OBSTETRICS

The risk of fetal death: current concepts of best gestational age for delivery

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OBJECTIVE: To compare the risk of fetal death (FD) between 34 and 41 weeks' gestational age (GA) with the neonatal mortality rate to examine the best GA for delivery.

STUDY DESIGN: Linked birth and infant death data for the US from the National Center for Health Statistics analyzed nonanomalous singleton pregnancies between 2003 and 2005. Pregnancies were classified as high risk or low risk based on preexisting maternal complications. Outcomes of 8,785,132 live births and 12,777 FDs between 34 and 42 completed weeks' gestation were examined. The risk of FD was determined using the following equation:

$$\frac{\#\text{ FD that occurred at a given GA} + \text{all FD that occurred after that GA}}{\text{Total deliveries at a given GA} + \text{all remaining undelivered pregnancies}}$$

The FD risk of those remaining undelivered was compared with the neonatal death rate for each week of gestation.

RESULTS: Between 34 and 40 weeks' gestation, the FD risk of those remaining undelivered for all pregnancies declined and then increased at term. For high risk pregnancies, the FD risk of those remaining undelivered is substantially higher than for low risk pregnancies. The number of FDs that can be avoided by delivery exceeds the neonatal death rate between 37 and 38 weeks' gestation in low risk pregnancies and at 36 weeks' gestation in high risk pregnancies.

CONCLUSION: These findings suggest that delivery at 39 weeks' gestation in both high and low risk pregnancies would result in an increased number of perinatal deaths. Decisions regarding the "optimal time for delivery" should include the risk of remaining undelivered.

Key words: fetal death, gestational age for delivery, stillbirth risk

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For over a century, investigators have reported on the adverse outcomes related to premature birth. To date, most of the improvements in outcomes related to prematurity have overwhelmingly been accomplished because of advances in neonatal care. As the frequency of preterm birth has remained stubbornly high in the United States,[1] there has been a shift in focus to reducing "iatrogenic" preterm birth, particularly in the late preterm (34-36 weeks' gestation) and early term (37-38 weeks' gestation) period of pregnancy.[2-5] Several recent publications have reported on gestational age (GA)-specific neonatal morbidities using large newborn cohorts, and have demonstrated that neonatal morbidities progressively fall as GA advances, reaching a nadir at 38-39 weeks' gestation.[6-10] As a result, a consensus has emerged that 39 weeks may be the "optimal" time for delivery.[8-13] Unfortunately, these recent reports, and their subsequent conclusions, do not address the essential corollary question: What are the fetal risks of remaining undelivered?

Despite the reality that there is an inherent risk of stillbirth for any gravida that remains undelivered, this fact has not received as much attention from either clinicians or investigators as neonatal outcomes have received. Over the past 20 years, we and others, have reported on the increasing rise of stillbirth over the last trimester of pregnancy.[14-19] The recent focus on examining neonatal outcomes alone for pregnancies in the late preterm and early term period, does not completely address the policy of "later is better" and adverse fetal outcomes, including fetal death (FD). In 2011, following a National Institute of Child Health and Human Development (NICHD) sponsored national workshop titled "Timing of Indicated Late Pre-Term and Early Term Deliveries," Spong et al[20] acknowledged that certain high risk conditions might warrant earlier delivery. Those recommendations, however, were based largely on "expert opinion and consensus."

The purpose of this study is to examine the risks of delivery vs nondelivery by comparing the risk of death for those fetuses remaining undelivered with the rate of neonatal death using the most recent data from the National Center for Health Statistics (NCHS). The approach of combining an analysis of population-based data of *both* fetal and neonatal deaths provides more complete data to determine the "optimal gestational age for delivery."

