

## OBSTETRICS

# Progress of labor in women induced with misoprostol versus the Foley catheter

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**OBJECTIVE:** To estimate and compare the duration and progress of labor in women induced with misoprostol vs Foley catheter plus oxytocin.

**STUDY DESIGN:** We performed a retrospective cohort study of labor progress among 617 consecutive term pregnancies induced with misoprostol ( $n = 503$ ) or Foley catheter plus oxytocin ( $n = 114$ ) who completed the first stage of labor. Labor duration and progress in the entire cohort, and stratified by parity, were compared in multivariable interval-censored regression models adjusting for maternal obesity and birthweight. Repeated-measures analysis with 9th degree polynomial modeling was used to construct average labor curves.

**RESULTS:** Total duration of labor was not significantly different in women induced with misoprostol compared with the Foley catheter (median duration from 1 to 10 cm: 12 vs 14.2 hours,  $P = .19$ ).

Progress from 1 to 4 cm was more rapid with the Foley catheter (median: 3.4 vs 5.6 hours,  $P < .01$ ), although progress from 4 to 10 cm was slower (median: 6.3 vs 3.6 hours,  $P < .01$ ). Labor curves demonstrated transition from latent to active labor at about 4 cm cervical dilatation with misoprostol and at 6 cm for the Foley catheter. Similar general patterns were noted for nulliparous and multiparous women, except for a shorter duration of labor with the Foley catheter among multiparous women.

**CONCLUSION:** Induction of labor with the Foley catheter is associated with more rapid initial cervical dilation, but transition to active labor occurs later compared with misoprostol. These differences should be considered in the management of induced labor.

**Key words:** Foley catheter, labor induction, labor progress, misoprostol

Cite this article as: Tuuli MG, Keegan MB, Odibo AO, et al. Progress of labor in women induced with misoprostol vs the Foley catheter. *Am J Obstet Gynecol* 2013;209:237.e1-7.

Induction of labor is frequently used in contemporary obstetrics and rates continue to increase.<sup>1</sup> It is associated with increased risk of cesarean delivery, especially among women with an unfavorable

cervix.<sup>2-4</sup> This increased risk appears to be strongly influenced by the duration of the induction attempt.<sup>5</sup> Yet there are no clear expectations of normal duration and course of induced labor. Using interval-censored regression analysis, we recently demonstrated that induced labor progresses slower than labor of spontaneous onset.<sup>6</sup> However, the effect of different methods of labor induction on progress of labor has not been well characterized.

The Foley catheter and misoprostol are 2 common methods of labor induction in the United States when the cervix is unfavorable. The Foley catheter acts by mechanically dilating the cervix and releasing endogenous prostaglandins. Misoprostol, a synthetic prostaglandin E<sub>1</sub>, promotes biochemical remodeling of the cervix and triggers uterine contractions. Prior studies suggest both methods are effective for labor induction.<sup>7</sup> However, data on their relative effects on the course of labor are limited. Prior studies assessing the course of labor in women induced with

misoprostol or Foley catheter compared induction-to-delivery intervals.<sup>8-10</sup> Such data are of limited value for the clinical management of labor where cervical dilatation is assessed intermittently and prospectively. Assessment of only induction-to-delivery intervals may obscure potentially important differences at different points in the labor course. For example, anecdotal evidence suggests women induced with the Foley catheter may not be in active labor even when the cervix is 3-4 cm or more dilated following expulsion of the Foley catheter. Establishing standards for onset of active labor in pregnancies induced with misoprostol or Foley catheter would potentially reduce the number of cesareans performed for failed induction of labor.

The objective of this study was to estimate and compare the duration and progress of labor in women induced with misoprostol or Foley catheter. Specifically, we sought to estimate onset of active labor in women induced with the 2 methods.

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Received Jan. 11, 2013; revised March 3, 2013; accepted May 1, 2013.

M.G.T. is supported by a Women's Reproductive Health Research Career Development grant from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NIH/NICHD – 1K12HD063086-01). A.G.C. is a Robert Wood Johnson Foundation Physician Faculty Scholar, which partially supports this work.

The contents of this publication are solely the responsibility of the authors and do not necessarily represent the official view of the NIH or Robert Wood Johnson Foundation.

The authors report no conflict of interest.

Reprints are not available from the authors.

