

Elective Induction of Labor in the 39th Week of Gestation Compared With Expectant Management of Low-Risk Multiparous Women

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OBJECTIVE: To compare perinatal and maternal outcomes in low-risk multiparous women who underwent elective induction of labor in the 39th week of gestation with those who were expectantly managed.

METHODS: We performed a single center retrospective cohort study of low-risk multiparous women delivering nonanomalous singletons between 39 and 42 completed weeks of gestation from 2014 to 2018. The primary outcome was a perinatal composite of death, neonatal respiratory support, a 5-minute Apgar score of 3 or less, and shoulder dystocia. Groups were compared using χ^2 , Fisher exact, two sample *t*-test, and Wilcoxon rank sum tests, as appropriate. Multivariable logistic regression models were used to adjust for potential confounders.

RESULTS: Of the 3,703 low-risk multiparous women meeting inclusion criteria, 453 (12%) delivered between 39 0/7 and 39 4/7 after an elective induction of labor. Women who underwent elective induction of labor were more likely to be privately insured, non-Hispanic, and weigh more at their first prenatal visit (all $P < .01$) compared with expectant management. An elective induction of labor was associated with decreased frequency

of the perinatal composite morbidity (4.0% vs 7.1%; adjusted odds ratio [aOR] 0.57, 95% CI 0.34–0.96) compared with expectant management. Fewer cesarean deliveries occurred among women in the elective induction of labor group (5.1% vs 6.6%; aOR 0.60, 95% CI 0.37–0.97). Other maternal outcomes (hypertensive disorders, chorioamnionitis, and operative vaginal deliveries) as well as neonatal intensive care unit admissions were not different between groups.

CONCLUSION: Elective induction of labor in low-risk multiparous women in the 39th week of gestation was associated with decreased perinatal morbidity and a lower frequency of cesarean delivery compared with expectant management.

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The ARRIVE trial was a U.S. multicenter randomized controlled trial conducted at 41 hospitals through the Maternal-Fetal Medicine Units Network.¹ Low-risk nulliparous women were randomized to either elective induction of labor, defined as induction of labor between 39 0/7 and 39 4/7 weeks of gestation, or expectant management. Although there was no significant difference in the primary composite outcome of perinatal death or severe neonatal complications between the elective induction of labor (eIOL) and expectant management (EM) groups (4.3% vs 5.4%, relative risk 0.80, 95% CI 0.64–1.00), the frequency of cesarean delivery was significantly lower in women allocated to induction (18.6% vs 22.2%, relative risk 0.84, 95% CI 0.76–0.93).

Few studies focus on perinatal and maternal outcomes among low-risk multiparous women undergoing elective induction of labor compared with expectant management. The available data are further

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limited by considerable heterogeneity in the populations studied, comparison groups, and the gestational age at elective induction.²⁻⁴ Available observational data suggest that elective induction of labor may reduce cesarean delivery rates among multiparous women. However, the association of elective induction of labor and perinatal outcomes is less clear, largely due to a wide variety of reported perinatal outcomes.^{2,3,5,6} Therefore, our objective was to compare perinatal and maternal outcomes among low-risk multiparous women undergoing elective induction of labor in the 39th week to the outcomes of those who were expectantly managed.

METHODS

Institutional review board approval from the University of Alabama at Birmingham was obtained prior to initiation of this retrospective cohort study. We queried our perinatal database for low-risk multiparous women who delivered a singleton between 39 0/7 and 42 6/7 weeks of gestation at the University of Alabama at Birmingham Hospital from 2014 to 2018 in accordance with STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.⁷ Data from the study time period were extracted from the electronic medical records database. Because group assignment was the cornerstone of this study, the lead author reviewed 20% of the admission histories and physicals to confirm eIOL or EM group assignment.

Inclusion and exclusion criteria were modeled after the ARRIVE trial¹ with the exclusion of any patient with a medical or obstetric factor that would indicate delivery by 39 weeks of gestation. Women were excluded from the study if they had any of the following: prior cesarean delivery, prior uterine incision, contraindication to labor, major fetal anomaly, abnormal placentation, medical comorbidities including pregestational diabetes, gestational diabetes, lupus, any hypertensive disorder before 39 weeks of gestation, cardiac disease, and renal disease. Women not excluded according to the criteria above were considered low-risk.

