OBSTETRICS

Gestational age–specific severe maternal morbidity associated with labor induction

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OBJECTIVE: The purpose of this study was to examine the association between labor induction and gestational age–specific severe maternal morbidity.

STUDY DESIGN: Our study was restricted to women who delivered singletons at 37-42 weeks' gestation who had no pregnancy complications from 2003-2010 (n = 1,601,253) in Canada (excluding Quebec). Using a pregnancies-at-risk approach, the week-specific rates of specific morbidity after induction were contrasted with rates among ongoing pregnancies. Logistic regression was used to adjust for confounders.

RESULTS: Induction increased the rate of postpartum hemorrhage that required blood transfusion at 38 weeks' gestation (adjusted rate ratio, 1.28; 95% confidence interval, 1.11–1.49) and 39 weeks' gestation (adjusted rate ratio, 1.21; 95% confidence interval, 1.06–1.38). Induction was also associated with higher rates of pueperal sepsis at 38 and 39 weeks' gestation and venous thromboembolism at 38 weeks' gestation. The absolute increase in morbidity rates was small; the number needed to harm was large (eg, 1270 for postpartum hemorrhage with blood transfusion at 38 weeks' gestation).

CONCLUSION: Among women without pregnancy complications, induction at earlier term is associated with higher rates of specific severe maternal morbidity, although absolute risks are low.

Key words: labor induction, pregnancy complication, severe maternal morbidity

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Induction of labor is used widely to prevent adverse maternal, fetal, and infant outcomes.[1] Currently, 22.5% of deliveries in the United States and

★ EDITORS' CHOICE ★

22.3% of deliveries in Canada occur after labor induction, with substantial variation across hospitals and regions.[2,3] Although induction of labor generally is considered to be safe, associated problems include prolonged labor,

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chorioamnionitis, fetal death, and uterine rupture.[1,4-8] Perhaps the most common concern that has been related to labor induction in the past was its reported association with cesarean delivery.[9-14] In fact, randomized controlled trials and metaanalyses of randomized trials of selected subgroups (including women with hypertension and women at or beyond term) have concluded that cesarean delivery rates are not increased after labor induction.[6,7,15,16]

Reported associations between labor induction and adverse pregnancy outcomes are based largely on observational studies that compare induction with the spontaneous onset of labor.[12-14] However, several researchers have highlighted the methodologic flaws that are inherent in a comparison of labor induction with spontaneous onset of labor at the same gestational age.[16-18] A more appropriate comparison group for the assessment of the effects of labor induction is constituted by ongoing pregnancies (at each gestational age and risk status) who are not induced (ie, those who are treated with expectant management instead, including those who are induced at later gestational ages).[15-20] We therefore carried out a study to examine the gestational age–specific effects of labor induction on specific subtypes of associated severe obstetric morbidity among women without pregnancy complications by comparing women who were induced with similar women who were treated expectantly.

Materials and Methods

The study was based on hospital records that were collated in the Discharge Abstract Database of the Canadian Institute for Health Information for fiscal years 2003-2004 to 2010-2011. Data on hospitalizations that occurred in Quebec were not included, because comparable information for this province is not contained in the Discharge Abstract Database. The Discharge Abstract Database includes all maternal hospital admissions for delivery and their linked newborn infant admissions; hospital deliveries accounted for >98% of all births in the study jurisdictions.[3] Obstetric deliveries were identified with the use of a prespecified algorithm of diagnostic codes that had been validated previously by the Canadian Perinatal Surveillance System.[3,21]

Hospital medical archivists extracted the hospital discharge data, including age, parity, date of admission, home postal code (first 3 digits), clinical estimate of gestational age at delivery, province of hospital delivery, province that issued the health care insurance, date and status at discharge, principal diagnosis, up to 24 secondary diagnoses (coded according to the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada [ICD-10 CA]) and up to 25 diagnostic, therapeutic, and surgical procedures (coded according to the Canadian Classification of Health Interventions).[3] Information in the database had been validated previously and extensively used in perinatal health surveillance and research.[3,21-24]

Induction was defined as the use of oxytocin or prostaglandin to initiate labor and identified in the database by specific Canadian Classification of Health Interventions procedure codes. To reduce the potential for confounding of associations between induction and maternal morbidity by the clinical indication for the induction, we restricted our analysis to women without pregnancy complications. The study was restricted to women who had a singleton, vertex delivery at 37-42 completed weeks' gestation (ie, 37 weeks to 42 weeks 6 days gestation) with no previous cesarean delivery and no medical/obstetric diagnoses such as grand multiparity (≥5 previous viable pregnancies), preeclampsia, preexisting/gestational hypertensive disease, preexisting/gestational diabetes mellitus, antepartum hemorrhage, chorioamnionitis, oligohydramnios, or polyhydramnios, abruption or premature separation of the placenta, anemia, heart disease, herpes, HIV disease, pulmonary disease, systemic lupus erythematosus, chronic renal abnormalities, infant macrosomia (>4000 g) or intrauterine fetal death, fetal growth restriction, or antepartum intensive care unit (ICU) admission.[1,3,6,9,25] ICU admission was defined with the specific codes that were available in the database.

The primary outcomes of interest were selected: specific subtypes of severe maternal morbidity that included postpartum hemorrhage that required blood transfusion, puerperal sepsis, uterine rupture during labor, postpartum ICU admission, venous thromboembolism, and obstetric shock. These outcomes were chosen to further reduce the potential for confounding by the indication for induction; such maternal morbidity is an unintended consequence of labor induction and hence is likely to be unrelated to the reason for induction.[26,27] For the same reason, cases with these outcomes were identified only if they arose in the postpartum period (eg, venous thromboembolism in the postpartum period); cases with the same severe maternal morbidity with an antepartum onset (and thus a potential indication for labor induction) were not included in the study. This restriction to postpartum cases of severe maternal morbidity was carried out with the sixth digit of the *International Statistical Classification of Diseases* code.

We first examined the differences in rates of maternal characteristics (eg, maternal age, parity, epidural use, gestational age at delivery) and specific severe maternal morbidity rates among women without pregnancy complications who had induction of labor and those who did not. This was followed by analyses of the more appropriate contrast between women who were induced and those women who were treated expectantly. Induction of labor at 37, 38, 39, 40, 41, and 42 weeks' gestation was compared with expectant management of pregnancy beyond each of these gestational ages. For instance, the effect of induction of labor at 37 weeks' gestation (ie, 37 weeks to 37 weeks 6 days gestation) was studied by contrasting women who delivered after induced labor at 37 weeks' gestation (induction of labor group) with all women who carried their pregnancy >37 weeks' gestation (ie, to ≥38 weeks' gestation; expectant management group). Similar comparison groups were created for women with labor induction at 38, 39, 40, 41, and 42 weeks' gestation (Figure).