OBSTETRICS

Oxytocin discontinuation during active labor in women who undergo labor induction

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OBJECTIVE: The purpose of this study was to determine whether there is an increase in the cesarean delivery rate in women who undergo induction when oxytocin is discontinued in the active phase of labor.

STUDY DESIGN: We conducted a prospective randomized controlled trial of women who underwent induction of labor at term; they were assigned randomly to either routine oxytocin use (routine) or oxytocin discontinuation (DC) once in active labor. Analysis was by intention to treat.

RESULTS: Two hundred fifty-two patients were eligible for study analysis: 127 patients were assigned randomly to the routine group and 125 patients were assigned randomly to the DC group. Cesarean delivery rate was similar between the groups (routine, 25.2% [n = 32] vs the DC group, 19.2% [n = 24]; $P = .25$). There was a higher chorioamnionitis rate and slightly longer active phase in those women who were assigned to the DC group. In adjusted analysis, the rate of chorioamnionitis was not different by randomization group but was explained by the duration of membrane rupture and intrauterine pressure catheter placement.

CONCLUSION: Discontinuation of oxytocin in active labor after labor induction does not increase the cesarean delivery rate significantly.

Key words: cesarean delivery, labor induction, oxytocin

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Oxytocin is the most common agent used to induce and augment labor.[1] Known benefits of oxytocin include the initiation and/or improvement of contractions to achieve labor, whereas risks include uterine overactivity, water intoxication, and, albeit rare, uterine rupture.[2-4] Despite its widespread use, optimal protocols for oxytocin use as an induction agent have not been identified.[5]

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★ EDITORS' CHOICE ★

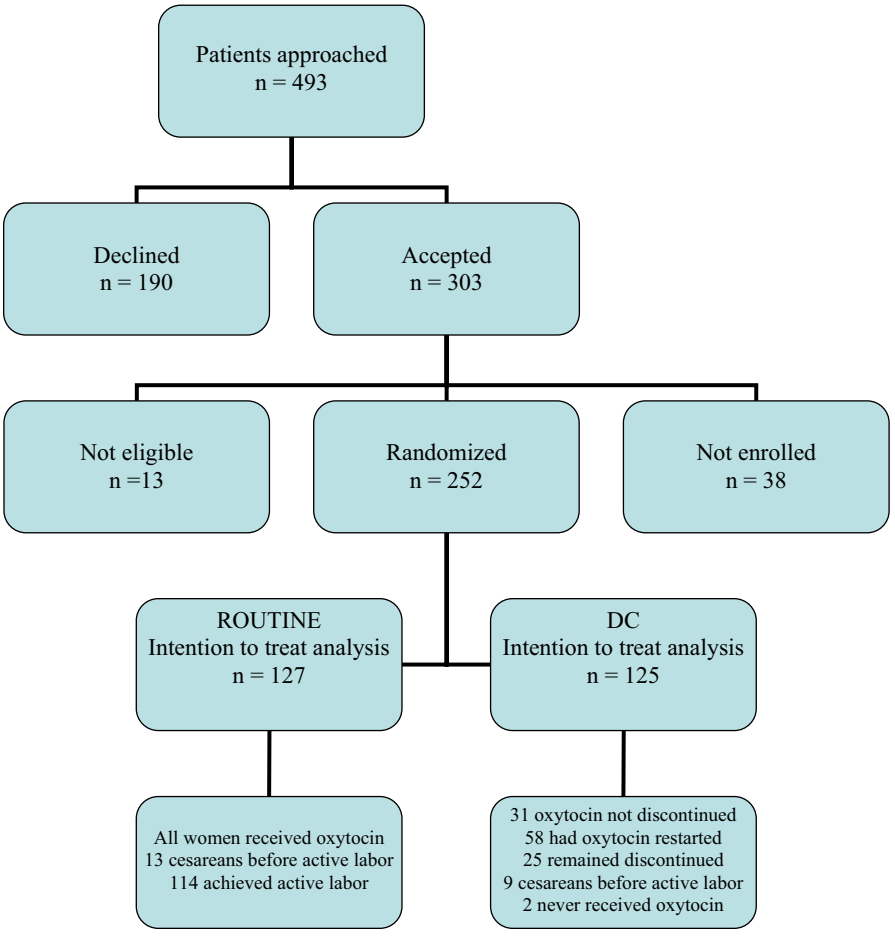
The relationship of oxytocin and its receptor is crucial in obtaining adequate uterine activity.[6] The myometrium contains receptors that are specific to oxytocin, which, when occupied, stimulate myometrial contraction and prostaglandin formation in the decidua.[7] Oxytocin receptors increase with advancing gestation, and uterine sensitivity to oxytocin increases rapidly in spontaneous labor.[8] A lower number of receptors have also been noted in women who have been given larger doses or a longer infusion of oxytocin compared with those who have been given shorter treatments or lower doses,[9,10] which suggests receptor down-regulation in this environment. As such, prolonged oxytocin use and receptor desensitization may lead to poor uterine contractility, atony,[11] and potential labor dysfunction.