The comparison groups were elective induction of labor and expectant management. We defined elective induction of labor as delivery between 39 0/7 and 39 4/7 weeks of gestation as a result of an induction of labor without a documented medical or obstetric indication; this window was chosen to mirror the window of elective induction of labor in the ARRIVE trial. Multiparous women who delivered between 39 5/7 and 42 6/7 weeks of gestation were assigned to the EM group.

Induction of labor at our institution is protocol based. Typically, cervical ripening for an unfavorable Bishop score is performed using a transcervical Foley catheter that is inflated with 30 mL of normal saline and taped to the inner thigh with traction. Oxytocin may be started concurrently or after Foley catheter expulsion. We routinely allow 18 hours of oxytocin with ruptured membranes in the latent phase (prior to 6 centimeters) before diagnosing a failed induction of labor in accordance with American College of Obstetricians and Gynecologists and Society for Maternal-Fetal Medicine consensus guidelines.⁸ Similarly, a minimum of two hours of complete dilation and pushing (three hours, if epidural) is allowed in the absence of contraindications before performing a cesarean delivery for arrest of descent.

The primary outcome was an adverse perinatal composite including death, which was defined as an intrauterine fetal demise or immediate neonatal death; neonatal respiratory support defined as supplemental oxygen or intubation in the delivery room; 5-minute Apgar score of 3 or less; and shoulder dystocia, defined by national standards⁹ and requiring, at minimum, that the McRoberts maneuver was employed, as documented on the delivery note by an attending obstetrician-gynecologist (ob-gyn) or maternal-fetal medicine specialist. We assessed a variety of secondary outcomes, including obstetric triage and office visits at 39 weeks of gestation or more.

Characteristics were compared between the eIOL and EM study groups. Differences were evaluated using χ^2 or Fisher exact test for categorical variables, and *t*-test or Wilcoxon rank sum test for continuous variables, as appropriate. Primary and secondary outcomes were investigated using multivariable logistic regression models to adjust for clinically relevant characteristics. Stratified analyses were performed investigating potential interactions by parity and first pregnancy weight. *P* values less than 0.05 were deemed statistically significant; no adjustments were made for multiple comparisons. SAS 9.4 was used to analyze data.

RESULTS

Of 6,644 deliveries to multiparous women from 2014 to 2018, 3,703 low-risk multiparous women met inclusion criteria reaching 39 weeks of gestation; 1,529 delivered between 39 0/7 and 39 4/7 weeks, and 2,174 delivered at 39 5/7 weeks or greater (Fig. 1). Of the 1,529 women who delivered between 39 0/7 and 39 4/7 weeks of gestation, 880 were excluded owing to spontaneous labor and 196 were excluded



owing to induction for a medical or obstetric indication, resulting in 453 women without a discernible delivery indication in the eIOL group. The 2,174 women who delivered at 39 5/7 weeks of gestation or more were therefore considered the EM group. In the EM group, 510 (23%), 1,253 (58%), 407 (19%), and 4 (0.2%) women delivered by 39, 40, 41, and 42 completed weeks of gestation, respectively.

Maternal age on average was higher in the eIOL group, as was first pregnancy weight. Additionally, significantly more women in the eIOL group were of private payer status and initiated prenatal care before 21 weeks of gestation (Table 1). Women in the EM group were significantly more likely to be of Hispanic ethnicity. Gestational age at delivery was approximately 1 week earlier in the eIOL group (39.2 ± 0.2 vs 40.4 ± 0.5 weeks of gestation; $P < .01$, Table 1).

The primary perinatal outcome composite was significantly more frequent in women who were expectantly managed compared with those undergoing elective induction of labor (4.0 vs 7.1%, adjusted odds ratio [aOR] 0.57, 95% CI 0.34–0.96, Table 2).

The primary composite analysis was repeated excluding shoulder dystocia and demonstrated a nonsignificant reduction of the perinatal composite (aOR 0.45, 95% CI 0.13–1.51). There were three cases of stillbirth in the EM group and none in the eIOL group. There were significantly fewer cesarean deliveries in the eIOL compared with the EM group (5.1% vs 6.6%, aOR 0.60, 95% CI 0.37–0.97).

