Predictors of successful vaginal birth after one caesarean section at selected hospitals in Lusaka, Zambia

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Background. Repeat caesarean section (CS) carries an increased risk of both maternal and neonatal morbidity and mortality. Planned vaginal birth after CS (VBAC), with an estimated success rate of 60 - 80%, is clinically safer than elective repeat CS, and also limits the rise in CSs. There is no single generalised validated tool to predict success of VBAC.

Objectives. To determine predictors of successful VBAC among mothers with one previous CS at selected hospitals in Lusaka, Zambia.

Method. Determination of independent predictors with significant high odds of a successful VBAC among mothers offered a trial of labour (TOL) was conducted in a cross-sectional study. Women with a history of one previous lower-segment CS, who were carrying a singleton fetus and were in established labour or draining amniotic fluid and scheduled for TOL after CS, were included in the study. Convenience sampling was used to enrol 290 participants. Using SPSS version 22, bivariate analysis and logistic regression analysis were used to analyse data. An independent factor associated with successful VBAC and with a *p*-value <0.05 was considered significant.

Results. Of the participants, 236 (81.4%) had a successful vaginal delivery and 54 (18.6%) failed to deliver vaginally and required emergency CS. Key independent predictors of success of VBAC were primary education level (adjusted odds ratio (AOR) 2.21; 95% confidence interval (CI) 1.01 - 4.84), multiparity (AOR 4.81; 95% CI 1.16 - 19.93), previous successful VBAC (AOR 9.94; 95% CI 1.29 - 76.70), inter-delivery interval after the primary CS (AOR 18.54; 95% CI 5.98 - 57.48), a history of fetal distress (AOR 9.33; 95% CI 2.48 - 35.08), malpresentation (AOR 6.13; 95% CI 1.65 - 22.70) or failed induction of labour (AOR 20.52; 95% CI 3.32 - 127.03) as indications for the primary CS, Bishop score (AOR 7.06; 95% CI 1.92 - 25.97), cervical dilation (AOR 11.62; 95% CI 3.86 - 35.03), duration of labour (AOR 20.78; 95% CI 5.62 - 76.80), birthweight (AOR 6.80; 95% CI 3.33 - 13.91) and Apgar score (AOR 28.42; 95% CI 5.67 - 142.38).

Conclusion. A combination of independent sociodemographic and obstetric factors that have significant high odds for a good outcome of VBAC could help predict success of delivery in a given population. This information could also aid in counselling mothers on mode of delivery.

Keywords. Caesarean section (CS), vaginal birth after caesarean section (VBAC), elective repeat caesarean section (ERCS), predictors of success.

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Vaginal birth after caesarean section (VBAC) describes a vaginal delivery in a woman who has previously given birth via caesarean section (CS). Patients desiring VBAC undergo a trial of labour (TOL), also called TOL after CS (TOLAC). Pregnant women who have had one previous CS have two delivery options: VBAC or elective repeat CS (ERCS). There is a consensus[1-3] that planned VBAC is a clinically safer choice than ERCS for the majority of women with a single previous lower-segment CS (LSCS). Several reports[4-6] have indicated that the absolute risk of uterine rupture attributable to a TOL after one previous CS is ~1 per 1 000. Having undergone two previous CSs further increases the risks of uterine rupture in a subsequent pregnancy, so for a future pregnancy, having had a successful VBAC offers protection after undergoing the risk in the current pregnancy.[4] Such a strategy would also limit escalation of the CS rate and maternal morbidity associated with multiple CSs.[3,7,8] Many studies[9-11] have addressed methods for identifying women at low and high risk of failure of VBAC, but none of them have resulted in a validated result, raising the crucial question of how to reliably predict successful VBAC. There is considerable variation across institutions in the proportion of women who attempt TOLAC and successfully deliver vaginally.[1,3,5,12] Even factors found to be associated with successful VBAC vary from centre to centre.[5] The Royal College of Obstetricians and Gynaecologists[3] reported in 2015 that vaginal birth after one previous CS had a success rate of 72 - 75%. In sub-Saharan Africa, a meta-analysis[12] of 17 published reports concluded that the probability of vaginal delivery in this situation was 69%. In Zambia, no large-scale, countrywide study has been done to establish what factors will predict success of VBAC. A prospective study[13] on the outcome of labour following one previous CS done at University Teaching Hospital (UTH) in Lusaka nearly three decades ago for the period 1 October 1995 - 30 September 1996 concluded that a TOL after a previous CS was a reasonable and moderately safe option to be followed at UTH. Our present aim was to determine the predictive factors associated with successful VBAC among mothers with one previous CS at selected hospitals in Lusaka.

