OBSTETRICS

Labor outcome at extremely advanced maternal age

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BACKGROUND: Women of advanced maternal age (AMA) are at increased risk for cesarean delivery compared to non-AMA women. However, it is unclear whether this association is altered by parity and the presence or absence of a trial of labor.

OBJECTIVE: We sought to examine modes of delivery and maternal outcomes among AMA women stratified by parity and the presence or absence of a trial of labor.

STUDY DESIGN: This is a retrospective cohort study of all women delivering singletons births at ≥20 weeks' gestation in the state of California from 2007 through 2011. Data were extracted from maternal discharge data linked to infant birth certificate records. We compared non-AMA women (age 20-34 years, reference group) to AMA women who were classified as follows: age 35-39, 40-44, 45-49, and ≥50 years). The primary outcome was route of delivery (cesarean vs vaginal) stratified by parity and whether a trial of labor occurred (prelabor vs intrapartum cesarean delivery). The association between a trial of labor and perinatal morbidity was also studied.

RESULTS: There were 1,346,889 women who met inclusion criteria, which included 181 (0.01%) women who were age ≥50 years at the time of delivery. Overall, 34.7% underwent a cesarean delivery and this risk differed significantly by age group (30.5%, 20-34 years; 40.5%, 35-39 years; 47.3%, 40-44 years; 55.6%, 45-49 years; 62.4%, >50 years). Nulliparous women age ≥50 years were significantly less likely to undergo a trial of labor compared to the reference group (relative risk [RR], 0.44; 95% confidence interval [CI], 0.32—0.62). Furthermore, nulliparous women age ≥50 years were significantly more likely to experience an intrapartum cesarean delivery (RR, 2.61; 95% CI, 1.31—5.20), however the majority (74%) who underwent a trial of labor experienced a vaginal delivery. Compared to the reference group, women age ≥50 years were 5 times more likely to experience severe maternal morbidity (1.7% vs 0.3%; RR, 5.08; 95% CI, 1.65—15.61) and their infants 3 times more likely to require neonatal intensive care unit admission (14.9% vs 5.2%; RR, 3.1; 95% CI, 2.2—4.4), however these outcomes were not associated significantly with having undergone a trial of labor, a cesarean delivery following labor, or a prelabor cesarean delivery. Similar trends were observed among multiparous women.

CONCLUSION: Compared to non-AMA women, women age ≥50 years with a singleton pregnancy experience significantly higher rates of cesarean delivery. However the majority of those who undergo a trial of labor will have a vaginal delivery. Neither a trial of labor nor a prelabor cesarean delivery is significantly associated with maternal or neonatal morbidity. These data support either approach in women of extremely AMA.

Key words: advanced maternal age, cesarean delivery, extreme advanced maternal age, trial of labor

Introduction

Advanced maternal age (AMA) has been historically defined as being ≥35 years at the time of delivery and is associated with a variety of adverse obstetric outcomes.[1-3] Assisted reproductive technologies have made pregnancy in the fifth and sixth decades of life possible and have shifted the demographics of women delivering at these ages from grand multiparous women to a more affluent, nulliparous population.[4,5] This also has led to use of terms like very AMA and extreme AMA to describe women delivering at ages 45-49 and ≥50 years, respectively.[6,7]

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AMA is an independent risk factor for cesarean delivery[8] and women age ≥45 years have a 7-fold increase in the risk of cesarean delivery compared to women age <30 years.[5] While much fewer in number, some studies suggest that in women age ≥50 years this risk may be as high as 100%.[4] These findings are significant in that there is biologic plausibility that the perimenopausal uterus functions differently in labor, contributing to labor dysfunction and ultimately the need for a cesarean delivery.[9-11] Given this suggested poor prognosis for vaginal delivery among women age ≥50 years, it is not surprising that reported rates of cesarean delivery on maternal request are very high.[4] Furthermore this poor prognosis for vaginal delivery may prompt some providers to counsel women age ≥50 years not to undergo a trial of labor.

Unfortunately, very few studies stratify the risk of cesarean delivery by parity and even fewer studies report whether a trial of labor was attempted.[12] We assert that to assess the risk of cesarean delivery and counsel women age ≥50 years appropriately regarding their options for delivery, the denominator must include all women who undergo a trial of labor. Furthermore, given significant differences in the risk of cesarean delivery between nulliparous and multiparous women, stratification of these risks by parity should occur.[13] The objective of this study is to examine the risk of cesarean delivery by parity and by whether a trial of labor was attempted. Furthermore we aim to assess whether a trial of labor and its outcome are associated with maternal or neonatal morbidity.

Materials and Methods

This is a retrospective cohort study of all women delivering live births at ≥20 weeks' gestation in the state of California From Jan. 1, 2007, through Dec. 31,

2011. Data were derived from the California birth cohort, a database linking maternal and pregnancy characteristics from the California Vital Statistics birth records to delivery and hospitalization information found in the Office of Statewide Health and Planning maternal and infant hospital discharge data. Over 96% of records have been linked successfully and this process is described extensively elsewhere.[14] The institutional review board at Stanford University exempted this study.