Various oxytocin regimens for the induction of labor have been described,[12] although limited data are available regarding which is superior. Particularly unclear is whether oxytocin should be continued once active labor is achieved.[13] Although traditional thinking is that discontinuation of oxytocin, once labor is achieved, may prolong labor length and/or increase the cesarean delivery rate, given what is known about prolonged oxytocin use, there actually may be benefit to discontinuing oxytocin once active labor is achieved. Studies in populations with a lower cesarean rate suggest that, once active labor is achieved, oxytocin may be discontinued without altering labor progression or the cesarean delivery rate.[14,15] It is unclear whether oxytocin discontinuation would lead to a higher rate of cesarean delivery in a population such as ours. Thus, the objective of this study was to determine in our population whether there is an increase in the cesarean delivery rate in women who undergo labor induction when oxytocin is discontinued in the active phase of labor. We hypothesized that oxytocin discontinuation, once active labor is achieved, would not increase the risk of labor abnormalities or cesarean delivery.

Materials and Methods

This was a prospective randomized controlled trial of women who underwent induction of labor from February 2009 to August 2011 at Lehigh Valley Health Network. The primary outcome was the rate of cesarean delivery among women for whom oxytocin was either discontin-

FIGURE
Flow diagram



DC, oxytocin discontinuation group; *ROUTINE*, routine oxytocin use group.

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ued or continued once in active labor. Institutional review board approval was obtained, and written informed consent was obtained from participants. The trial was registered at ClinicalTrials.gov, ID NCT00957593.

Our inclusion criterion was a singleton gestation of ≥37 weeks that was scheduled for labor induction, regardless of indication for induction, Bishop score, or parity. Patients were recruited at the time of admission to Labor and Delivery. Exclusion criteria were multiple gestations, previous cesarean delivery, active labor, and documented fetal anomalies. Method of induction was at the provider's discretion. Cervical ripening before the initiation of oxytocin was allowed in the study protocol. In our institution, women whose induction requires cervical ripening undergo ripening with either misoprostol or intracervical Foley bulb placement with or without oxytocin. Women with a favorable Bishop score are induced with oxytocin alone.

At enrollment, patients were assigned randomly to either routine treatment or discontinuation (DC). The routine group followed a standard institutional oxytocin protocol in which oxytocin is titrated to target 3-5 contractions in a 10-minute period. Usual practice is to continue oxytocin until delivery, unless there is an indication to stop the infusion. The DC group followed an oxytocin protocol by which oxytocin was discontinued once the patient was deemed to be in active labor by the obstetrician. *Active labor* was defined by the clinician's assessment of regular uterine contractions with a cervical examination that confirmed dilation of ≥4 cm.[16,17]

The study's primary outcome was the difference in the rate of cesarean delivery between the groups. Secondary outcomes included the length of latent and active phases of labor and maternal and neonatal outcomes including chorioamnionitis. Chorioamnionitis was diagnosed by clinical criteria: maternal temperature of ≥100.4°F and maternal tachycardia, fetal tachycardia, or both. The decision to perform a cesarean delivery was according to standard obstetric indications and ultimately was decided by the treating physician, regardless of treatment assignment. The treating physician was able at any time to restart the oxytocin infusion in patients who assigned to the DC group if they believed it was indicated clinically.

