OBSTETRICS

Neonatal outcomes in early term birth

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OBJECTIVE: To determine neonatal morbidity rates for early term birth compared with full term birth by precursor leading to delivery.

STUDY DESIGN: This was a retrospective study of 188,809 deliveries from 37 0/7 to 41 6/7 weeks of gestation with electronic medical record data from 2002 to 2008. Precursors for delivery were categorized as spontaneous labor, premature rupture of membranes indicated, and no recorded indication. After excluding anomalies, rates of neonatal morbidities by precursor were compared at each week of delivery.

RESULTS: Early term births (37 0/7-38 6/7 weeks) accounted for 34.1% of term births. Overall, 53.6% of early term births were due to spontaneous labor, followed by 27.6% indicated, 15.5% with no recorded indication, and 3.3% with premature rupture of membranes. Neonatal intensive care unit admission and respiratory morbidity were lowest at or beyond 39 weeks compared with the early term period for most precursors, although indicated deliveries had the highest morbidity compared with other precursors. The greatest difference in morbidity was between 37 and 39 weeks for most precursors, although most differences in morbidities between 38 and 39 weeks were not significant. Respiratory morbidity was higher at 37 than 39 weeks regardless of route of delivery.

CONCLUSION: Given the higher neonatal morbidity at 37 compared with 39 weeks regardless of delivery precursor, our data support recent recommendations for designating early term to include 37 weeks. Prospective data is urgently needed to determine the optimal timing of delivery for common pregnancy complications.

Key words: early term birth, neonatal morbidity, precursors for delivery

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Neonatal morbidity due to physiologic immaturity has been studied primarily in preterm infants less than 37 weeks' gestation.[1-4] However, more recent evidence indicates that neonatal morbidity decreases with delivery at later gestational ages and that infants delivered at 37 and 38 weeks' gestation, are at increased risk for morbidity compared with infants delivered at 39 weeks.[5-8] Specifically, rates of respiratory distress syndrome, transient tachypnea of the newborn, pneumonia, hypothermia, and feeding difficulties are increased in infants born at 37 to 38 weeks compared with infants born after 38 weeks.[8-10] An increased rate of cerebral palsy, a more severe complication, has also been observed in infants born at 37 weeks compared with 38 weeks' gestation.[11] Long-term childhood morbidities including increased risk of problems with school performance and behavior, increased hospital admission up to 5 years of age, and increased rates of asthma and wheezing have also been observed in children born at 37 to 38 weeks compared with those born after 38 weeks' gestation.[12]

The small but measurable increased risk of neonatal morbidity for infants born at 37 and 38 compared with 39 weeks' gestation led Fleischman et al[13] to suggest adoption of an "early term" delivery category. Subsequently, the American College of Obstetrics and Gynecology recommended designating 37 to 38 completed weeks' gestation as "early term" and 39 to 40 weeks' gestation as "full term."[14] The potential public health impact of early term delivery is large as 27% of all deliveries in the United States occurred at 37 and 38 weeks' gestation in 2010[15] and in 1 study, approximately 50% of 20,973 elective term cesarean deliveries occurred during the early term period.[16]

Both the reason and gestational age at delivery are likely important factors contributing to morbidity, as neonatal morbidity has been found to vary depending on the underlying indication for delivery between 34 and 36 weeks' of gestation.[17] However, there has been a paucity of data regarding whether

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increased morbidity in early term neonates is a consequence of physiologic immaturity at earlier gestation or because of the underlying precursor leading to early term delivery.

Therefore, our objectives were to determine whether morbidity differed in neonates born during the early term and full term period by delivery precursor and to describe the precursors leading to early term birth using data from a large US obstetric cohort. We further explored incidence of respiratory morbidity according to planned vs actual route of delivery for different precursors.

Materials and Methods

This was a retrospective study based on data from the Consortium on Safe Labor (CSL), which has been described elsewhere.[18] The study included 12 sites (including 19 hospitals) across the United States with deliveries between 2002 and 2008. Institutional review board approval was obtained from each facility within the CSL. Maternal demographic data, labor, and delivery information, birth records, and neonatal information were extracted from the patient electronic medical records and supplemented with discharge summary codes. Validation studies comparing discharge codes with medical chart review confirmed high level of accuracy. Overall, there was 91.1% to 95% concordance with the medical chart for 20 variables examined.[18]

Data was also collected from chart review for all infants delivered >37 weeks' gestation who required respiratory support in the delivery room with oxygen or ventilation and were admitted to the neonatal intensive care unit (NICU) with a respiratory diagnosis. Gestational age at delivery as recorded in the medical record was based on the best obstetric estimate available.