Methods

This was a cross-sectional study to identify predictive independent factors associated with successful VBAC among mothers with one previous CS who were offered a TOL at selected hospitals in Lusaka. The hospitals were UTH, Kanyama General Hospital, Matero General Hospital, Chilenje General Hospital and Chipata General Hospital. Data were collected for the 5-month period 1 May 2021 - 30 September 2021. The sample size of 280 was calculated using the Cochran formula with the estimate of prevalence of ~76%, based on a study by Mulindi.[13] The desired width of confidence interval (CI) or absolute error of precision was taken as 0.05. Convenience sampling was used to enrol 290 participants. Women carrying a singleton fetus with a history of one

Table 1. List of variables

Independent variables	Dependent variable
Sociodemographic variables • Maternal age • Gestational age • Parity • Level of education • Employment status	Outcome of VBAC • Failure • Success
Past obstetric variables • Indication for primary CS • Inter-delivery interval • Previous successful VBAC • History of stillbirth	
Current obstetric variables • Bishop score at admission • Status of membranes at admission • Duration of ROM • Presence of meconium • Position of the presenting part • Duration of labour	
Fetal factors • Birthweight • Apgar score at birth	

CS = caesarean section; VBAC = vaginal birth after CS; ROM = rupture of membranes.

previous LSCS who were in established labour or draining amniotic fluid and scheduled for TOLAC were included in the study, whereas pregnant women who did not consent and those with incomplete medical records were excluded. There were two outcomes, successful VBAC or failed VBAC. A successful VBAC was defined as a participant who managed to deliver spontaneously by the vaginal route after being offered a TOLAC, while a failed VBAC was a participant who did not manage to deliver vaginally after been offered a TOLAC and proceeded to deliver via emergency CS. Sociodemographic factors, past and present obstetric factors and fetal factors in the cases of successful VBAC were then analysed. Table 1 shows the variables that were studied.

Bivariate analysis was performed using the data editor of SPSS, version 22 (IBM, USA), to determine the associations between various independent and dependent categorical factors. If Pearson's χ^2 p-value was <0.05, the association was considered significant. This analysis was followed by logistic regression analysis to control for the confounding effect of independent determinants.

Ethical clearance was obtained from the University of Zambia Biomedical Research Ethics Committee (ref. no. 1514-2021), and permission to conduct the study was then obtained from the National Health Research Authority in Zambia (ref. no. NHRA00007/19/04/2021).

