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Effect of stage of initial labor dystocia on vaginal birth after cesarean success

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Abstract

OBJECTIVE—The objective of the study was to examine whether the stage of labor dystocia causing a primary cesarean delivery (CD) affects a trial of labor after cesarean (TOLAC) success.

STUDY DESIGN—This was a retrospective cohort study of women who had primary CD of singleton pregnancies for first- or second-stage labor dystocia and attempted TOLAC at a single hospital between 2002 and 2014. We compared TOLAC success rates between women whose primary CD was for first- vs second-stage labor dystocia and investigated whether the effect of prior dystocia stage on TOLAC success was modified by previous vaginal delivery (VD).

RESULTS—A total of 238 women were included; nearly half (49%) achieved vaginal birth after cesarean (VBAC). Women with a history of second-stage labor dystocia were more likely to have VBAC compared with those with first-stage dystocia, although this trend was not statistically significant among the general population (55% vs 45%, adjusted odds ratio, 1.4, 95% confidence interval, 0.8–2.5]). However, among women without a prior VD, those with a history of second-stage dystocia did have statistically higher odds of achieving VBAC than those with prior first-stage dystocia (54% vs 38%, adjusted odds ratio, 1.8 [95% confidence interval, 1.0–3.3], P for interaction = .043).

CONCLUSION—Nearly half of women with a history of primary CD for labor dystocia will achieve VBAC. Women with a history of second-stage labor dystocia have a slightly higher VBAC rate, seen to a statistically significant degree in those without a history of prior VD. TOLAC should be offered to all eligible women and should not be discouraged in women with a prior second-stage arrest.

Keywords

labor dystocia; trial of labor after cesarean; vaginal birth after cesarean

Because of the low risk of maternal and neonatal morbidity, a trial of labor after cesarean section (TOLAC) is considered a safe and reasonable option for women with a prior cesarean birth,[1] with successful vaginal birth after cesarean (VBAC) rates among all those

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who attempt TOLAC reported between 60% and 74%.[2-4] However, women who attempt TOLAC and end up delivering via unplanned repeat cesarean delivery (CD) are known to suffer higher rates of blood transfusion or hysterectomy compared with women who have elective, planned repeat CD.[2,5]

To improve maternal morbidity by decreasing the rates of unplanned repeat CD, multiple studies have attempted to characterize predictors of TOLAC success. Data consistently suggest women have higher likelihood of VBAC if they have a history of vaginal delivery (VD) before or after a CD, had spontaneous labor in the TOLAC, or had a prior CD for a nonrecurrent indications such as breech presentation or nonreassuring fetal heart rate tracing.[6-9] Conversely, women have lower likelihood of VBAC if the indication of CD was for labor dystocia; among these women, TOLAC success rates range from 13%[10] to 80%.[11]

Data remain limited, and conflicting, regarding the impact that stage of labor dystocia at the time of primary cesarean delivery may have on subsequent TOLAC success and whether the effect of labor dystocia is modified by other factors such as a previous VD or spontaneous labor in TOLAC.[10-17] It also remains unclear whether women who have a primary CD for first- or second-stage labor dystocia are at risk for unplanned repeat CD for a recurrent indication.

This study aims to examine whether the stage of labor dystocia resulting in primary CD affects TOLAC success and whether this effect is modifiable by maternal or fetal factors.

MATERIALS AND METHODS

This retrospective cohort study was conducted at the University of California, San Francisco (UCSF), a tertiary care, academic medical center. Between January 2002 and July 2014, the annual rate of cesarean delivery at UCSF ranged from 22.7% to 25.8% (average, 24.3%). There were no significant changes to labor management practices or TOLAC counseling during this time period, and prior cesarean alone is not considered an indication for induction.

Clinical information about all deliveries at UCSF is entered into a clinical research database immediately after birth by the delivering clinician. Data are validated by research coordinators shortly thereafter. Additional information that is not collected in this research database was obtained by detailed chart review. The UCSF Committee for Human Subjects Research approved this study.

Our study population consisted of women who had a primary CD of a singleton pregnancy for first- or second-stage labor dystocia at UCSF between January 2002 and July 2014 and attempted TOLAC with a subsequent singleton pregnancy at UCSF during the same time period. Our primary predictor was the stage of labor dystocia at time of prior primary CD, and the primary outcome was successful VBAC. First-stage labor dystocia was defined as a CD for a primary indication of failed induction of labor at any cervical dilation or active-phase arrest (cervical dilation at the time of CD of more than 4 cm but less than 10 cm); actual cervical dilation at the time of primary CD was not utilized as a variable for this study.