Using a power of 80% and an alpha level of .05, we estimated that 304 women (152 in each group) would be needed to show an increase in the cesarean delivery rate from a baseline rate of 25% to 40% for women who had oxytocin discontinuation. Four-block randomization was used that was stratified for parity. For statistical analysis, we used Stata software (version 9.0 SE; StataCorp, College Station, TX). Comparisons were made with the Student *t* test or the Mann Whitney *U* test for continuous variables and χ^2 analysis or Fisher exact test for categoric variables. Multinomial logistic regression models, controlled for confounding, were developed; adjusted relative risk ratios (RRR) with 95% confidence interval (CI) were derived from the models. Statistical analysis was by intention to treat.

RESULTS

Three hundred three patients agreed to enroll in the study (Figure); 38 women did not complete the enrollment process, and 13 pregnancies were screen failures, allowing 252 patients for enrollment and participation in the study. Enrollment was stopped after 30 months primarily because of enrollment challenges. One hundred twenty-seven women (50.4%) were randomly assigned to the routine group, and 125 women (49.6%)

were randomly assigned to the DC group once active labor was achieved. Demographic and antepartum characteristics were similar between the routine group and DC groups (Table 1). There was no difference in indication for induction or method of induction between groups (Table 2). Most women were induced initially with oxytocin (77.2% in the routine group vs 72.0% in the DC group; $P = .26$). The use of Foley bulb ripening was also similar between the groups ($P = .10$; Table 2).

The primary outcome, cesarean delivery, was similar between groups (25.2% in the routine group vs 19.2% in the DC group (RR, 0.76; 95% CI, 0.48–1.21; $P = .25$; Table 3). The difference in the rate of cesarean delivery for an arrest disorder (arrest of the active phase or arrest of descent) was not significant by randomization (59.4% in the routine group vs 70.8% in the DC group; RR, 1.19; 95% CI, 0.81–1.75; $P = .38$; Table 3). Although intrapartum complications, as a whole, were similar by randomization, the rate of chorioamnionitis was higher among those who were assigned randomly to the DC group (5.5% in the routine group vs 12.8% in the DC group; $P = .05$; Table 4). Postpartum complications were similar among randomized groups (Table 4).

The median active phase of labor was longer among women who were assigned randomly to the DC group by 1 hour (3.0 hours in the routine group vs 3.9 hours in the DC group; $P = .01$; Table 3). Duration of ruptured membranes was also higher in women assigned randomly to the DC group (median, 6.1 hours in the routine group vs 8.0 hours in the DC group; $P = .01$; Table 3). Latent phase and second stage of labor duration were similar (Table 3), as were neonatal outcomes (Table 5).

Thirty-one participants (24.8%) in the DC group had the oxytocin infusion continued once active labor was achieved, despite randomization to the DC group (Figure). Data regarding rationale for this occurrence were not always available. Discussion with participating nurses and providers identified reasons for this likely to be provider preference to continue the infusion, provider being unaware that the patient was enrolled in the DC group, or a short active phase. Oxytocin was restarted in an additional 58 patients from the DC group (46.4%), which was allowed by the study protocol. Restarting oxytocin was mostly due to a lack of cervical change (44.8%) or a decrease in contraction frequency (39.7%). Among the 58 patients whose infusion was restarted, 51 women delivered vaginally (87.9%). Of the remaining 36 patients from the DC group, 9 women never achieved active labor; 2 women achieved active labor after undergoing cervical ripening alone, and 25

TABLE 1
Demographic characteristics of the patient population by randomization group