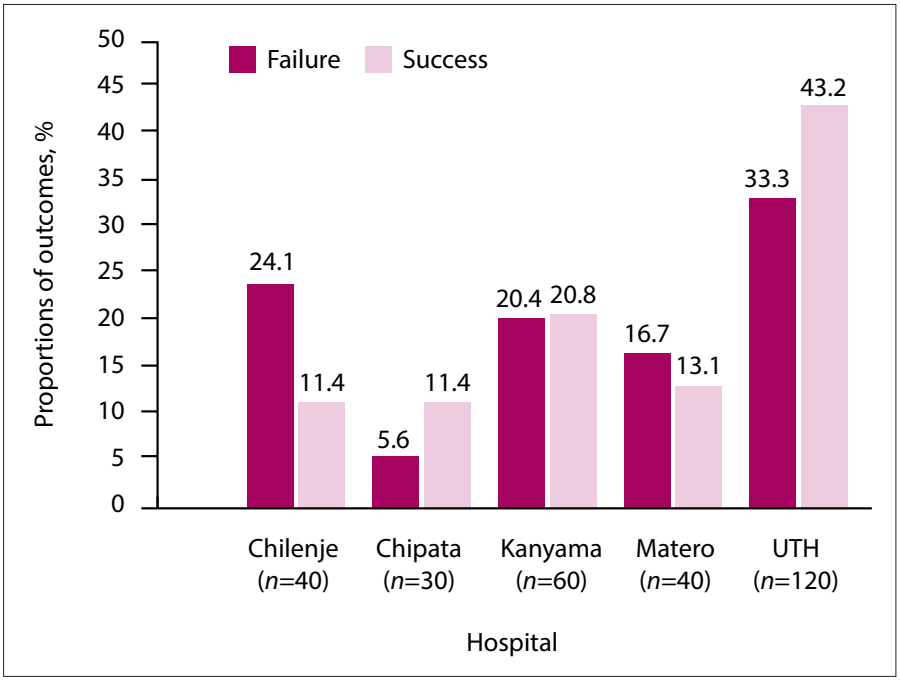

Fig. 1. Proportions of outcomes of trial of labour after caesarean section in the sampled hospitals in Lusaka district, Zambia. (UTH = University Teaching Hospital.)

Results

Study participants

Of the 290 participants, 236 (81.4%) successfully delivered vaginally after one previous CS, while 54 (18.7%) failed the TOL and underwent emergency CS. Fig. 1 shows the proportions of outcomes of VBAC in the sampled hospitals in the Lusaka district. Being a referral centre, UTH had the largest proportion of participants (n=120; 41.4%), followed by Kanyama General Hospital with 60 (20.7%), Chilenje and Matero General Hospitals with 40 each (13.8%), and Chipata General Hospital with the lowest number of participants at 30 (10.3%). Of all successful VBACs, UTH had the highest proportion (43.2%), followed by Kanyama General Hospital (20.8%) and Matero General Hospital (13.1%). Chipata and

Table 2. Bivariate analysis for sociodemographic characteristics of women undergoing TOLAC at selected hospitals in Lusaka district (*N*=290)

	Outcome of TOLAC, *n* (%)†			
Independent characteristics	**Failure (*n*=54)**	**Success (*n*=236)**	**Total, *n***	***p*-value**
Maternal age (years) (continuous), mean (SD)	28.7 (5.9)		290	
Maternal age (years) (categorical)				0.185
<30	35 (64.8)	122 (51.7)	157	
30 - 35	15 (27.8)	82 (34.7)	97	
>35	4 (7.4)	32 (13.6)	36	
Parity				0.001*
1	23 (42.6)	79 (33.5)	102	
2	22 (40.7)	52 (22.0)	74	
3	5 (9.3)	46 (19.5)	51	
≥4	4 (7.4)	59 (25.0)	63	
Gestational age (weeks)				0.281
<39	26 (48.1)	131 (55.5)	157	
39 - 41	21 (38.9)	66 (28.0)	87	
>41	7 (13.0)	39 (16.5)	46	
Level of education				0.161
Illiterate	21 (38.9)	59 (25.0)	80	
Primary	15 (27.8)	95 (40.3)	110	
Secondary	14 (25.9)	59 (25)	73	
Tertiary	4 (7.4)	23 (9.7)	27	

TOLAC = trial of labour after caesarean section.
*Statistically significant ($p<0.05$).
†Except where otherwise indicated.

Table 3. Bivariate analysis for past obstetric characteristics of women undergoing TOLAC at selected hospitals in Lusaka district (*N*=290)

	Outcome of TOLAC, *n* (%)			
Independent characteristics	**Failure (*n*=54)**	**Success (*n*=236)**	**Total, *n***	***p*-value**
Knowledge of indication for primary CS				0.666
Unknown	12 (22.2)	18 (7.6)	20	
Known	42 (77.8)	218 (92.4)	270	
Indication for primary CS				<0.0001*
Big baby	19 (35.2)	7 (3.0)	26	
CPD	10 (18.5)	1 (0.4)	11	
Failed IOL	2 (3.7)	29 (12.3)	31	
Fetal distress	8 (14.8)	97 (41.1)	105	
Malpresentation	9 (16.7)	45 (19.1)	54	
Others	3 (5.6)	40 (16.9)	43	
Unknown	3 (5.6)	17 (7.2)	20	
Health of baby in primary CS				0.029*
Dead	6 (11.1)	9 (3.8)	15	
Alive	48 (88.9)	227 (96.2)	275	
Previous successful VBAC				<0.0001*
No	22 (40.7)	166 (70.3)	188	
Yes	32 (59.3)	70 (29.7)	102	
Inter-delivery interval after primary CS (years)				<0.0001*
<2	8 (14.8)	86 (36.4)	94	
2 - 4	5 (9.3)	121 (51.3)	126	
>4	41 (75.9)	29 (12.3)	70	
SVD before primary CS				0.300
No	39 (72.2)	153 (64.8)	192	
Yes	15 (27.8)	83 (35.2)	98	
History of stillbirth				0.087
No	52 (96.3)	209 (88.6)	261	
Yes	2 (3.7)	27 (11.4)	29	

