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ORIGINAL ARTICLE

Vaginal birth after a cesarean delivery for arrest of descent*

Nathan S. Fox[a,b], Amalia G. Namath[c], Munira Ali[d], Mariam Naqvi[a,b], Simi Gupta[a,b] and Andrei Rebarber[a,b]

[a]Department of Obstetrics, Gynecology and Reproductive Science, Icahn School of Medicine at Mount Sinai, New York, NY, USA; [b]Maternal Fetal Medicine Associates, PLLC, New York, NY, USA; [c]Georgetown University School of Medicine, Washington, DC, USA; [d]Touro College of Osteopathic Medicine, New York, NY, USA

ABSTRACT

Objective: The objective of this study is to determine vaginal birth after cesarean (VBAC) success rates for patients with a prior cesarean delivery (CD) for arrest of descent, as well as determine any predictors for success.

Study design: This was a retrospective cohort study of all patients delivered by a single MFM practice from 2005 to 2017 with a singleton pregnancy and one prior CD for arrest of descent. We estimated the rate and associated risk factors for successful VBAC.

Results: We included 208 patients with one prior CD for arrest of descent, 100 (48.1%) of whom attempted a trial of labor after cesarean (TOLAC) with a VBAC success rate was 84/100 (84%, 95% CI 76–90%). Among the women who attempted TOLAC, women with a prior vaginal delivery >24 weeks' had a significantly higher VBAC success rate (91.8% versus 71.8%, $p = .01$). Maternal age, body mass index, estimated fetal weight, induction of labor, and cervical dilation were not associated with a higher VBAC success rate.

Conclusions: For women with a prior CD for arrest of descent, VBAC success rates are high. This suggests that arrest of descent is mostly dependent on factors unique to each pregnancy and not due to an inadequate pelvis or recurring conditions. Women with a prior CD for arrest of descent should not be discouraged from attempting TOLAC in a subsequent pregnancy due to concerns about the likelihood of success.

Introduction

For women with a prior cesarean delivery (CD), a decision must be made regarding the mode of delivery in subsequent pregnancies. The two options are a trial of labor after cesarean (TOLAC) and a planned repeat CD. When balancing the relative risks and benefits of each option, the likelihood of a successful vaginal birth after cesarean (VBAC) is an important and integral component of this decision. Even assuming a less than 1% risk of uterine rupture with TOLAC [1], women with a low likelihood of a successful VBAC might prefer a planned repeat CD. In one cost effectiveness model developed by the National Institute of Child Health and Human Development Maternal–Fetal Medicine Units Network (NICHD-MFMU), assuming a risk of uterine rupture of 0.8%, TOLAC would be cost effective if the probability of successful VBAC was 47.2% or higher [2].

Several calculators, including one from the NICHD-MFMU data [3], are available online to estimate the odds of a successful VBAC in a particular patient, but none have been prospectively validated to determine if they improve outcomes. The two risk factors that have been shown to increase the odds of a successful VBAC by the largest amount are a prior VBAC and a prior vaginal delivery [3,4]. The risk factor that decreased the odds of a successful VBAC the most, particularly for women with no prior vaginal deliveries, is a prior CD for a recurring indication, such as an arrest of labor [3]. However, arrest of labor can occur in the first or second stage of labor. A prior CD for arrest of descent in the second stage of labor specifically is considered to greatly lower the likelihood of successful VBAC in a subsequent pregnancy, with success rates between 13% and 76% [5–9]. One meta-analysis found the combined VBAC success rate for women with a prior CD for arrest of descent in the second stage of labor to be 52% (or 66%, if the study by Hoskins and Gomez with the lowest success rate of 13% [5] is excluded) [9]. However, success rates are highly influenced by the selection of women attempting TOLAC, as well as the provider's willingness to

manage labor similarly to women with no prior CD. Additionally, since arrest of descent in the second stage is not common, prior studies use cohorts from large hospital databases where obstetrical care was delivered by many different providers, likely with different counseling and labor management practices.

In our practice, we care for many women with prior CD for arrest of descent and we manage labor for a woman undergoing TOLAC similar to women with no prior CD (aside from not using prostaglandins, as they are contraindicated in women with a prior cesarean delivery). The objective of this study was to determine VBAC success rates in one obstetrical practice with uniform counseling and management for patients with a prior CD for arrest of descent, as well as to determine any risk factors associated with the likelihood of successful VBAC.