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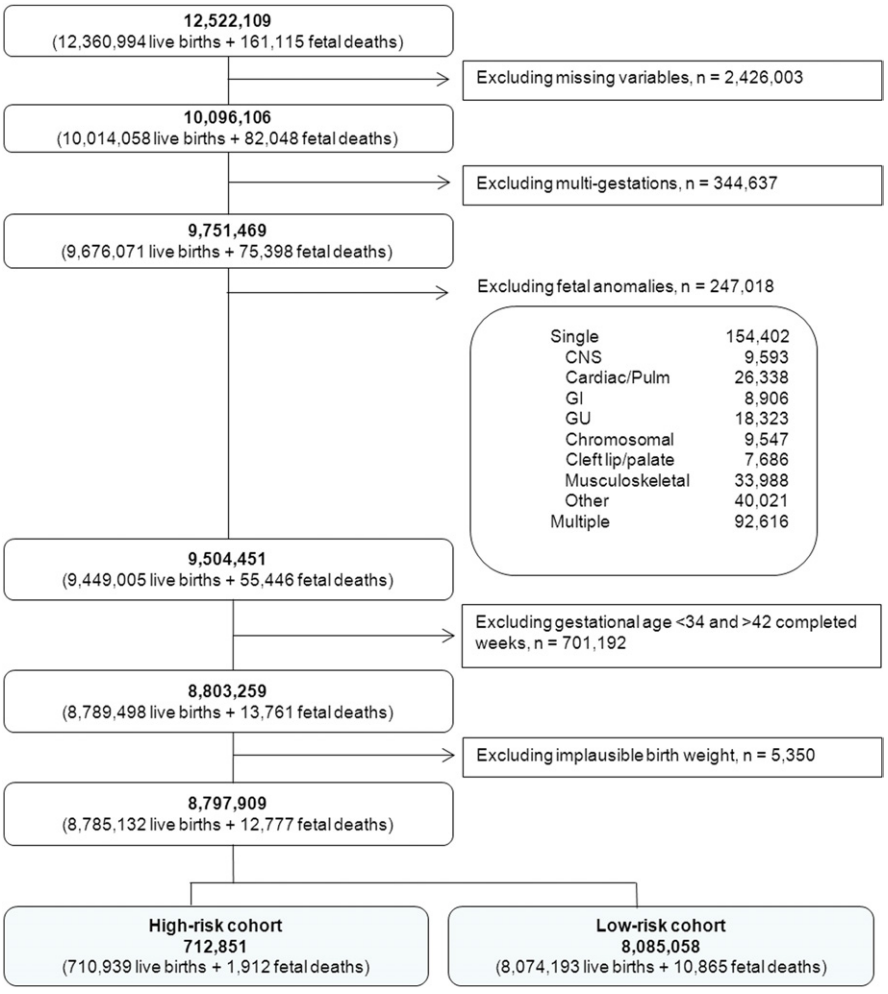
FIGURE 1
Cohort selection



Analyses were limited to singleton pregnancies delivered between 34 and 42 completed weeks' gestation. Multifetal gestations, fetal anomalies, cases with a birthweight inconsistent with the recorded gestational age (GA)[21] and cases with missing or unknown variables were excluded.

CNS, central nervous system; *GI*, gastrointestinal; *GU*, genitourinary.

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Materials and Methods

This is a retrospective cohort analysis of the NCHS files on FD data and cohort-linked birth and infant death data for 2003-2005. Analyses were limited to singleton pregnancies delivered between 34 and 42 completed weeks' gestation. Multifetal gestations, fetal anomalies, and cases with missing or unknown variables for fetal anomalies or maternal medical conditions were excluded. In addition, cases with a birthweight inconsistent with the recorded GA were excluded according to the methods previously reported by Alexander et al.[21] A summary of the cases excluded based on these criteria are presented in Figure 1. For the remaining pregnancies, we estimated the risk of FD that could be avoided by delivery of all subjects at a given GA according to the following equation:

$$\frac{\#\text{ FD that occurred at a given GA} + \text{all FD that occurred after that GA}}{\text{Total deliveries at a given GA} + \text{all remaining undelivered pregnancies}}$$

This estimate of the FDs that could be avoided by delivery (the FD risk for those remaining: FDRRe) was then compared with the calculated neonatal death rate at each GA. As the neonatal death rate (NDR) is presumably fixed for a GA, this does not require adjustment for the number of deliveries that would theoretically occur for a particular week. A comparison of these 2 rates was made to estimate at what GA delivery would minimize the risk of a perinatal death.

To evaluate the impact of maternal disease on the risk of FD, cases were then categorized as either low risk (LR) or high risk (HR). Cases were designated as HR if any of the following preexisting maternal conditions were present: anemia, cardiac disease, lung disease, diabetes mellitus, hemoglobinopathy, chronic hypertension, renal disease, or Rh sensitization. Pregnancies without any of these conditions were considered LR. Pregnancy-related complications (gestational diabetes, abruption, preeclampsia) were not used to designate subjects as HR for this analysis. Estimates of FD risk remaining per thousand were made as described in the above *Materials and Methods* and were compared with the corresponding NDR for both HR and LR subjects.

Best-fit trend lines were generated according to the R^2 values. All data were analyzed using IBM SPSS Statistics 20 (SPSS, Inc., Chicago, IL). This study was approved by our institution's institutional review board.

Results

From 2003-2005, a total of 12,522,109 deliveries occurred in the United States, of which there were 12,360,994 live births and 161,115 FDs. Figure 1 depicts the number of deliveries that were excluded from this analysis because of the previously listed criteria. A total of 8,797,909 deliveries were used for our primary analysis with 8,785,132 (99.9%) live births and 12,777 (0.1%) FDs. These deliveries were further divided into HR and LR cohorts based on the presence or absence of preexisting maternal medical conditions. The HR cohort contained 712,851 deliveries (8.1% of total), of which 710,939 (99.7%) were live births and 1912 (0.3%) were FDs. The LR cohort contained 8,085,058 deliveries (91.9% of total) encompassing 8,074,193 (99.9%) live births and 10,865 (0.1%) FDs.