Characteristic	Group	
	Routine (n = 127)	Oxytocin discontinuation (n = 125)
Maternal age, y[a]	27.1 ± 5.6	27.7 ± 5.7
Nulliparity, n (%)	63 (49.6)	64 (51.2)
Marital status, n (%)		
Married	56 (44.1)	66 (52.8)
Divorced/widow	1 (0.8)	1 (0.8)
Never married	70 (55.1)	58 (46.4)
Race/ethnicity, n (%)		
White	86 (67.7)	82 (65.6)
African American	8 (6.3)	7 (5.6)
Latina	27 (21.3)	30 (24.0)
Other	6 (4.7)	6 (4.8)
Insurance, n (%)		
Government	52 (41.0)	45 (36.0)
Private	60 (47.2)	61 (48.8)
Self-pay	15 (11.8)	19 (15.2)
Private service vs resident service, n (%)	70 (55.1)	67 (53.6)
Tobacco use, n (%)	17 (13.4)	18 (14.4)
Alcohol use, n (%)	0	1 (0.8)
Drug use, n (%)	0	2 (1.6)
Body mass index (kg/m^2)[a]	31.7 ± 7.3	31.0 ± 7.4
Obesity: body mass index ≥30, n (%)	75 (59.1)	64 (51.2)
Pregestational diabetes mellitus, n (%)	1 (0.8)	1 (0.8)
Gestational diabetes mellitus, n (%)	14 (11.0)	17 (13.6)
Essential hypertension, n (%)	5 (3.9)	6 (4.8)
Gestational hypertension or preeclampsia, n (%)	46 (36.2)	41 (32.8)
Any comorbidity, n (%)	89 (70.6)	82 (65.6)
History of preterm birth, n (%)	3 (2.4)	8 (6.4)
Gestational age at first prenatal visit, wk[a]	12.5 ± 6.7	12.2 ± 6.1
Group B streptococcus, n (%)	34 (27.4)	24 (19.4)

Data were analyzed with the Student *t* test, the χ^2 test, and the Fisher exact test, as appropriate.

[a] Data are expressed as mean ± SD.

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TABLE 2
Admission characteristics of the patient population by randomization group

Characteristic	Group: Routine (n = 127)	Group: Oxytocin discontinuation (n = 125)	*P* value
Gestational age at admission, wk[a]	39.8 ± 1.3	40.0 ± 1.0	.18
Indication for induction of labor, n (%)			.52
Prolonged pregnancy	32 (25.2)	36 (28.8)	
Premature rupture of membranes	6 (4.7)	9 (7.2)	
Nonreassuring antenatal testing	14 (11.0)	5 (4.0)	
Oligohydramnios	14 (11.0)	12 (9.6)	
Gestational hypertension or preeclampsia	21 (16.5)	19 (15.2)	
Intrauterine growth restriction	1 (0.8)	1 (0.8)	
Diabetes mellitus, any	10 (7.9)	13 (10.4)	
Elective	19 (15.0)	15 (12.0)	
Other[b]	10 (7.9)	15 (12.0)	
First method of induction, n (%)			.26
Misoprostol	22 (17.3)	21 (16.8)	
Oxytocin	98 (77.2)	90 (72.0)	
Foley bulb and oxytocin	7 (5.5)	14 (11.2)	
Cervical ripening, n (%)	29 (22.8)	35 (28.0)	.35
Bishop score[c]	5 (0–10)	5 (0–10)	.84
Bishop score >4, n (%)	81 (63.8)	80 (64.0)	.97
Membrane status, n (%)			.84
Amniotomy	103 (81.1)	101 (80.8)	
Spontaneous rupture of membranes	15 (11.8%)	13 (10.4%)	
Premature rupture of membranes	9 (7.1%)	11 (8.8%)	

Data were analyzed with the Student *t* test, the χ^2 test, and the Fisher exact test, as appropriate.

[a] Data are expressed as mean ± SD; [b] Other indications included conditions such as intrahepatic cholestasis of pregnancy, essential hypertension, renal disease, history of abruptio placentae, history of fetal death, history of deep venous thromboembolism; [c] Data are expressed as median (range).

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women never had the oxytocin infusion restarted, of whom 84% (n = 21) delivered vaginally.

Because of the number of patients in the DC group who had oxytocin infusion continued, analyses were performed by actual treatment received (Table 6). Cesarean delivery rates were similar by actual treatment received (22.8% in those treated as routine vs 21.3% in those treated as DC; $P = .78$); the median active phase of labor was prolonged in the discontinuation group when analyzed by actual treatment received (3.0 hours when oxytocin was continued vs 4.2 hours in the group where oxytocin was discontinued; $P = .004$).

