that other fetal physiologic processes are adequately developed.

Prevention of Nonmedically Indicated Early-Term Deliveries

Implementation of a policy to decrease the rate of nonmedically indicated deliveries before 39 weeks of gestation has been found to both decrease the numbers of these deliveries and improve neonatal outcomes. Clark and colleagues examined the implementation of three approaches to this issue: 1) a hard-stop policy, which prohibited nonmedically indicated deliveries at the hospital level; 2) a soft-stop policy, in which health care providers agreed not to perform nonmedically indicated deliveries before 39 weeks of gestation; and 3) an education program that informed health care providers about the risks associated with delivery before 39 weeks of gestation. Overall, these approaches were able to demonstrate more than a 50% reduction in the rate of nonmedically indicated early-term deliveries, regardless of the policy used (13). However, the reduction was the greatest in the hard-stop policy group, with a reduction from 8.2% to 1.7% (P=.007); slightly less in the soft-stop policy group, with a reduction from 8.4% to 3.3% (P=.025), and least in the educational approach group, with a reduction from 10.9% to 6.0% (P=.135), which was not statistically significant.

In a parallel effort, the Ohio Perinatal Quality Collaborative chose to focus on the reduction of nonmedically indicated deliveries at 36 0/7–38 6/7 weeks of gestation (14). Twenty hospitals in Ohio were enrolled in the study, and a range of approaches were provided to reduce nonmedically indicated deliveries, including improved determination of gestational age, usage of the College's criteria for indication for delivery, education of patients and health care providers regarding these indications and the risks of nonindicated delivery before 39 weeks of gestation, and measurement of the outcome of scheduled delivery without a documented indication. The researchers reported a reduction in the rate of nonmedically indicated deliveries at 36 0/7–38 6/7 weeks of gestation from 13% to 8% (P=.003).

Another more recent study examined the effects of a policy to reduce the rate of nonmedically indicated deliveries before 39 weeks of gestation similar to the hard-stop policy previously described (15). After implementation of this policy, the overall rate of deliveries at 37 weeks of gestation or 38 weeks of gestation decreased from 33.1% to 26.4% (P<.001). In addition, the rate of NICU admission for neonates delivered at term decreased from 9.3% to 8.6% (P=.04). However, there also was a statistically significant increase in the rate of stillbirth at 37 weeks of gestation or 38 weeks of gestation, from 2.5 per 10,000 births to 9.1 per 10,000 births (P=.032). Additionally, there was an 11% increase in odds of birth weight greater than 4,000 g (adjusted OR 1.11; 95% CI, 1.01–1.22).

These programs demonstrate that a reduction in nonmedically indicated early-term and late-preterm deliveries can be achieved. However, to decrease the overall rate of perinatal morbidity and mortality before 39 weeks of gestation, more research is necessary to further characterize pregnancies at risk of in utero morbidity or mortality.

Conclusions and Recommendations

Although there are specific indications for delivery before 39 weeks of gestation, a nonmedically indicated early-term delivery is not appropriate. For certain medical conditions, available data and expert opinion support optimal timing of delivery in the late-preterm or early-term period for improved neonatal and infant outcomes (12, 4). However, for nonmedically indicated early-term deliveries, such an improvement has not been demonstrated. In fact, there are greater reported rates of morbidity and mortality among neonates and infants delivered during the early-term period compared with those delivered at 39 weeks and 40 weeks of gestation. The differences between 37 weeks of gestation and 39 weeks of gestation are consistent, larger, and statistically significant across multiple studies. Even comparing neonates and infants delivered at 38 weeks of gestation with those delivered at 39 weeks of gestation there is still an increased (albeit clinically small) risk of adverse outcomes. The role of amniocentesis to determine pulmonary maturity is limited, and a mature fetal pulmonary maturity result does not ensure good neonatal outcomes.

An additional item of concern related to early-term delivery is that at least one state Medicaid agency has stopped reimbursement for nonindicated deliveries before 39 weeks of gestation. This will affect the health care provider who performs the delivery, the hospital, and the patient, so indications for delivery before 39 weeks of gestation should be clearly documented and discussed with the patient. Avoidance of nonindicated delivery before 39 weeks of gestation should not be accompanied by an increase in expectant management of patients with indications for delivery before 39 weeks of gestation (12). Management decisions, therefore, should balance the risks of pregnancy prolongation with the neonatal and infant risks associated with early-term delivery.

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