TOLAC = trial of labour after caesarean section; CS = caesarean section; CPD = cephalopelvic disproportion; IOL = induction of labour; VBAC = vaginal birth CS; SVD = spontaneous vaginal delivery.
*Statistically significant ($p<0.05$).

Table 4. Bivariate analysis for current obstetric and fetal characteristics of women undergoing TOLAC at selected hospitals in Lusaka district (*N*=290)

Independent characteristics	Outcome of TOLAC, *n* (%)		Total, *n*	*p*-value
	Failure (*n*=54)	Success (*n*=236)		
Bishop score at admission				<0.0001*
<4	34 (63)	70 (29.7)	104	
4 - 7	7 (13.0)	88 (37.3)	95	
>7	3 (5.6)	32 (13.6)	35	
Unknown	10 (18.5)	46 (19.5)	56	
ROM at admission				0.078
No	44 (81.5)	164 (69.5)	208	
Yes	10 (18.5)	72 (30.5)	82	
Duration of ROM (hours)				0.707
<12	38 (70.4)	170 (72.0)	208	
≥12	7 (13.0)	22 (9.3)	29	
Unknown	9 (16.7)	44 (18.6)	53	
Cervical dilation at admission (cm)				<0.0001*
<4	48 (88.9)	131 (55.5)	179	
≥4	6 (11.1)	105 (44.5)	111	
Presence of meconium				<0.0001*
No	46 (85.2)	233 (98.7)	279	
Yes	8 (14.8)	3 (1.3)	11	
Position of presenting part				<0.0001*
Occiput anterior	0	133 (56.4)	133	
Occiput posterior	16 (29.6)	7 (3.0)	23	
Unknown	38 (70.4)	96 (40.7)	134	
Duration of labour after admission (hours)				<0.0001*
<4	8 (14.8)	71 (30.1)	79	
4 - 6	28 (51.9)	157 (66.5)	185	
>6	18 (33.3)	8 (3.4)	26	
Birthweight (g)				<0.0001*
<3 000	12 (22.2)	152 (64.4)	164	
>3 000	42 (77.8)	84 (35.6)	126	
Apgar score at birth				<0.0001*
0 - 3	15 (27.8)	5 (2.1)	20	
4 - 7	26 (48.1)	111 (47.0)	137	
>7	13 (24.1)	120 (50.8)	133	

TOLAC = trial of labour after caesarean section; ROM = rupture of membranes.
*Statistically significant (p<0.05).

Chilenje hospitals had the lowest contributions to the success rate of VBAC with 1.4% each.

Bivariate analysis for sociodemographic characteristics

Table 2 shows that parity was the only sociodemographic characteristic of pregnant women with a single previous CS that was significantly associated with outcome (p=0.001).

Bivariate analysis for past obstetric characteristics

Table 3 shows that indication for the primary CS (p<0.0001), health of the baby in the primary CS (p=0.029), previous successful VBAC (p<0.0001) and inter-delivery interval after the primary CS (p<0.0001) were all found to have a statistically significant association with successful vaginal delivery after one previous CS.

Bivariate analysis for current obstetric and fetal characteristics

Table 4 shows that a Bishop score at admission of ≥4, cervical dilation of ≥4 cm at admission, lack of meconium, occipito-anterior position of presenting part, shorter duration of labour (≤6 hours), birthweight <3 000 g and Apgar score >7 had a statistically significant association with successful VBAC, as p-values were all <0.05.

Logistic regression analysis for sociodemographic characteristics of study participants

Table 5 shows that multiparity of ≥4 increased the odds of successful VBAC by more than four times (adjusted odds ratio (AOR) 4.81; 95% CI 1.16 - 19.93; p=0.030) compared with para 1 mothers. Women with primary education were more than twice as likely to have a successful VBAC (AOR 2.21; 95% CI 1.01 - 4.84; p=0.046) compared with illiterate mothers.

