The use of cervical sonography to differentiate true from false labor in term patients presenting for labor check

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BACKGROUND: Cervical length by transvaginal ultrasound to predict preterm labor is widely used in clinical practice. Virtually no data exist on cervical length measurement to differentiate true from false labor in term patients who present for labor check. False-positive diagnosis of true labor at term may lead to unnecessary hospital admissions, obstetrical interventions, resource utilization, and cost.

OBJECTIVE: We sought to determine if cervical length by transvaginal ultrasound can differentiate true from false labor in term patients presenting for labor check.

STUDY DESIGN: This is a prospective observational study of women presenting to labor and delivery with labor symptoms at 37-42 weeks, singleton cephalic gestation, regular uterine contractions (≥4/20 min), intact membranes, and cervix ≤4 cm dilated and ≤80% effaced. Those patients with placenta previa and indications for immediate delivery were excluded. The shortest best cervical length of 3 collected images was used for analysis. Providers managing labor were blinded to the cervical length. True labor was defined as spontaneous rupture of membranes or spontaneous cervical dilation ≥4 cm and ≥80% effaced within 24 hours of cervical length measurement. In the absence of these outcomes, labor status was determined as false labor. Receiver operating characteristic curves were generated to assess the predictive ability of cervical length to differentiate true from false labor and were analyzed separately for primiparous and multiparous patients. The diagnostic accuracies of various cervical length cutoffs were determined. The relationship of cervical length and time to delivery was also analyzed including both use and nonuse of oxytocin.

RESULTS: In all, 77 patients were included in the study; the prevalence of true labor was 58.4% (45/77). Patients who were in true labor had shorter cervical length as compared to those in false labor: median 1.3 cm (range 0.5-4.1) vs 2.4 cm (range 1.0-5.0), respectively ($P < .001$). The area under the receiver operating characteristic curve for primiparous patients was 0.88 ($P < .001$) and for multiparous patients was 0.76 ($P < .01$), both demonstrating good correlation. The area under the receiver operating characteristic curves were not significantly different between primiparous and multiparous ($P = .23$). The area under the receiver operating characteristic curve for primiparous and multiparous patients combined was 0.8 ($P < .0001$), indicating a good overall correlation between cervical length and its ability to differentiate true from false labor. Overall, a cervical length cutoff of ≤1.5 cm to predict true labor had the highest specificity (81%), positive predictive value (83%), and positive likelihood ratio (4.2). There were no differences in cervical length prediction between primiparous and multiparous patients. Cervical length was positively correlated with time to delivery, regardless of the use of oxytocin.

CONCLUSION: In differentiating true from false labor in term patients who present for labor check, a cervical length of ≤1.5 cm was the most clinically optimal cutoff with the lowest false positive rate—due to its highest specificity—and highest positive predictive value and positive likelihood ratios. Its use to decide admission in patients at term with labor symptoms may prevent unnecessary admissions, obstetrical interventions, resource utilization, and cost.

Key words: cervical length, cervical sonography, false labor, labor check, term gestation, true labor

Introduction

The obstetrical patient presenting to labor and delivery triage for a labor evaluation at term is one of the most common clinical scenarios. Currently, the diagnosis of true labor at term relies on patient symptomatology and very frequently on progressive cervical dilation by digital vaginal exams. However, perception of contractions is a poor predictor of labor and digital exams and therefore Bishop score have large intraobserver and interobserver variabilities,[1] providing low accuracy to predict true labor.[2,3]

There are several studies examining the use of cervical length (CL) surveillance by transvaginal ultrasound (TVUS) to predict spontaneous preterm birth in symptomatic as well as asymptomatic patients.[4-12] As a matter of fact, the usefulness of CL to predict preterm labor (PTL) has been documented very well so that it is now routinely used in clinical practice.[5-12] In term patients the use of CL has been limited to prediction of spontaneous labor in prolonged pregnancies and also in the prediction of successful labor induction.[13-16]

To our knowledge, there are no data on CL measurements to differentiate true from false labor in term patients presenting for a labor check. Consequences from false-positive diagnosis of true labor at term are unnecessary hospital admissions, unnecessary obstetrical interventions, increased resource utilization, and increased cost.[17,18] Therefore, the primary objective of this prospective study was to determine if CL by TVUS can differentiate true from false labor in term patients who present to the hospital for labor check. Our secondary objective was to determine the relationship between CL and time to delivery in these patients.

Materials and Methods

This was an institutional review board–approved prospective observational study from 2013 through 2016 in

Cite this article as: Kunzier NB, Kinzler WL, Chavez MR, et al. The use of cervical sonography to differentiate true from false labor in term patients presenting for labor check. Am J Obstet Gynecol 2016;215:372.e1-5.