Second-stage labor dystocia was defined as a CD for arrest of descent (after full cervical dilation) or failed operative vaginal delivery. We excluded women whose main indication for primary CD was for nonreassuring fetal heart rate tracing or other nondystocia indication, even if labor dystocia was also present, to eliminate potential confounders from our analysis on the effect that stage of labor dystocia may have on TOLAC outcomes.

Demographic and obstetric characteristics of the TOLAC delivery were examined by descriptive statistics as well as χ^2 and *t* tests. TOLAC success rates between women whose primary CD was for first- vs second-stage labor dystocia were investigated with χ^2 and univariate and multivariate logistic regression. Covariates included maternal age, previous VD, infant weight, race or ethnicity, maternal diabetes mellitus (gestational or pregestational), and induction of labor for TOLAC.

We also tested the possibility of effect modification on the stage of labor dystocia by previous VD or induction of labor for TOLAC by adding the interaction term between each of these modifier variables and the stage of labor dystocia of primary CD into the separate multivariable models. Among women who failed TOLAC, logistic regression analysis was used to evaluate whether labor dystocia was recurrent.

We also conducted a literature search using the terms labor dystocia and VBAC to identify previously published data on this topic, and further references were identified via the bibliographies of those studies. The results of all applicable studies were stratified by stage of labor dystocia to create a patient-level meta-analysis of the relationship between a history of labor dystocia resulting in CD and TOLAC outcomes.

RESULTS

A total of 405 women were identified as having a primary CD for labor dystocia and a subsequent delivery at UCSF between January 2002 and July 2014. Of these, 238 women (58.8%) attempted TOLAC, and TOLAC rates were similar among those with a history of first- or second-stage dystocia (58.1% vs 59.6%, $P = .78$). Demographic and obstetric characteristics at the time of the TOLAC attempt are reported in Table 1.

The overall mean gestational age at delivery was slightly less than 39 weeks; most women in each group had spontaneous labor. Among women with prior first-stage dystocia and those with prior second-stage dystocia, characteristics during TOLAC attempt were similar, except for intrapartum oxytocin augmentation (61.4% vs 39.6%, $P < .001$), and induction of labor, with a marginal significance level (25.0% vs 15.1%, respectively; $P = .06$) (Table 1).

Nearly half of those attempting TOLAC (49.2%) achieved VBAC. Although a higher TOLAC success rate was observed among women with a prior second-stage dystocia compared with those with first-stage dystocia, the difference was not statistically significant in the entire population (54.7% vs 44.7% , respectively; $P = .12$, adjusted odds ratio [aOR] 1.43 [95% confidence interval (CI), 0.82–2.47)) (Table 2). However, when we investigated the possibility of effect modification by history of prior vaginal delivery, we found the interaction term of prior vaginal delivery to be statistically significant (*P* for interaction term = .04).

Among women without prior VD, those with a history of second-stage dystocia had statistically significantly higher odds of achieving VBAC than those with previous first-stage dystocia (54% vs 38%, $P = .03$; aOR for history of second-stage dystocia, 1.8 [95% CI, 1.0–3.3]). Such an effect was not observed if the woman had a prior VD (aOR, 0.35 [95% CI, 0.08–1.53]) (Table 2).

VBAC rates were similar among the women who had spontaneous labor for the TOLAC (52% vs 47.5%, respectively, for history of second-stage vs first-stage dystocia, $P = .51$). However, among women who had an induction of labor for their TOLAC, those with a history of second-stage dystocia (n = 11) had a higher VBAC rate compared with those with prior first-stage dystocia (n = 12) (68.7% vs 36.4%, $P = .03$) (Table 2), although no statistically significant interaction effect was observed ($P = .17$).

Of the 121 women who had a failed TOLAC, those with a history of second-stage labor dystocia were more likely to reach the second stage before having their unplanned repeat cesarean delivery (52% vs 19%, $P < .001$, aOR, 4.61 [95% CI, 1.86–11.43]).

When data among all previously published studies analyzing labor dystocia and subsequent VBAC rates were analyzed on a patient level, the overall VBAC rate of CD after first-stage dystocia was 69% (range, 45–80%) and after second-stage dystocia was 52% (range, 13–76%) (Table 3). Of note, the overall VBAC rate with a history of second-stage dystocia improved to 66% if the outlying study with a 13% success rate was excluded (Table 3).

COMMENT

This retrospective cohort study showed that nearly half of women with a history of primary CD for labor dystocia who elect for TOLAC achieved VBAC. Our analyses suggested that the stage of labor dystocia resulting in primary CD in conjunction with a history of VD were independent predictors associated with TOLAC success. Indeed, women with a history of VD had the highest likelihood of achieving VBAC, followed by those with a history of second-stage labor dystocia and a history of first-stage labor dystocia (observed VBAC rates were 70%, 54%, and 38%, respectively).