Table 6 shows that women with a previous history of successful VBAC were found to have more than nine times higher odds of successful VBAC (AOR 9.94; 95% CI 1.29 - 76.70; p=0.027) compared with those with no history of previous successful VBAC. Women with a shorter inter-delivery interval of 2 - 4 years after the primary CS were found to be >18 times more likely to give birth vaginally (AOR 18.54; 95% CI 5.98 - 57.48; p<0.0001) compared with those with a

Table 5. Multivariate logistic regression analysis for sociodemographic characteristics of women undergoing TOLAC at selected hospitals in Lusaka district

Independent characteristics	*p*-value	AOR	95% CI for AOR
Parity			
1	Ref.		
2	0.372	0.70	0.31 - 1.54
3	0.154	2.44	0.72 - 8.28
≥4	0.030	4.81	1.16 - 19.93*
Level of education			
Illiterate	Ref.		
Primary	0.046	2.21	1.01 - 4.84*
Secondary	0.547	1.30	0.56 - 3.04
Tertiary	0.935	1.07	0.21 - 5.55

TOLAC = trial of labour after caesarean section; AOR = adjusted odds ratio; CI = confidence interval.
*Statistically significant ($p<0.05$).

Table 6. Multivariate logistic regression analysis for past obstetric characteristics of women undergoing TOLAC at selected hospitals in Lusaka district

Independent characteristics	*p*-value	AOR	95% CI for AOR
Health of baby in previous CS			
Dead	Ref.		
Alive	0.255	3.54	0.40 - 31.31
Prior successful VBAC			
No	Ref.		
Yes	0.027	9.94	1.29 - 76.70*
Inter-delivery interval after primary CS (years)			
<2	0.001	5.94	2.13 - 16.60*
2 - 4	<0.0001	18.54	5.98 - 57.48*
>4	Ref.		
Indication for primary CS			
Big baby	Ref.		
Failed IOL	0.001	20.52	3.32 - 127.03*
Fetal distress	0.001	9.33	2.48 - 35.08*
Malpresentation	0.007	6.13	1.65 - 22.70*

TOLAC = trial of labour after caesarean section; AOR = adjusted odds ratio; CI = confidence interval; CS = caesarean section; VBAC = vaginal birth after CS; IOL = induction of labour.
*Statistically significant ($p<0.05$).

longer interval of >4 years. Non-recurring indications for the primary CS, such as fetal distress and malpresentation, were found to have a stronger statistical association with successful VBAC than recurring indications such as CPD and a big baby. Mothers with a history of fetal distress had an AOR of 9.33 (95% CI 2.48 - 35.08; $p=0.001$), while those with a history of malpresentation had an AOR of 6.13 (95% CI 1.65 - 22.70). Although failed induction of labour (IOL) is a recurring indication for CS, in this study it was found that a history of IOL in the primary CS had a strong statistical correlation with success of VBAC (AOR 20.52; 95% CI 3.32 - 127.03; $p=0.001$).

Table 7 shows that a Bishop score at admission of >7 was associated with a seven times higher likelihood of successful VBAC (AOR 7.06; 95% CI 1.92 - 25.97; $p<0.003$) compared with a score of <4. Women with a single previous CS who were admitted in the active phase of labour (≥4 cm cervical dilation) had a >11 times higher likelihood of successful VBAC (AOR 11.62; 95% CI 3.86 - 35.03; $p<0.0001$) compared with those in the latent phase of labour with <4 cm dilation of the cervix. Furthermore, women with a shorter duration of labour of 4 - 6 hours after admission were found to have a >20 times higher likelihood of successful VBAC (AOR 20.78; 95% CI 5.62 - 76.80; $p<0.0001$) compared with women with prolonged labour of >6 hours. With regard to fetal characteristics, babies weighing <3 000 g were more than six times more likely to be born successfully via vaginal delivery after a TOL (AOR 6.80; 95% CI 3.33 - 13.91) than those whose birthweight was ≥3 000 g. In addition, babies with an Apgar score >7 were more than 28 times more likely to have been born successfully via vaginal delivery after a TOL (AOR 28.42; 95% CI 5.67 - 142.38; $p<0.0001$) compared with those whose Apgar score was ≤3, who were more likely to have been born by emergency CS.