There were 228,438 deliveries from 208,695 women in the CSL. We limited the current analysis to 188,809 singleton deliveries from 173,569 women with gestational ages between 37 0/7 to 41 6/7 weeks. Precursors for delivery were categorized as previously described[1] into 4 exclusive categories: spontaneous labor, premature rupture of membranes (PROM), indicated, and no recorded indication. We classified the precursors for delivery according to the following hierarchy: women who presented in spontaneous labor with and without pregnancy complications or rupture of membranes were only included in the spontaneous labor category. A pregnancy was determined to be PROM exclusive of spontaneous labor if a woman presented with premature rupture of membranes and underwent an induction of labor or prelabor cesarean delivery. Indicated deliveries included women without spontaneous labor or PROM who underwent an induction of labor or prelabor cesarean delivery for maternal, fetal, or obstetric complications of pregnancy. If an induction of labor or indication for prelabor cesarean delivery was not recorded, but the pregnancy had other complications such as hypertensive disease or diabetes, it was also categorized as indicated. Therefore, a woman could potentially have multiple pregnancy conditions in the indicated category. Finally, admission for a fetal or maternal reason not specified in the above categories, as well as history of fetal or maternal condition not present in the current pregnancy were considered indicated. Postdates, defined as 41 0/7 to 41 6/7 weeks of gestation, was also counted as an indicated delivery exclusive of other indications. In a previous study,[1] we determined that birth outcomes for deliveries that had "elective" stated as the indication were similar to that for uncomplicated pregnancies with no recorded indication. Therefore, we combined elective cesarean deliveries and labor inductions with no other complications noted in the medical record along with deliveries without a recorded indication into the no recorded indication category.

The incidences of neonatal outcomes for the specific delivery precursors by gestational week were calculated. Neonatal outcomes included neonatal intensive care unit (NICU) admission; respiratory morbidity; sepsis or evaluation to rule out sepsis; hypoxic ischemic encephalopathy, asphyxia, or seizures; and birth trauma. Neonatal respiratory morbidity included any of the following conditions requiring NICU admission: oxygen therapy with nasal cannula, continuous positive airway pressure, bilevel positive airway pressure, ventilator use, or diagnosis of respiratory distress syndrome, hyaline membrane disease, pneumonia, apnea, bradycardia, pulmonary hypertension, pneumothorax, meconium aspiration, or pulmonary hypoplasia. Birth trauma included epicranial subaponeurotic hemorrhage, scalp injury, clavicular fracture, facial nerve or brachial plexus injury, other cranial or peripheral nerves injuries, and other specified or unspecified birth trauma. Composite neonatal morbidity, which included NICU admission, respiratory morbidity, sepsis or evaluation to rule out sepsis, neurologic morbidity, and birth trauma was calculated at each week gestational age for each major precursor. Because cesarean delivery is an independent risk factor for respiratory morbidity,[19] we compared estimates of planned and actual route of delivery on neonatal respiratory morbidity by gestational age at delivery and precursor.

Characteristics of mothers and newborns according to precursor for delivery were calculated for early term (37-38 6/7 weeks) and full term (39-41 6/7 weeks) birth. Significance testing was performed to compare characteristics across the 4 major precursors of early term birth using either ordinal (categoric variables) or logistic (binary variables) regression with generalized estimating equations (GEE) to account for correlations between pregnancies to the same mother. The rates of deliveries for each gestational week were calculated according to precursor with significance testing performed using generalized linear models with GEE. Deliveries with anomalies (n = 11,559) and antepartum stillbirth before onset of labor (n = 228) were then excluded. There were 7 deliveries associated with both anomalies and stillbirth leaving 177,029 deliveries in our analyses of morbidities. The neonatal morbidity rates for each precursor were calculated for each gestational week at delivery and tested for significance using generalized linear models with GEE to obtain a global P value with contrast statements to calculate for significant differences between individual

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