There were no significant differences in hypertensive disorders of pregnancy, chorioamnionitis or operative vaginal deliveries between groups. Neonates of women undergoing elective induction of labor were smaller and less likely to be macrosomic than neonates of women who were expectantly managed. However, frequency of neonatal intensive care unit admission was not different. Furthermore, although resource utilization as defined by triage visits at 39 weeks of gestation or more was similar between groups, women undergoing expectant management had significantly more office visits at or beyond 39 weeks of gestation than did those in the eIOL group (Table 2).

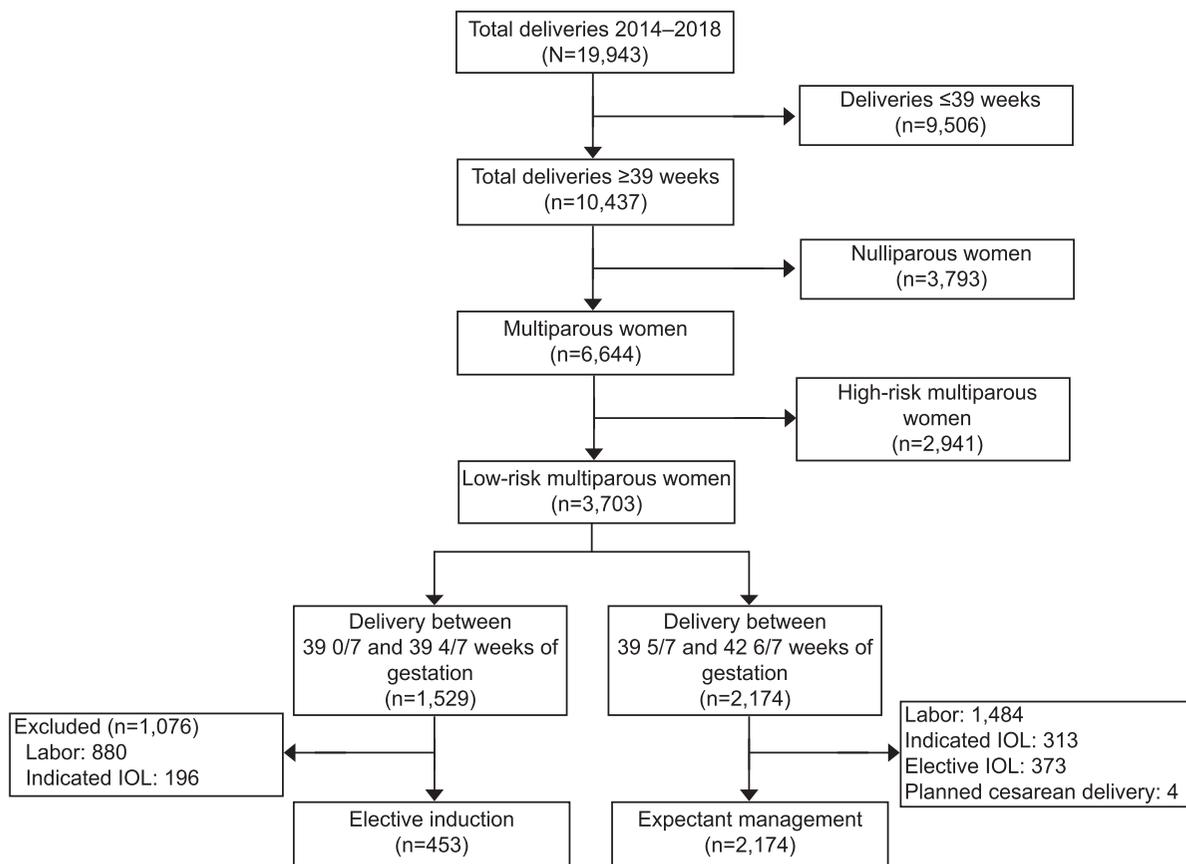


Fig. 1. Flow diagram depicting the elective induction of labor and expectant management cohorts. IOL, induction of labor. Sinkey. Labor Induction in Low-Risk Multiparous Women. *Obstet Gynecol* 2019.