0002-9378/\$36.00

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<http://dx.doi.org/10.1016/j.ajog.2013.05.005>

**TABLE 1**  
**Baseline characteristics of all women induced with misoprostol or the Foley catheter**

Characteristic	Misoprostol (n = 503)	Foley catheter (n = 114)	P value
Maternal age (y), mean (SD)	24.7 (6.2)	24.9 (6.4)	.81
Maternal weight (kg), mean (SD)	90.1 (21.1)	86.1 (18.3)	.06
Maternal BMI (kg/m <sup>2</sup> ), mean (SD)	33.3 (7.5)	32.6 (6.6)	.34
Obese (BMI >30 kg/m <sup>2</sup> ), n (%)	319 (64.7)	65.0 (58.0)	.19
Parity, n (%)			
Nulliparous	206 (41.0)	38 (33.3)	.13
Multiparous	297 (59.1)	76 (66.7)	
Maternal race, n (%)			
Black	323 (64.2)	85 (74.6)	.06
White	129 (25.7)	24 (21.1)	
Other	51 (10.1)	5 (4.4)	
Chronic hypertension, n (%)	30 (6.0)	7 (6.1)	.94
Diabetes, n (%)	14 (2.8)	6 (5.3)	.18
Smoking, n (%)	80 (15.9)	27 (23.7)	.05
Alcohol use, n (%)	4 (0.8)	2 (1.8)	.35
Indication for induction, n (%)			
Elective	152 (33.1)	16 (24.2)	.41
Oligohydramnios	62 (13.5)	11 (16.7)	
Maternal comorbidity	51 (11.1)	12 (18.2)	
Preeclampsia	57 (12.4)	6 (9.1)	
Nonreassuring fetal status	39 (8.5)	7 (10.6)	
Other	98 (21.4)	14 (21.2)	
Admission Bishop score, median (range)	1 (0–7)	3 (0–8)	< .01
Admission cervical dilation, median (range)	1 (0–2)	1 (0–3)	< .01
Gestational age (wks), mean (SD)	39.1 (1.4)	39.3 (1.3)	.41
Prior cesarean, n (%)	0 (0)	24 (21.1)	< .01
Fetal sex, n (%)			
Male	235 (46.8)	61 (53.5)	.20
Female	267 (53.2)	53 (46.5)	
Birthweight (g), mean (SD)	3261.1 (560.6)	3256.4 (519.0)	.94
Macrosomia (birthweight >4000 g), n (%)	5 (4.4)	30 (6.0)	.51
Oxytocin augmentation	385 (76.5)	99 (86.8)	.02
Regional anesthesia	466 (92.6)	107 (93.9)	.65

BMI, body mass index; SD, standard deviation.

Tuuli. Labor progress with misoprostol vs Foley catheter. *Am J Obstet Gynecol* 2013.

## MATERIALS AND METHODS

We conducted a retrospective cohort study of consecutive term, vertex singleton deliveries from 2004 to 2008 at a

single academic teaching hospital. The study was approved by the Washington University School of Medicine Human Research Protection Office. Women were

eligible if they underwent labor induction and completed the first stage. We excluded women if they had cesarean delivery in the first stage of labor, were in spontaneous labor on admission, or had a known fetal anomaly. Detailed demographic information was extracted from patients' records including medical and surgical history, obstetric and gynecologic history and prenatal history. We abstracted detailed labor and delivery information including medications, labor onset type, indications for induction, method of labor induction, cervical examination times, cervical dilatation (0 to 10 cm), fetal head station (−5 to +5) and mode of delivery. Inductions of labor without any obstetric or medical indication as classified as elective. Pregnancies were dated by a woman's last menstrual period and confirmed with first or second trimester ultrasonography using standard criteria. The comparison groups were defined by induction with misoprostol or the Foley catheter. We excluded women induced with a combination of misoprostol and Foley catheter or with another type of prostaglandin.

Labor and delivery care was provided largely by resident physicians under the supervision of attending physicians. However, per institutional obstetric protocols women with prior cesareans were not induced with misoprostol. The decision to use the Foley catheter or misoprostol was determined by the admitting physician. Cervical examinations were performed at regular intervals, usually every 2 hours. Women undergoing induction with misoprostol received 25 mcg vaginally every 4 hours until cervical ripening was achieved. Oxytocin was then started as needed, after at least 4 hours from when the last misoprostol was placed. Oxytocin was administered per standard institutional protocol starting at 2 milliunits per minute and increasing by 2 milliunits every 20 minutes until regular uterine contractions occurred. When the Foley catheter was used for induction, it was placed blindly or under direct visualization with the aid of a speculum. The balloon was inflated to 60 cc and the catheter was taped under traction to the woman's thigh. Oxytocin was

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