Women age ≥20 years with a singleton pregnancy were included in the study. Excluded were women with multiple gestations and whose records lacked information regarding parity, delivery method, or whether a trial of labor occurred. Because women age ≥35 years have been historically described as being of AMA, we compared non-AMA women (age 20-34 years, the reference group) to AMA women. AMA women were further subdivided into 4 age groups (35-39, 40-44, 45-49, and ≥50 years) to better describe trends in cesarean delivery and a trial of labor with AMA and to examine specifically the subgroup of women age ≥50 years.

The primary outcome was the risk of cesarean delivery following a trial of labor or "intrapartum" cesarean delivery. The total and prelabor cesarean delivery risks were also reported and all risks were stratified by parity. Information regarding a trial of labor was derived from the birth certificate data. A prelabor cesarean included the following outcomes for the variable "delivery method": "cesarean—primary," "cesarean—primary, vacuum," "cesarean—repeat," and "cesarean—repeat, vacuum." An intrapartum cesarean included the following outcomes: "cesarean—primary, with trial of labor attempted," "cesarean—repeat, with trial of labor attempted," "cesarean—repeat, vacuum, with trial of labor attempted," and all outcomes labeled "vaginal" as a trial of labor is required to precede a vaginal delivery. Specific indications for cesarean delivery were not available in the data set. Therefore, in an attempt to distinguish between cesarean delivery on maternal request ("elective") and an "indicated" prelabor cesarean delivery, we examined the frequencies of pregnancy complications associated with indicated prelabor cesarean delivery present in the data set, specifically nonvertex presentation and placenta previa.

In addition to basic demographic and clinical characteristics, several obstetric and clinical outcomes were examined: gestational age at delivery and preterm delivery, gestational diabetes, development of any new hypertensive disorders during pregnancy (defined as new-onset blood pressure of ≥140/90 mm Hg at ≥20 weeks), any hypertensive disorder during pregnancy (including chronic hypertension), nonvertex fetal presentation, and placenta previa. Neonatal outcomes included birth injury (skeletal fracture, peripheral nerve injury, soft tissue or solid organ hemorrhage requiring intervention), neonatal intensive care unit (NICU) admission, and seizure or serious neurological dysfunction.

Finally, severe maternal morbidity (SMM) was examined using the methods described by Kuklina et al[15] and Callaghan et al.[16] SMM was defined by *International Classification of Diseases, Ninth Revision* or birth certificate codes if the length of stay for the delivery hospitalization was ≥90th percentile for the route of delivery and if any of the following occurred: postpartum hemorrhage, maternal sepsis, deep vein thrombosis, pulmonary embolism, uterine rupture, respiratory failure, heart failure, puerperal cerebral vascular accident, severe anesthetic complication, maternal shock, disseminated intravascular coagulation, or renal failure. SMM also was designated as occurring regardless of length of stay if *International Classification of Diseases, Ninth Revision* or birth certificate codes indicated any of the following: hysterectomy, ventilation, unplanned return to operating room, transfer to the intensive care unit, or maternal death.

All statistical analyses were performed using SAS software (version 9.4; SAS Institute Inc, Cary, NC). The χ^2 or Fisher exact tests were used to analyze categorical variables where appropriate and Student *t* test or Mann-Whitney *U* test were used to analyze continuous variables depending on their distributions. Multivariable logistic regression was performed to examine covariates associated with SMM and NICU admission in women age ≥45 years. Women aged ≥50 years were analyzed together with women age 45-49 years because few women age ≥50 years were identified with SMM or had infants requiring NICU admission. We identified risk factors for SMM and neonatal morbidity using a manual backward elimination model selection that retained only those covariates that were significant at the .05 significance level. Relative risks were determined, all tests were 2-tailed, and a *P* value of <.05 was considered statistically significant.

Results

From Jan. 1, 2007, through Dec. 31, 2011, there were 1,392,150 women age ≥20 years who delivered either 1 or 2 infants. Excluded were 1135 women (0.08%) who lacked information regarding parity and 1 woman who lacked information about trial of labor and route of delivery, leaving 1,391,014 women without missing data. The percentage of twin pregnancies within this cohort increased significantly with age group: 2.8% of women 20-34 years, 4.6% of women 35-39 years, 5.6% of women 40-44 years, 23.1% of women 45-49 years, and 45.3% of women age ≥50 years (*P* for trend <.001). After excluding twin pregnancies, the final cohort consisted of 1,346,889 women with 181 women age ≥50 years. The percentages by age group were as follows: 80.7% of women were 20-34 years, 15.4% of women were 35-39 years, 3.7% of women were 40-44 years, 0.2% of women were 45-49 years, and 0.01% of women were ≥50 years.

Table 1 presents basic maternal and obstetric characteristics across age groups and comparing women age ≥50 years to the reference group (age 20-34 years). Women who were age ≥50 years were more likely to be Caucasian, have undergone infertility treatment, and enter pregnancy with chronic hypertension or type 2 diabetes. In addition, they were less likely to have public insurance and experience labor. Finally, their pregnancies were more likely to be