Of note, among women whose TOLAC was induced, those with second-stage dystocia showed a trend of higher likelihood to VBAC compared with those with first-stage dystocia, although this finding was derived from a small study population. Finally, among those who failed TOLAC, those with second-stage dystocia showed a trend of higher likelihood to achieve second-stage prior to unplanned repeat CD when compared with those with first-stage dystocia.

Prior studies with fewer participants (study populations ranging from 41 to 131 women) did not find any correlation between previously reached cervical dilation and the outcome of a subsequent TOLAC.[13,14,16] However, our finding that women who achieved second stage prior to CD had a higher likelihood of a successful VBAC compared with women who did not supports most[12,15] but not all[10] prior studies with larger study populations (388–1533 women).

Similarly, our conclusion that, among women without prior VD, those with CD for second-stage dystocia were more likely to have a VBAC than those with first-stage dystocia has also been described, although among women who were stratified by cervical dilation at the time of CD instead of labor stage.[11,12] It is surprising that this finding is not seen among women with a history of a prior VD, although this could be due to the fact that these women have overall very high rates of VBAC (60–80% in our sample); thus, the impact of prior labor dystocia would not be as clinically significant. Additionally, the number of women with a prior VD in our study is relatively small, so this finding may achieve statistical significance among a larger population.

Our finding that women with a history of second-stage labor dystocia were more likely to have a VBAC if their TOLAC was induced compared with spontaneous labor has not been reported previously.[6-8] This difference, however, could be due to chance alone because of the comparatively small sample size of women who had their TOLAC labor induced within our study population.

Finally, our study provides novel findings that warrant further investigation among a larger study population to determine whether a history of first-stage dystocia individually has an impact on the VBAC rate, namely that less than one fifth of women with a primary CD for first-stage dystocia achieved second stage prior to unplanned repeat CD and that women with a history of first-stage dystocia had higher rates of pitocin augmentation and labor induction for their TOLAC compared with those with prior second-stage dystocia.

Future investigations could focus on the recurrence rates of the active-phase arrest of cervical dilation as well as analyzing whether other factors not addressed in our analyses may affect VBAC rates: whether women with a history of first-stage dystocia either arrest at the same cervical dilation in their TOLAC or stop their TOLAC in lieu of an unplanned repeat CD if their cervical dilation in their TOLAC is not rapid.

This study is not without limitations. First, selection bias could have an impact on our results because fewer than 60% of eligible women elected for TOLAC. However, the proportion of women who elected TOLAC in our population was higher compared with that in similar studies, which reported TOLAC rates of approximately 50%[11,12,15] as well as the national average of TOLAC rates among women with a prior history of labor dystocia from 2002 to 2009, which ranged from 15% to 25%.[18]

Second, our study's relatively small sample size decreased the statistical significance of some of our outcomes, particularly when data were substratified by prior VD or induction history. More research is needed to determine the impact these factors may have on VBAC rates.

Lastly, the study population was obtained from an institution with a notably low overall CD rate and a high TOLAC rate, particularly among women with a prior history of labor dystocia, which may have had an impact on our findings. Indeed, our overall VBAC rates being lower for both first- and second-stage dystocia may be due to having a higher threshold for CD among the primary pregnancy and a willingness to attempt TOLAC, regardless of the duration of prior first- or second-stage dystocia.

Regardless of these limitations, these data contribute to a small but growing body of literature describing acceptable VBAC rates among women with a primary CD for labor dystocia. Labor dystocia has been previously described not only as a recurrent indication for CD[11] but also as a factor decreasing TOLAC success.[6-8] However, labor dystocia is not a prohibitive factor in VBAC rates: nearly half of our study population achieved VBAC, including nearly 55% of those with a history of second-stage labor dystocia. Notably, women with a history of CD for second-stage dystocia who either did not have a history of prior VD or had their TOLAC induced were also more likely to achieve VBAC than require unplanned repeat CD.

These data indicate that more research is needed to determine just how recurrent second-stage dystocia is: a component of arrest of descent may be due to nonrecurrent factors like fetal malpositioning, a factor that was not included in our analyses.

In summary, VBAC rates among women with a history of labor dystocia with or without prior VD are encouraging, and providers could incorporate the stage of dystocia into their TOLAC counseling to adequately inform their patients. All eligible women should be offered TOLAC, regardless of their indication for primary CD, their prior parity, or whether their TOLAC is spontaneous or induced.