Because chorioamnionitis was diagnosed more commonly in the DC group, secondary analyses were performed. The median latent phase, active phase, second stage of labor, and duration of ruptured membranes were longer in women who were diagnosed with chorioamnionitis (Table 7). Intrauterine pressure catheter (IUPC) use was also higher in women with chorioamnionitis (69.6% vs 29.7% in those without chorioamnionitis; $P < .001$). Chorioamnionitis was diagnosed in 4 women before IUPC placement, in 11 women after IUPC placement, and in 1 woman retrospectively after delivery because of persistently elevated maternal temperature (with 15.7 hours between IUPC placement and delivery). Median time from IUPC placement to the diagnosis of chorioamnionitis was 5.4 hours (range, 0.8–15.7 hours). The median length of the active phase of labor was longer in women who underwent IUPC placement (3.9 hours; range, 0.9–15.5) vs those who did not (3.2 hours; range, 0.1–15.0; $P = .02$).

Univariate analyses were performed to evaluate risk factors for chorioamnionitis besides randomization (Table 8). Both the number of cervical examinations and active labor length were associated with chorioamnionitis. Logistic regression models were constructed to evaluate the relationship between randomization and chorioamnionitis, controlling for confounders that were identified in univariate analysis ($P \leq .20$; Table 8). With the use of stepwise regression, the active phase of labor, not the number of cervical examinations, was associated significantly with chorioamnionitis (RRR, 1.26; 95% CI, 1.08–1.47; $P = .004$]). In the final model, discontinuation no longer was associated significantly with chorioamnionitis (RRR, 0.90; 95% CI, 0.23–3.44; $P = .87$); however, IUPC placement and duration of ruptured membranes remained significantly associated with chorioamnionitis (RRR, 4.39; 95% CI, 1.17–16.4; $P = .03$ and RRR, 1.19; 95% CI, 1.08–1.31; $P < .001$, respectively) independent of randomization. There was a trend towards significance between active labor length and chorioamnionitis (RRR, 1.16; 95% CI, 0.99–1.36; $P = .08$). Results were the same when they were analyzed by actual treatment received (data not shown).

COMMENT

Our data suggest that, once labor is active in women being induced, oxytocin may be discontinued if regular contractions continue to generate cervical change, without increasing the cesarean delivery rate. Restarting oxytocin for arrest of dilation and/or decrease in contractions does not appear to be associated with an

increased risk of cesarean delivery for arrest disorders. However, oxytocin discontinuation can lead to labor prolongation and a higher rate of chorioamnionitis; the latter is related to IUPC use and duration of membrane rupture. Our data suggest that, if oxytocin is discontinued, such practice should take place only after careful assessment of the labor curve and contraction frequency, with IUPC placement only when strictly indicated because of the potential for infection.

An Israeli study randomly assigned 104 women to either oxytocin infusion until 5 cm dilation with maintenance thereafter or oxytocin discontinuation once the cervix was 5 cm dilated.[14] Length of the active phase was similar between groups, as was the mode of delivery, with a low cesarean rate among both groups (11.5% in continuation and 5.8% in discontinuation). A Turkish study also evaluated oxytocin discontinuation in active labor and found a longer active phase and second stage in those women whose oxytocin was discontinued, although the difference was not statistically significant.[15] Cesarean delivery rates were also similar between groups. A French equivalence study found a longer active phase of labor but a lower cesarean delivery rate when oxytocin was discontinued.[13] Although the above populations and the US populations differ by rate of cesarean delivery, the aforementioned results are consistent with our findings, even in a population with a higher baseline cesarean delivery rate.

Univariate analysis suggested that the rate of chorioamnionitis was higher in women who had a longer active phase of labor; in adjusted analysis, the duration of membrane rupture and IUPC placement, not oxytocin discontinuation, were associated independently with an increased risk of chorioamnionitis. This is consistent with previously published data on risk factors for chorioamnionitis, in which the duration of ruptured membranes and the placement of intrauterine monitoring were identified as independent risk factors for intraamniotic infection.[18] Other variables that were associated with infection included the number of vaginal examinations and the duration of total labor,[18] the latter a potential risk factor in our study. Although the presence of intraamniotic infection may lead to abnormalities in the labor curve, which then may lead to increased IUPC use, in our study only 25% of patients were diagnosed with chorioamnionitis before IUPC placement, which suggests that IUPC placement was the primary risk factor for chorioamnionitis. The utility of the routine use of IUPCs to monitor contractions has been questioned previously,[19] and a recent study found that the routine placement of internal monitoring during induced or augmented labor does not decrease the rates of operative deliveries or adverse neonatal outcomes.[20] Although our study was not designed specifically to address this, our data suggest that IUPC placement should be performed only after careful evaluation of the labor curve and when absolutely necessary (inability to externally monitor contraction frequency and/or strength or titrate oxytocin) because of the potential for infection. Our data suggest that patients with a longer active phase had more IUPCs placed, which then may have increased the risk of chorioamnionitis. In our study, labor length was longer, and cesarean delivery was more common in women who were diagnosed with chorioamnionitis, which confirms previous observations that have associated chorioamnionitis with labor prolongation.[21]