Discussion

The main objective of this study was to investigate the factors associated with successful VBAC among mothers with one previous CS at selected hospitals in Lusaka, Zambia. In this study, the key independent predictors of success of VBAC were primary education level, multiparity, previous successful VBAC, inter-delivery interval after the primary CS, fetal distress, malpresentation, failed IOL, Bishop score, cervical dilation, duration of labour, birthweight and Apgar score. Maternal age, gestational age, spontaneous vaginal delivery before the primary CS, health of the baby in the previous CS, history of stillbirth, and ruptured membranes at admission were found to have no statistical effect on the odds of success of VBAC.

Using both bivariate analysis and multivariate logistic regression analysis, the outcome of VBAC for maternal age was insignificant.

Table 7. Multivariate logistic regression analysis for current obstetric and fetal characteristics of women undergoing TOLAC at selected hospitals in Lusaka district

Independent characteristics	*p*-value	AOR	95% CI for AOR
Bishop score			
<4	Ref.		
4 - 7	<0.0001	11.55	4.33 - 30.81*
>7	0.003	7.06	1.92 - 25.97*
Cervical dilation at admission (cm)			
<4	Ref.		
≥4	<0.0001	11.62	3.86 - 35.03*
Duration of labour after admission (hours)			
<4	<0.0001	18.07	3.83 - 85.24*
4 - 6	<0.0001	20.78	5.62 - 76.80*
>6	Ref.		
Birthweight (g)			
<3 000	<0.0001	6.80	3.33 - 13.91*
>3 000	Ref.		
Apgar score at birth			
0 - 3	Ref.		
4 - 7	<0.0001	15.26	3.77 - 61.79*
>7	<0.0001	28.42	5.67 - 142.38*

TOLAC = trial of labour after caesarean section; AOR = adjusted odds ratio; CI = confidence interval.
*Statistically significant ($p<0.05$).

This was contradictory to many studies,[14-16] which found that there was a significant decline in the success rate of VBAC with increased maternal age. It has been argued that medical problems such as chronic hypertension and diabetes mellitus increase with age, and this in turn increases the VBAC failure rate.[17] Multiparity of ≥4 was found to be associated with more than four times the odds of a successful VBAC (AOR 4.81; 95% CI 1.16 - 19.93; $p=0.030$) compared with para 1 mothers. This finding is consistent with studies by Balachandran *et al.*[18] and Senturk *et al.*,[19] who found that increasing parity was associated with an increase in the VBAC rate. Our study found that women with primary education were more than twice as likely to have a successful VBAC (AOR 2.21; 95% CI 1.01 - 4.84; $p=0.046$) compared with illiterate mothers, and that there was no statistically significant significance between outcomes of VBAC in women with secondary or tertiary education. A study by Gilbert *et al.*[20] found that elective CSs were planned and carried out more often in more educated women than in women with high school education or less, suggesting that level of education does influence the obstetric management of women with a previous CS. A woman who is more educated would probably opt for a planned repeat CS rather than attempt a vaginal birth after CS.

Multivariate logistic regression analysis showed that women with a previous successful VBAC had more than nine times higher odds of having a successful VBAC (AOR 9.94; 95% CI 1.29 - 76.70; $p=0.027$) compared with those with no history of a previous successful VBAC. This finding is consistent with a meta-analysis by Guise *et al.*,[21] who concluded that women with a previous successful VBAC were three to seven times more likely to have a VBAC for their current delivery compared with women choosing VBAC who had not had a previous vaginal delivery. Several other studies[16,22,23] report that a woman with history of a previous successful VBAC had a higher chance of vaginal birth compared with a woman without a previous successful VBAC when attempting a TOL after CS. Furthermore, the rate of uterine rupture decreased after the first successful VBAC and did not increase with subsequent vaginal deliveries (0.87% risk after VBAC, 0.52% after five deliveries).[24] A possible explanation for this finding is that multiparous women develop efficient uterine contractions in labour and are less likely to have a problem with cephalopelvic disproportion (CPD).[25] In the present study, women with an inter-delivery interval of 2 - 4 years after the primary CS were found to be >18 times more likely to give birth vaginally (AOR 18.54; 95% CI 5.98 - 57.48) compared with those with a longer interval of >4 years. Non-recurring indications for primary CS such as fetal distress and malpresentation were found to have a stronger statistical association with success of VBAC than recurring indications such as CPD and a big baby. Mothers with a history of fetal distress had more than nine times higher odds of having a successful VBAC (AOR 9.33; 95% CI 2.48 - 35.08), while those with history of malpresentation such as transverse or oblique lie and breech presentation had more than six times higher odds (AOR 6.13; 95% CI 1.65 - 22.70). This finding is consistent with several other studies that concluded that VBAC was maximally successful in patients whose CS was carried out for non-recurring indications such as malpresentation, fetal distress and antepartum haemorrhage.[14,26,27]