Table 1. Baseline Characteristics of the Study Cohort

Characteristic	eIOL Group (n=453)	EM Group (n=2,174)	P
Gestational age at delivery (wk)	39.2±0.2	40.4±0.5	<.01
Maternal age (y)*	29.4±5.3	28.6±5.2	<.01
Age 35 or older*	74 (16.4)	307 (14.2)	.22
Race			.77
African American	197 (43.5)	919 (42.3)	
Caucasian	242 (53.4)	1,175 (54.1)	
Other	14 (3.1)	80 (3.7)	
Ethnicity			<.01
Hispanic	19 (4.2)	641 (29.5)	
Non-Hispanic	434 (95.8)	1,533 (70.5)	
Parity*			.27
1 previous delivery	135 (29.9)	593 (27.3)	
More than 1 previous delivery	317 (70.1)	1,577 (72.7)	
Married	231 (51.0)	788 (36.3)	<.01
Payer status [†]			<.01
Public	189 (43.8)	1,473 (70.2)	
Private	232 (53.7)	483 (23.0)	
Other	11 (2.6)	142 (6.8)	
No. of prenatal visits [‡]	12 (9–13)	12 (9–13)	.46
Female neonatal sex [§]	223 (49.2)	1,105 (50.9)	.52
1st pregnancy weight (kg)	79.4±23.0	75.3±19.7	<.01
Foley induction	288 (63.6)	317 (14.6)	<.01
Misoprostol induction	8 (1.8)	8 (0.4)	<.01
GA at 1st ultrasound scan or at 1st prenatal visit at least 20 wk [¶]	368 (87.2)	1,686 (80.4)	<.01

eIOL, elective induction of labor; EM, elective management; GA, gestational age.

Data are mean±SD, n (%), or median (interquartile range) unless otherwise specified.

* Missing five patients: eIOL group n=452, EM group n=2,170.

[†] Missing 97 patients: eIOL group n=432, EM group n=2,098.

[‡] Missing 125 patients: eIOL group n=419, EM group n=2,083.

[§] Missing three patients: eIOL group n=453, EM group n=2,171.

^{||} Missing 109 patients: eIOL group n=421, EM group n=2,097.

[¶] Missing 108 patients: eIOL group n=422, EM group n=2,097.

In stratified analyses, the perinatal composite occurred less frequently among women who underwent elective induction of labor and who had either one previous delivery (aOR 0.66, 95% CI 0.21–2.03) or more than one (aOR 0.55, 95% CI 0.30–0.99). The *P*-value for interaction suggested that the reduction was different by parity (*P*=.02). The primary composite did not differ by obesity, and the results for cesarean delivery did not differ by parity or obesity.

DISCUSSION

In this observational study, we found that elective induction of labor in low-risk multiparous women in the 39th week of gestation was associated with improved perinatal morbidity, fewer cesarean deliveries, and fewer obstetric clinic visits after 39 weeks compared with expectant management.

Our primary finding was a reduction in perinatal morbidity among low-risk multiparous women who were induced without an identifiable indication. Stratified analyses suggested that the reduction may be

greater among women with more than one previous delivery. The composite was driven by shoulder dystocia (not included in the ARRIVE composite): 3.3% in the eIOL group as compared with 5.8% in the EM group. In a population with a lower rate of shoulder dystocia, it is unclear whether elective induction of labor would still result in this magnitude of improved perinatal outcomes. Importantly, we did not observe a lower risk of neonatal respiratory support as was demonstrated in ARRIVE, possibly due to smaller numbers. Larger studies are needed to evaluate the association of elective induction of labor and the need for neonatal respiratory support among multiparous women.

We also found that multiparous women undergoing elective induction of labor had fewer cesarean deliveries than those who were expectantly managed. Our findings are similar to randomized data in nulliparous women¹ and observational studies in both nulliparous and multiparous women suggesting that elective induction of labor decreases the risk of cesarean delivery compared with expectant management.^{2,3,5,6,10,11}



Table 2. Outcomes in Low-Risk Multiparous Women Undergoing Elective Induction of Labor at 39 Weeks of Gestation Compared With Those Undergoing Expectant Management