Strengths of our study include its prospective randomized nature, its relatively large sample size, and the ability of obstetricians to alter labor management as they believed clinical circumstances warranted, such as restarting oxytocin when indicated. Allowing such decisions by the obstetrician as part of the study protocol makes our study results generalizable to "real life obstetrics" where clinicians make decisions that are based on the overall clinical picture. We also believed it would be unethical to omit this option.

TABLE 3
Primary outcome and length of labor by randomization group

Characteristic	Group: Routine (n = 127)	Group: Oxytocin discontinuation (n = 125)	*P* value
Cesarean delivery, n (%)	32 (25.2)	24 (19.2)	.25
Indications for cesarean delivery, n (%)			.74
Nonreassuring fetal heart tracing	8 (25.0)	7 (29.2)	
Arrest of the active phase	12 (37.5)	11 (45.8)	
Arrest of descent	7 (21.9)	6 (25.0)	
Failed induction of labor	2 (6.3)	0	
Malpresentation	2 (6.3)	0	
Other	1 (3.1)	0	
Latent phase of labor, hr[a,b]	n = 114 7.7 (1.3–54.6)	n = 117 10.4 (0.3–23.7)	.05
Active phase of labor, hr[a,b]	n = 102 3.0 (0.1–15.3)	n = 107 3.9 (0.1–15.5)	.01
Second stage of labor, hr[a,b]	n = 95 0.5 (0–6.7)	n = 101 0.5 (0–6.5)	.97
Ruptured membranes, hr[a]	n = 127 6.1 (0.1–32.7)	n = 125 8.0 (0–37.4)	.01

Data were analyzed with the Mann Whitney *U* test, the χ^2 test, and the Fisher exact test, as appropriate.

[a] Data are expressed as median (range); [b] The lengths of the first and second stages of labor were calculated for those patients who completed each phase or stage.

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TABLE 4
Labor and delivery characteristics among the patient population by randomization group

Characteristic	Group: Routine (n = 127)	Group: Oxytocin discontinuation (n = 125)	*P* value
Oxytocin dose in active labor, mU/min[a]	9.8 ± 5.4	10.8 ± 6.2	.23
Maximum oxytocin dose, mU/min[a]	13.0 ± 6.8	13.1 ± 6.6	.87
Cervical dilation once diagnosed in active labor, cm[b]	5 (3–7)	5 (3–9.5)	< .001
Use of intrauterine pressure catheter, n (%)	42 (33.1)	42 (33.6)	.93
Cervical examinations, n[b]	7 (1–17)	7 (2–13)	.03
Epidural anesthesia, n (%)	122 (96.1)	118 (94.4)	.54
Intrapartum complications, n (%)			.24
Preeclampsia	5 (3.9)	3 (2.4)	
Chorioamnionitis	7 (5.5)	16 (12.8)	
Abruptio placentae	1 (0.8)	1 (0.8)	
Other	12 (9.5)	8 (6.4)	
Postpartum complications, n (%)			
Postpartum hemorrhage	8 (6.3)	8 (6.4)	
Preeclampsia diagnosed after delivery	1 (0.8)	0	
Endometritis	0	1 (0.8)	
Acute blood loss anemia	10 (7.9)	17 (13.6)	
Other	2 (1.6)	3 (2.4)	.48

Data were analyzed with the Student *t* test, the Mann Whitney *U* test, the χ^2 test, and the Fisher exact test, as appropriate.

[a] Data are expressed as mean ± SD; [b] Data are expressed as median (range).