Materials and methods

After Institutional Review Board approval was obtained, we reviewed the charts of all patients with a prior CD delivered between July 2005 (when our computerized medical record was created) and June 2017. We reviewed the computerized medical record for each patient to record the maternal baseline characteristics, obstetrical history, and delivery information. For this study, we included patients with a prior CD for arrest of descent in the second stage of labor. Patients whose primary indication for CD was non-reassuring fetal heart rate tracing were excluded. Patients with more than one prior CD were included, but not women with more than one prior CD for arrest of descent in the second stage. The primary outcome for this study was a successful VBAC.

In our practice over the course of the study period, patients with a prior CD for arrest of descent were counseled that their likelihood of a successful VBAC was approximately 50% [9]. Online calculators were not systematically used to more specifically predict a successful VBAC, but risk factors known to impact success rate (maternal body mass index (BMI) and parity, for example) were discussed with the patients over the course of their pregnancy. Assuming there was no contraindication to TOLAC, the patient was the one who made the decision whether she would attempt a TOLAC or not. Women attempting TOLAC in our practice are monitored in labor with continuous fetal heart rate monitoring. Induction and augmentation of labor are utilized, as indicated, similar to women with no prior CDs.

We compared baseline characteristics between women who did and did not attempt a TOLAC. The characteristics compared were any prior vaginal delivery >24 weeks, birthweight for the prior arrest of descent CD, maternal age, maternal race, total prior CDs, gestational age at delivery, prepregnancy BMI, the sonographic estimated fetal weight within 4 weeks of delivery, and the last cervical exam before delivery. Chi square and Student's t-testing were used for analysis (IBM SPSS for Windows 22.0, Armonk, NY, 2013).

For all patients, we calculated the successful VBAC rate and 95% confidence interval. We then repeated the calculation in several subgroups: (1) all women who attempted a TOLAC; (2) women with no prior vaginal deliveries >24 weeks who attempted a TOLAC; (3) women with one or more prior vaginal deliveries >24 weeks who attempted a TOLAC.

Among women who attempted a TOLAC, we compared baseline characteristics between women who did and did not have a successful VBAC. Since this subgroup analysis had fewer patients, we used non-parametric testing (Fisher's exact test and Mann–Whitney U test).

Results

During the study period, there were 208 women with one prior CD for arrest of descent, 100 of whom (48.1%) attempted a TOLAC. There were no patients who experienced a uterine rupture. Compared with women who did not attempt a TOLAC, women who attempted a TOLAC were significantly more likely to have a prior vaginal delivery >24 weeks, were younger, had fewer total prior CDs, and had a later mean gestational age at delivery (Table 1).

In the overall population, the likelihood of successful VBAC was 84/208 (40.5%, 95% CI 34–47%) (Table 2). For the 100 women who attempted a TOLAC, the likelihood of a successful VBAC was 84/100 (84%, 95% CI 76–90%). Of the 84 successful VBACs, 82 were spontaneous vaginal deliveries, one was a forceps-assisted delivery, and one was a vacuum-assisted delivery. Women who attempted TOLAC and had a prior vaginal delivery >24 weeks had a 91.8% likelihood of successful VBAC (95% CI 82–96%), whereas women who attempted TOLAC and did not have a prior vaginal delivery >24 weeks had a 71.8% likelihood of successful VBAC (95% CI 56–83%).

Among the 100 women who attempted a TOLAC, when comparing baseline characteristics between women who did and did not have a successful VBAC, only a prior vaginal delivery >24 weeks was associated with a successful VBAC (Table 3). Maternal age, BMI, induction of labor, gestational age, estimated fetal

Table 1. Baseline characteristics of women with a prior cesarean delivery for arrest of descent, based on whether they attempted a trial of labor.