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TABLE 1

Demographic and obstetric characteristics at the time of TOLAC attempt among women with a history of primary CD for labor dystocia[a]

Characteristics	Total (n = 238)	History of primary CD for first-stage dystocia (n = 132)	History of primary CD for second-stage dystocia (n = 106)	*P* value
Maternal factors				
Maternal Age, y	33.9 (±5.1)	34.1 (±5.7)	33.6 (±4.4)	.49
Race or ethnicity				
White	114 (47.9%)	58 (43.9%)	56 (52.8%)	.39
Black	29 (12.2%)	20 (15.2%)	9 (8.5%)	
Latina	28 (11.8%)	18 (13.6%)	10 (9.4%)	
Asian or Pacific Islander	46 (19.3%)	25 (18.9%)	21 (19.8%)	
Other or unknown	21 (8.8%)	21 (8.3%)	10 (9.4%)	
Current diabetes mellitus[b]	28 (11.3%)	19 (14.4%)	9 (8.5%)	.16
History of vaginal delivery	40 (16.8%)	20 (15.2%)	20 (18.9%)	.45
Neonatal factors				
Gestational age at delivery, wks	38.8 (±1.9)	38.7 (±2.2)	38.9 (±1.5)	.43
Infant birthweight, g	3499.4 (±594.0)	3487.7 (±615.9)	3514.1 (±567.9)	.73
Intrapartum factors				
Labor induced	49 (20.6%)	33 (25.0%)	16 (15.1%)	.06
Labor augmented with oxytocin	123 (51.7%)	81 (61.4%)	42 (39.6%)	< .001
Epidural used	161 (67.9%)	94 (71.8%)	67 (63.2%)	.16

CD, cesarean delivery; *TOLAC*, trial of labor after cesarean.

[a] All data are presented as n (percentage) or mean (±SD);

[b] Includes gestational or pregestational diabetes mellitus.

TABLE 2

VBAC rates among women with a history of prior labor dystocia who attempted TOLAC, stratified by prior VD and labor induction for TOLAC attempt

	History of first-stage dystocia, n, %	History of second-stage dystocia, n, %	*P* value	aOR (95% Cl) for prior second- vs prior first-stage dystocia[a]	*P* value	*P* value for interaction
All (n = 238)	59/132 (45%)	58/106 (55%)	.12	1.43 (0.82-2.47)	.20	N/A
Prior VD						.043
No prior VD (n = 198)	43/112 (38%)	46/86 (54%)	.03	1.82 (1.00-3.32)[b]	.049	
Prior VD (n = 40)	16/20 (80%)	12/20 (60%)	.17	0.35 (0.08-1.53)[b]	.16	
Labor induction for TOLAC						.146
Spontaneous labor (n = 189)	47/99 (47%)	47/90 (52%)	.51	1.17 (0.62-2.15)[b]	.61	
Labor induction (n = 49)	12/33 (36%)	11/16 (69%)	.03	3.70 (0.91-15.14)[b]	.07	

aOR, adjusted odds ratio; *CD*, cesarean delivery; *CI*, confidence interval; *DM*, diabetes mellitus; *N/A*, not available; *TOLAC*, trial of labor after cesarean; *VBAC*, vaginal birth after cesarean; *VD*, vaginal delivery.

[a] aOR for history of second-stage dystocia on VBAC, adjusting for maternal age, race-ethnicity, birthweight, prior vaginal delivery, induction of labor for TOLAC, and DM;

[b] Multivariable model additionally included an interaction term between the stage of labor dystocia from the prior primary CD and the effect modifiers being investigated, as indicated.

TABLE 3

Overall VBAC rates derived from a metaanalysis of patient-level data from previous studies on TOLAC outcomes for women with a history of prior CD for labor dystocia

Reference	Year	Total study population, n	VBAC rate after prior CD for first-stage dystocia, n, %	VBAC rate after prior CD for second-stage dystocia, n, %
Hoskins and Gomez[10]	1997	1533	885/1288 (69%)	32/245 (13%)
Bujold and Gauthier[15]	2001	859	429/654 (66%)	161/214 (75%)
Kwon et al[11]	2009	380	260/326 (80%)	41/54 (76%)
Abildgaard et al[12]	2013	355	100/115 (47%)	85/140 (61%)
Lewkowitz et al	2015	238	59/132 (45%)	58/106 (55%)
Duff et al[13]	1988	131	78/114 (68%)	11/17 (65%)
Melamed et al[17][a]	2013	93	—	57/93 (61%)
Ollendorf et al[14]	1988	88	37/53 (70%)	24/35 69%)
Impey and O'Herlihy[16]	1988	40	16/25 (64%)	11/15 (73%)
Total	—	3717	1864/2707 (69%)	480/919 (52%)[b]

CD, cesarean delivery; *TOLAC*, trial of labor after cesarean; *VBAC*, vaginal birth after cesarean.

[a] Study population composed of only women with history of failed operative vaginal delivery who attempted TOLAC;

[b] When the study by Hoskins and Gomez is excluded as an outlier, the average VBAC rate for women with a history of second-stage dystocia is 66% (448 of 674).