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TABLE 5
Neonatal outcomes by randomization group

Characteristic	Group: Routine (n=127)	Group: Oxytocin discontinuation (n = 125)	*P* value
Male sex, n (%)	70 (55.1)	66 (52.8)	.71
Apgar score			
At 1 min[a]	8 (1–9)	8 (1–9)	.27
At 5 min[a]	9 (6–10)	9 (8–10)	.27
Neonatal weight, g[a]	3475 (2345–4495)	3475 (2715–4650)	.55
Arterial cord pH[a]	7.26 (6.94–7.64)	7.27 (7.08–7.68)	.21
Neonatal resuscitation, n (%)	9 (7.1)	7 (5.6)	.63
Admission to neonatal intensive care unit, n (%)	10 (7.95)	9 (7.25)	.84
Neonatal antibiotic use, n (%)	9 (7.1)	16 (12.8)	.13
Length of stay, d[a]	3 (2–7)	3 (2–8)	.79

Data were analyzed with the Mann Whitney *U* test, the χ^2 test, and the Fisher exact test, as appropriate.

[a] Data expressed in median (range).

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In 31 patients who were assigned randomly to discontinuation, the oxytocin infusion was continued, despite the patient's enrollment into discontinuation. An inability to account why this occurred in all cases is a limitation that may have introduced bias, if such patients were perceived to be at a higher risk of abnormal labor progression. We acknowledge this limitation because only 94 patients remained in the DC group when we evaluated the actual treatment received. Although when evaluated both by intent to treat and by the actual treatment received, the cesarean delivery rates were not different between the 2 groups, we do acknowledge that our sample size was limited by the continuation of oxytocin in 31 patients who were assigned originally to the DC group.

Clinicians were asked to document when labor was deemed to be active in women who were assigned randomly to discontinuation based on the clinical examination, contraction regularity, and patient's perception of pain and labor transition. We would not expect the nature of the study to cause clinicians to either overdiagnose or underdiagnose labor as being active, but the relatively subjective nature of the diagnosis in women whose labor is induced is a potential limitation of our study. The range of cervical dilation in centimeters once in active labor was higher for those women in the DC group, likely because clinicians ensured that labor was indeed active by the examination, contraction regularity, and symptoms before deciding to stop the oxytocin infusion. We thus do not believe that labor that was induced with a Foley bulb would have been diagnosed as active labor with the cervical examination alone. However, we do acknowledge that our study definition can be somewhat subjective when the patient is dilated (but not effaced) because of a Foley bulb. Another potential limitation is our original definition of *active labor*, because the active phase of labor in women who undergo induction of labor may actually be reached at 6 cm.[22] Premature diagnosis of active labor by our definition therefore potentially resulted in inadequate induction for patients in the DC group, which

would presumably increase the cesarean delivery rate in this group. Because there was no difference in the cesarean delivery rate between the groups, we do not believe that our original definition significantly impacted our results. The blinding of clinicians to the study groups would have been difficult to achieve given the nature of the study with management of the oxytocin infusion (discontinuation, continuation, or restarting) requiring knowledge of the intervention by both nurses and clinicians.

Our sample size calculation was based on finding a 40% cesarean delivery rate in women whose oxytocin was discontinued in active labor. We chose 40% as a significantly increased rate based on the investigators' consensus because this rate would represent a considerable increase from the baseline population rate. Enrollment was stopped after 30 months primarily because of growing clinician anxiety about potentially prolonging the length of labor inductions in a very busy labor unit with difficult-to-navigate-throughput issues. Using the cesarean delivery rates that were produced by this analysis, we estimate that >1500 deliveries would be needed to show that the observed rates are significantly different. We acknowledge that our study was underpowered for our primary outcome because enrollment was stopped after 30 months, although our results likely would not be different if we had enrolled an additional 52 patients. To have found an increase in the cesarean delivery rate from 25% to either 35% or 30% would have required the enrollment of either 329 or 1251 patients, respectively, per group.