Outcome	eIOL Group (n=453)	EM Group (n=2,174)	OR (95% CI)	aOR* (95% CI)
Primary outcome				
Perinatal composite [†]	18 (4.0)	155 (7.1)	0.54 (0.33–0.89)	0.57 (0.34–0.96)
Death ^{†‡}	0 (0.0)	3 (0.1)	—	—
Neonatal respiratory support	4 (0.9)	20 (0.9)	0.96 (0.33–2.82)	0.65 (0.19–2.25)
Apgar score 3 or less at 5 min [§]	0 (0.0)	12 (0.6)	—	—
Shoulder dystocia	15 (3.3)	127 (5.8)	0.55 (0.32–0.95)	0.61 (0.34–1.08)
Secondary outcomes				
Maternal outcomes				
Cesarean delivery [†]	23 (5.1)	143 (6.6)	0.76 (0.48–1.19)	0.60 (0.37–0.97)
Chorioamnionitis	9 (2.0)	47 (2.2)	0.92 (0.45–1.89)	0.79 (0.35–1.80)
Preeclampsia	1 (0.2)	42 (1.9)	0.11 (0.02–0.82)	0.20 (0.03–1.51)
Operative vaginal delivery [†]	15 (3.3)	85 (3.9)	0.84 (0.48–1.47)	0.75 (0.42–1.35)
Neonatal outcomes				
Birth weight (g) ^{¶#}	3,330.3±433.9	3,500.3±402.3	—	—
4,000 g or more [¶]	28 (6.2)	248 (11.5)	0.51 (0.34–0.76)	0.51 (0.33–0.80)
NICU admission	27 (6.0)	66 (3.0)	2.02 (1.28–3.21)	1.57 (0.96–2.58)
Resource utilization				
Triage visits at more than 39 wk of gestation	145 (32.0)	674 (31.0)	1.05 (0.84–1.30)	0.97 (0.78–1.22)
Office visits at more than 39 wk of gestation	277 (61.2)	1,544 (71.0)	0.64 (0.52–0.79)	0.69 (0.55–0.87)

Data are n (%) or mean±SD unless otherwise specified.

* aOR not computed for continuous variables; adjusted for age, Hispanic ethnicity, and first pregnancy weight.

[†] Missing one patient: eIOL group n=453, EM group n=2,173.

[‡] P>.999.

[§] Missing 12 patients: eIOL group n=451, EM group n=2,164.

^{||} P=.240.

[¶] Missing 20 patients: eIOL group n=451, EM group n=2,156.

[#] P<.001.

As expected, our results differ from studies comparing induction of labor in multiparous women to those presenting in spontaneous labor alone.^{12,13} We did not observe a lower rate of hypertensive disorders of pregnancy in association with elective induction. This may be due to both a smaller sample size and the decreased prevalence of hypertensive disorders of pregnancy in multiparous women.¹⁴

Our study has two major strengths. First, we have a robust cohort of more than 3,700 low-risk multiparous women who reached 39 weeks of gestation. Second, our contemporary cohort from 2014 to 2018 was managed by standard institutional labor induction protocols based on national standards.

There are notable limitations to our study. It is single-centered and retrospective and, thus, may not be generalizable to other patient populations. Since our composite was largely driven by shoulder dystocia, populations with a lower shoulder dystocia rate may not find improved perinatal outcomes. Cesarean deliveries may not be reduced in centers that use induction protocols that differ from those proposed by our national societies. Labor and

delivery at our institution has around-the-clock coverage by in-house maternal–fetal medicine specialists, ob-gyn specialists, and ob-gyn residents, which may reduce cesarean delivery rates and may not be generalizable to other centers with different in-house coverage. An important limitation of our study is the challenge associated with retrospective identification of elective induction of labor. We categorized women without an identified or obvious indication as having undergone elective induction of labor, but it is possible an indication was present that was not captured in our perinatal database in some instances. Our groups differed somewhat at baseline; specifically, women undergoing induction were more likely to have a private payer. Although we attempted to control for confounding variables in our multivariable logistic regression models, it is possible that certain confounders were not identified by retrospective analysis, leading to residual confounding. We used obstetric triage and office visits at 39 weeks of gestation or more as a proxy for health care utilization because these data were available in our database.



The limitations of our study notwithstanding, we observed better perinatal outcomes and fewer cesarean deliveries among low-risk multiparous women who underwent elective induction of labor in the 39th week compared with those who were expectantly managed.

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