0002-9378/$36.00

http://dx.doi.org/10.1016/j.ajog.2016.03.031

term (37-42 weeks) patients presenting to labor and delivery triage at Winthrop University Hospital, Mineola, NY, with labor symptoms. A history and physical was performed as standard of care. Informed consent was obtained after determining eligibility. Recruitment was not consecutive secondary to time constraints because of a very busy labor and delivery unit where the study was conducted. Inclusion criteria were: singleton, live intrauterine pregnancy in cephalic presentation, gestational age 37-42 weeks, regular uterine contractions (defined as ≥4 contractions/20 min on the tocometer), intact membranes, and cervix <4 cm dilated and <80% effaced. Exclusion criteria were: clinical chorioamnionitis (defined as temperature >100.4°F and 2 of the following: malodorous discharge, maternal leukocytosis, maternal tachycardia, fetal tachycardia, uterine tenderness), maternal or fetal indications for immediate delivery, placenta previa, and previous cesarean delivery.

TVUS was performed by residents previously trained on proper CL technique.[19] Three images per patient were collected and the shortest best image was chosen to be analyzed in the study. Providers making management decisions were blinded to the CL measurements. True labor was defined as spontaneous rupture of membranes or spontaneous cervical dilation ≥4 cm and ≥80% effaced within 24 hours of CL measurement. False labor was defined as cases that did not fulfill the above definition of true labor. Patient's demographics and obstetrical variables were collected and included: patient's age, prepregnancy body mass index, race, gravidity, parity, gestational age, cervical exam, CL measurement upon presentation, date and time of CL measurement, date of admission to or discharge from hospital, time of active labor, induction or augmentation of labor, spontaneous or artificial rupture of membranes and timing, time of birth, birthweight, and mode of delivery.

Several statistical analyses were performed. The demographic and clinical characteristics of true vs false labor patients were compared with parametric and nonparametric analysis. Receiver operating characteristic (ROC) curves of CL in the prediction of true labor were generated and the diagnostic accuracy of CL was determined for various CL cutoffs for both primiparous and multiparous patients. The diagnostic accuracy of the various CL cutoffs was expressed by sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and positive and negative likelihood ratios for both primiparous and multiparous patients separately as well as combined. Lastly, the relationship between CL and time to delivery was determined by linear regression and scatter plot and the correlation coefficient (r) was calculated. CL vs time to delivery was analyzed individually for patients who received oxytocin augmentation and those who did not.

TABLE 1
Comparison of demographic and obstetric variables for true vs false labor patients

	True labor n = 45 [58.4%]	False labor n = 32 [41.6%]	*P* value
Age, y	28.7 ± 6.0	27.7 ± 5.7	.47
BMI, kg/m^2	29.9 ± 5.5	30.1 ± 5.0	.85
Race			.71
White	20 (44.4)	12 (37.5)	
Black	13 (28.9)	12 (37.5)	
Hispanic	12 (26.7)	5 (15.6)	
Other	0 (0.0)	3 (9.4)	
Gravidity	2 (1–5)	2 (1–6)	.54
Parity	0 (0–3)	0 (0–2)	.30
Gestational age, wk	39.3 ± 0.9	38.7 ± 1.1	<.01
Cesarean delivery	7 (15.6)	5 (15.6)	1.00
Birthweight, g	3285 ± 434	3413 ± 375	.18
Cervical length, cm	1.3 (0.5–4.1)	2.4 (1.0–5.0)	<.001

Data expressed as n (%), mean ± SD, or median (range).

BMI, body mass index.

Kunzier et al. Cervical length to predict true labor at term. Am J Obstet Gynecol 2016.

Results

In all, 101 patients were enrolled; 24 patients were excluded because of: induction prior to active labor (22), breech presentation after the CL measurement (delivered by scheduled cesarean) (1), and spontaneous rupture of membranes after the vaginal exam and before the TVUS (1). Analysis was performed on the remaining 77 patients.

Of the 77 patients analyzed, 45 were in true labor (prevalence of true labor 45/77 or 58.4%) and 32 (41.6%) were in false labor. The groups were similar in regards to maternal age, body mass index, race, gravidity, parity, and mode of delivery (Table 1). Patients who were in true labor had shorter CL measurements at the time of presentation as compared to those in false labor: median 1.3 cm (range 0.5-4.1) vs 2.4 cm (range 1.0-5.0), respectively ($P < .001$). Those who were in true labor were also of more advanced gestational age compared to the false labor patients ($P < .01$) (Table 1).

ROC curves were generated separately for primiparous and multiparous (Figure 1). There was no statistically significant difference in the area under the ROC curves between primiparous and multiparous (0.88 vs 0.76, respectively, $P = .23$), therefore, the data were combined (Figure 2). Table 2 shows the sensitivity, specificity, PPV, NPV, and