Oxytocin is one of the most common medications used in obstetrics; despite its widespread use, optimal protocols for the use of oxytocin as an induction agent have not been identified.[5] Identification of optimal clinical protocols and their associated risks is important in the treatment of patients who undergo labor induction. Our study attempts to investigate 1 aspect of oxytocin usage: whether to continue or discontinue oxytocin once active labor has been achieved in women undergoing induction. Our study suggests that discontinuation in the active phase of labor can be considered in women who undergo labor induction without increasing the risk of cesarean delivery. However, the finding of a higher rate of chorioamnionitis must be taken into consideration when the decision is made to discontinue oxytocin in the active phase for women who are being induced, with careful assessment of the labor progress before proceeding

TABLE 6
Labor and neonatal outcomes by actual treatment received

Characteristic	Group: Routine (n = 158)	Group: Oxytocin discontinuation (n = 94)	*P* value
Cesarean delivery, n (%)	36 (22.8)	20 (21.3)	.78
Oxytocin dose once active, mU/min[a]	10.2 ± 5.8	10.5 ± 5.9	.67
Maximum dose of oxytocin, mU/min[a]	13.4 ± 7.1	12.4 ± 6.0	.27
Length of latent phase of labor, hr[b,c]	n = 144 8.8 (0.3–54.6)	n = 87 9.2 (2.3–23.7)	.76
Length of active phase of labor, hr[b,c]	n = 130 3.0 (0.1–15.3)	n = 79 4.2 (0.1–15.5)	.004
Length of second stage of labor, hr[b,c]	n = 122 0.5 (0–6.7)	n = 74 0.4 (0–4.7)	.47
Chorioamnionitis, n (%)	9 (5.7)	14 (14.9)	.01
Intrauterine pressure catheter, n (%)	52 (32.9)	32 (34.0)	.85
Admission to neonatal intensive care unit, n (%)	10 (6.3)	9 (9.6)	.35
Neonatal antibiotic use, n (%)	11 (7.0)	14 (14.9)	.04
Length of stay, d[b]	3 (2–7)	3 (2–8)	.51

Data were analyzed with the Student *t* test, the Mann Whitney *U* test, and the χ^2 test, as appropriate.

[a] Data are expressed as mean ± SD; [b] Data expressed as median (range); [c] The lengths of the first and second stages of labor were calculated for those patients who completed each phase or stage.

Diven. Discontinuation of oxytocin in active labor. Am J Obstet Gynecol 2012.

TABLE 7
Labor characteristics in women with and without chorioamnionitis

Characteristics	No chorioamnionitis (n = 229)	Chorioamnionitis (n = 23)	*P* value
Length of latent phase, hr[a]	8.2 (0.3–54.6)	11.9 (2.5–23.7)	.004
Length of active phase, hr[a]	3.2 (0.1–15.2)	7.8 (2.2–15.5)	< .001
Length second stage, hr[a]	0.4 (0–6.7)	1.2 (0.1–3.6)	.02
Length of ruptured membranes, hr[a]	6.3 (0–32.8)	17.7 (7.3–37.4)	< .0001
Intrauterine pressure catheter use, n (%)	68 (29.7)	16 (69.6)	< .001
Cesarean delivery, n (%)	47 (20.5)	9 (39.1)	.04
Admission to neonatal intensive care unit, n (%)	11 (4.8)	8 (34.8)	< .001
Neonatal antibiotic use, n (%)	3 (1.3)	22 (95.7)	< .001
Length of stay, d[a]	3 (2–7)	3 (3–8)	.004

Data were analyzed with the Mann Whitney *U* test and the χ^2 test, as appropriate.

[a] Data are expressed as median (range).

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TABLE 8
Unadjusted analyses of potential predictors of chorioamnionitis

	Chorioamnionitis	
Potential predictor	**Relative risk (95% CI)**	***P* value**
Oxytocin discontinuation group	2.32 (0.99–5.45)	.04
Length latent phase	1.07 (1.01–1.14)	.03
Length active phase	1.36 (1.19–1.55)	< .001
Duration of membrane rupture	1.20 (1.13–1.28)	< .001
Cervical examinations	1.45 (1.22–1.73)	< .001
Nulliparity	6.56 (2.00–21.5)	.0002
Bishop score >4	0.36 (0.16–0.81)	.01
Body mass index ≥30 kg/m^2	0.75 (0.34–1.62)	.46
Intrauterine pressure catheter use	4.57 (1.96–10.7)	.0001
Any comorbidity	0.61 (0.28–1.32)	.21
Private obstetrician vs resident	0.45 (0.20–1.02)	.05

CI, confidence interval.

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with IUPC placement. Given the importance of this clinical issue, future studies should continue to focus on the identification of optimal clinical protocols for oxytocin use. ■

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