	Attempted TOLAC, $N = 100$	Did not attempt TOLAC, $N = 108$	p^a
Any prior vaginal delivery >24 weeks	61 (61.0%)	28 (25.9%)	<.001
Birthweight of prior cesarean (g)	3595 ± 515	3658 ± 494	.373
Maternal age (years)	30.9 ± 5.5	35.3 ± 5.0	<.001
White race	97 (97.0%)	101 (93.5%)	.241
Total number of prior cesarean deliveries	1.1 ± 0.3	2.2 ± 1.4	<.001
Gestational age at delivery (weeks)	39.1 ± 2.2	38.0 ± 2.0	<.001
Prepregnancy body mass index (kg/m^2)	24.7 ± 5.2	25.4 ± 5.3	.313
Sonographic estimated fetal weight within 4 weeks of delivery (g)	3147 ± 588	3103 ± 520	.667
Last cervical dilation (cm)	1.6 ± 1.1	1.2 ± 1.5	.265
Last cervical effacement (%)	36 ± 28	21 ± 30	.050

TOLAC: trial of labor after cesarean. Data presented as n (%), or mean ± SD.
^{a}Chi-square or Student's t-test.

Table 2. Likelihood of successful vaginal birth in the population.

	Number of patients	Likelihood of successful VBAC (%)	95% Confidence interval (%)
All patients	208	40.5	34–47
Patients who attempted TOLAC	100	84	76–90
Patients who attempted TOLAC, with a prior vaginal delivery >24 weeks	61	91.8	82–96
Patients who attempted TOLAC, no prior vaginal delivery >24 weeks	39	71.8	56–83

TOLAC: trial of labor after cesarean; VBAC: vaginal birth after cesarean.

Table 3. Baseline characteristics of women with a prior cesarean delivery for arrest of descent who attempted a subsequent trial of labor, based on whether they had a successful vaginal birth or not.

	Successful VBAC, $N = 84$	Failed VBAC, $N = 16$	p^a
Any prior vaginal delivery >24 weeks	56 (66.7%)	5 (31.3%)	.011
Induction of Labor	7 (8.3%)	1 (6.3%)	.999
Birthweight of prior cesarean (g)	3657 (3289, 3983)	3558 (3345, 3742)	.377
Maternal age (years)	30.2 (26.7, 35.5)	32.7 (24.7, 35.8)	.940
White race	82 (97.6%)	15 (93.8%)	.411
Gestational age at delivery (weeks)	39.6 (38.2, 40.1)	39.6 (37.8, 40.5)	.731
Body mass index at delivery (kg/m^2)	28.5 (26.1, 31.7)	29.3 (26.3, 32.6)	.608
Sonographic estimated fetal weight within 4 weeks of delivery (g)	3152 (2750, 3536)	3258 (3118, 3975)	.203
Last cervical dilation (cm)	1.5 (1, 2.5)	1.8 (1, 2.5)	.267
Last cervical effacement (%)	50 (0,50)	50 (50,70)	.242

VBAC: vaginal birth after cesarean. Data presented as N (%) or median (25, 95).
^{a}Fisher's exact test or Mann–Whitney U test.

weight, birthweight of prior CD, and cervical exam were not associated with VBAC success.

Eleven women who attempted TOLAC had 2 prior cesarean deliveries (one for arrest of descent), all of whom also had a prior vaginal delivery 24 weeks. Nine of 12 (82%) had a successful VBAC.

The ability of a prior vaginal delivery >24 weeks predicting a successful VBAC was as follows: sensitivity 66.7%, specificity 68.7%, positive predictive value 91.8%, negative predictive value 28.2%, positive likelihood ratio 2.1, and negative likelihood ratio 0.48.

Comment

In this study, we found that women with a prior CD for arrest of descent who attempted TOLAC had an 84% likelihood of successful VBAC. The only patient characteristic that was associated with a successful VBAC was a prior vaginal delivery. Women with a prior vaginal delivery had a 91.8% likelihood of successful VBAC, whereas women without a prior vaginal delivery had a 71.8% likelihood of successful VBAC. Prior studies found a lower success rate, with a pooled success rate of 52% [9]. However, the success rate can be influenced by several factors. First, it is important to consider patient selection. In our study, women who attempted TOLAC were more likely to be young, not obese, white, and with only one prior CD; 61% had a prior vaginal delivery. It is possible that women with different characteristics would have a lower VBAC success rates. For example, in similar sample size of 106 patients with a prior CD for arrest in the second stage, Lewkowitz et al. found a VBAC success rate of 55%. Compared with our population, their population was older (33.6 versus 30.9 years), had a higher percentage of non-white women (47.2% versus 3.0%), and had a lower percentage of women with a prior vaginal delivery (18.9% versus 61%) [9]. They did

not report maternal BMI. It is possible that the high VBAC success rates seen in our study are influenced by patient selection.