In the present study, women with a Bishop score at admission of >7 had a seven times higher likelihood of a successful VBAC (AOR 7.06; 95% CI 1.92 - 25.97) compared with those with a lower Bishop score of <4. This finding is consistent with a study by Durnwald and Mercer,[28] who reported that a favourable Bishop score on admission was the strongest and most significant predictor for successful VBAC, and that the chances of VBAC improved as the Bishop score at the time of admission increased. Several other studies[25,29-31] found that spontaneous onset of labour and a higher Bishop score were associated with successful VBAC. Although cervical dilation is part of the Bishop score, it was analysed independently in logistic regression in the present study in order to appreciate its specific effect on success of vaginal birth after one previous CS. It was found that women with a single previous CS admitted in the active phase of labour (≥4 cm cervical dilation) had a >11 times higher chance of successful VBAC (AOR 11.62; 95% CI 3.86 - 35.03) compared with those admitted in the latent phase of labour with <4 cm dilation of the cervix. These findings are similar to those in a study by Landon *et al.*,[32] who reported that women

with cervical dilation of ≥4 cm at admission had a greater likelihood of achieving a successful TOL compared with women with a failed TOLAC (48.1% v. 26.4%; $p<0.001$). In the present study, women with a shorter duration of labour of 4 - 6 hours after admission were found to have a >20 times higher likelihood of successful VBAC (AOR 20.78; 95% CI 5.62 - 76.80; $p<0.0001$) compared with women with prolonged labour of >6 hours. Our results were similar to the observational data obtained from the OptiBIRTH randomised trial, in which 790 patients undergoing TOLAC from Ireland, Italy and Germany were analysed.[33] With regard to fetal characteristics, both bivariate and multivariate logistic regression analysis in the present study showed that birthweight had a strongly significant association with successful VBAC ($p<0.0001$). We found that that babies with a birthweight <3 000 g had a more than six times higher chance of being delivered vaginally (AOR 6.80; 95% CI 3.33 - 13.91) compared with babies weighing ≥3 000 g. This finding is consistent with reports from several studies that the chances of a vaginal delivery decreased when the fetal weight exceeded 3 500 g ($p<0.05$).[14,27,34] In the present study, babies with an Apgar score >7 had a >28 times higher likelihood of having been born successfully via vaginal delivery after a TOLAC (AOR 28.42; 95% CI 5.67 - 142.38; $p<0.0001$) compared with those whose Apgar score was ≤3, who were more likely to have been born by emergency CS. This finding indicates good clinical practice of monitoring fetal wellbeing during labour, so that fetal compromise and distress can be diagnosed early and the baby can be delivered by emergency CS. This practice prevents most babies from having a lower Apgar score (≤3) after vaginal birth. An Apgar score ≤3 defines severe grade III hypoxic ischaemic encephalopathy, which has serious neonatal and long-term complications including cerebral palsy. In addition, several studies[35-38] report that prolonged duration of labour is significantly associated with a low Apgar score.

Conclusion

Successful VBAC depends on a combination of independent sociodemographic, past obstetric, current obstetric and fetal predictive factors associated with high odds of success. Knowledge of these factors on the part of the attending obstetrician or midwife is key in counselling mothers on mode of delivery. With the aim of predicting success, this information could help to appropriately select women who have had one previous CS as candidates for a TOL and thus reduce the morbidity and mortality associated with multiple elective repeat CSs. In our study, the main determinants of success of VBAC included multiparity, a previous successful VBAC, non-recurring indications for the primary CS, an inter-delivery interval of 2 - 4 years after the primary CS, a favourable Bishop score, active phase of labour, shorter duration of labour, occipito-anterior position of the presenting part, birthweight <3 000 g, and an Apgar score >7.

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