However, aside from patient selection and maternal factors, there likely exist other factors that impact VBAC success rates in this population. For example, Lewkowitz et al. only had a 60% VBAC success rate among women with a prior vaginal delivery, in comparison with the 91.8% success rate in our study. Hoskins and Gomez [5] reported on a large cohort of women with a prior CD, 245 of whom had a prior CD after 10-cm dilation. In that cohort, among women attempting TOLAC, the VBAC success rate was only 13%. Their population was mostly Hispanic (56%), black (28%), and Asian (13%) (they did not report maternal age or BMI), which could have contributed to their lower VBAC success rate, as non-white race is a risk factor for failed TOLAC. However, in their study, the VBAC success rate for women with a prior CD at less than 10 cm dilated was 67–69%. This indicates that the prior arrest disorder, and not the patient population itself, was responsible for the very low VBAC success rate for women with a prior second stage arrest in their study. Bujold et al. [6] reported outcomes on 214 women with a prior CD for arrest of descent and had very similar success rates to those seen in our study. Their overall VBAC success rate was 72.4% for women with no prior vaginal deliveries and 84.3% for women with at least one prior vaginal delivery. Maternal BMI was not reported and aside from it being a Canadian cohort, no other maternal race details were reported.

We suspect that, in addition to differences in patient demographics, much of the differences seen in VBAC success rates across the different cohorts are due to the obstetricians' management of labor and counseling regarding the likelihood of success. If the obstetrician believes the likelihood of success is low, he or she might be unwilling or less likely to manage labor in a manner similar to women with a more favorable likelihood of success. It is very difficult to glean this information from published studies, but it would explain how reports from different institutions could have markedly different VBAC success rates. In our study, since all the patients were under the care of one specific obstetrical practice, we know that they were counseled similarly that they had an approximately 50% chance of successful VBAC and that their labors were managed similarly to women with no prior CD for arrest of descent. We believe that this is one reason why our success rate was so high. It is also the biggest strength of this study that the patients were under the care of one obstetrical practice. This limits the bias introduced by including all patients in one institution, or from a larger registry database, which would include multiple obstetrical providers, and thus multiple approaches to labor management, caring for the cohort of patients. Our study is limited by its retrospective nature and that our results might not be generalizable to other populations. We are also underpowered for some of the analyses done regarding risk factors for successful VBAC.

Given the results of our study and others [9], VBAC success rates for women with a prior CD for arrest of descent are likely above 50%, and according to our results and others [6], could be significantly higher. Based on a NICHD cost analysis [2], this would indicate that TOLAC is cost effective in this population. It is curious why women with a prior arrest of descent in one pregnancy could have such a high likelihood of successful VBAC in a second pregnancy. After all, arrest of descent is thought to imply a measure of cephalo-pelvic disproportion (CPD), which would portend a low chance of successful VBAC in the next pregnancy. The high VBAC success rates seen in the next pregnancy indicate either that the initial CD was not truly due to CPD or that CPD is pregnancy-specific, which can be due to the fetal size or perhaps the position of the fetal head. Recent data suggesting that allowing a longer second stage of labor will achieve a higher rate of vaginal delivery [10,11] supports the possibility that many CDs done in the second stage of labor are not truly due to CPD and had the second stage been allowed to proceed longer, a vaginal delivery may have occurred. It is also known that fetal position and asynclitism have an effect of the presenting diameter of the head, which impacts the ability of the cardinal movements of labor to occur easily. Regardless of the exact reason, it is important to counsel women that a prior CD in the second stage of labor does not indicate that they are unable to have a vaginal delivery in a subsequent pregnancy. Based on our data and others, women with a prior CD for arrest of descent should not be discouraged from attempting TOLAC in a subsequent pregnancy due to concerns about the likelihood of success.

Disclosure statement

The authors did not report any potential conflicts of interest.

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