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Delivery outcome and predictors of successful vaginal birth after primary cesarean delivery: A comparative study

Adewole AA[1ID], Fawole AA[2ID], Ijaiya MA[2ID], Adeniran AS[2ID], Adeshina KT[2ID], Aboyeji AP[2ID]

[1]Department of Obstetrics and Gynecology, Federal Medical Centre, Lokoja, Nigeria.
[2]Department of Obstetrics and Gynecology, University of Ilorin/ University of Ilorin Teaching Hospital, Ilorin, Nigeria.

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Abstract
Objectives: This study aimed to determine the rate and predictive factors for successful vaginal birth after cesarean delivery, and measure maternal and neonatal outcomes of VBAC following one previous cesarean delivery.
Methods: In this hospital-based prospective study, sixty women with one previous CD (subjects) who attempted VBAC and another sixty without previous CD (controls) carrying singleton cephalic fetuses matched for maternal age, parity, and gestational age were compared. The primary outcome measures were successful vaginal delivery and its predictors. Data were analyzed using SPSS (version 22.0), and $p<0.05$ was significant.
Results: Out of 1768 deliveries, 105 (5.9%) had one previous CD; 57.1% (60/105) attempted while 61.7% (37/60) had successful VBAC; 23 (38.3%) had failed VBAC and repeat CD, while 14 (23.3%) of the control group had CD. The significant predictors of successful VBAC were cervical dilatation ≥4cm on admission (p=0.003), maternal age ≥35 years (p=0.019); and augmentation of labor (p=0.020); while previous vaginal delivery (p=0.108), parity (p=0.706), BMI (0.240), and inter-delivery interval (p=0.265) were not statistically significant. The maternal and neonatal outcomes were not statistically different among women who had successful VBAC after one CD compared to women without previous CD. Important morbidities following VBAC included uterine rupture (3.3%) and primary postpartum hemorrhage (6.7%). There was no peripartum hysterectomy or maternal death; the perinatal mortality rate was 16.7/1,000 live births for women who attempted VBAC while no perinatal death was recorded among the controls.
Conclusion: VBAC is safe, and its outcome is comparable to women without previous CD.

Keywords: Trial of scar, predictors, successful trial of scar, failed trial of scars.

Plain English Summary

This study was conceptualized due to the high rate of cesarean delivery (CD) observed for women with one previous CD scar. The objectives were to determine the success rate among women who attempted VBAC, maternal and neonatal outcomes, and the predictive factors for successful VBAC following one previous CD. The study was conducted using the quantitative method. The purposive non-probability sampling method was used to recruit participants from the antenatal clinic of the University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria, and structured questionnaires were used to collect data. Our findings showed that the success rate of VBAC was 61.7%. The significant predictors of successful VBAC were cervical dilatation ≥4cm on admission into the labor ward, augmentation of labor, and maternal age ≥35 years. The study shows that VBAC is safe, and its outcome is comparable to outcome in women without previous CD.

Background

There is a growing global concern over the rising cesarean delivery (CD) rates; reported rates include 35% in India (1), 32% in the USA (2), and 37.8% in Egypt (3). In Nigeria, reports include 28.9% in Ibadan (4) and

Correspondence:
Adewole, Adebayo A
Department of Obstetrics and Gynecology,
Federal Medical Centre,
Lokoja, Nigeria.
+2348036324806, adewoleobsgyn@hotmail.com

20.7% in Ilorin (5). Repeat CD remains the major contributor to the rising CD rates, while the increasing primary CD implies a higher number of women with scarred uteri in the subsequent pregnancy. The management of women with one previous CD scar poses a challenge due to perceived increased risks of maternal and perinatal morbidity and mortality compared to those with unscarred uteri, especially the life-threatening complications.

Management of women with previous CD scar includes either a planned vaginal birth after CD (VBAC) or an elective repeat CD, although obstetricians are encouraged to explore VBAC to reduce repeat CD at minimal risk (6). A Cochrane review concluded that there are risks and benefits associated with both options (7); thus, women require an evidence-based discussion based on the individual clinical scenario with their obstetricians to formulate a safe birth plan. Also, repeat CD confines the woman to CD for subsequent deliveries with an increased likelihood of dense pelvic adhesions, placenta previa, morbidly adherent placenta, postpartum hemorrhage (PPH), and peripartum hysterectomy compared to those who have successful VBAC (8). The Royal College of Obstetricians and Gynecologists (RCOG) recommends implementing the VBAC versus elective repeat CD checklist for antenatal counseling to promote shared decision-making and informed consent (9). According to the RCOG, women carrying a singleton cephalic fetus at 37weeks or beyond with one previous CD with/without previous vaginal delivery and no contraindication to vaginal delivery are best suited for VBAC with a 72-75% success rate (9). Furthermore, because there is a greater risk of failed VBAC and subsequent emergency repeat CD, appropriate patient evaluation and selection are recommended for planned VBAC (9).

However, despite the recommendations on its safety, there is a downward trend in VBAC in high-income countries, including the USA (6), due to the fear of litigation from adverse maternal and perinatal outcomes following failed VBAC. These adverse outcomes include emergent repeat CD, uterine rupture, PPH, peripartum hysterectomy, blood transfusion, and perinatal and maternal deaths (3, 4, 5, 6). However, the practice of VBAC still subsists in low-income countries, including Nigeria, due to aversion to CD; therefore, obstetricians need appropriate individualized evaluation that can assist in formulating a safe birth plan. Evidence from large clinical series (6, 8) tertiary centers (10) smaller community hospitals and private hospital settings (11) where facilities are limited suggests that the benefits of VBAC outweigh the risks in most women with one previous transverse lower segment scar. However, other researchers have raised serious concerns about the safety of VBAC following records of uterine ruptures with perinatal deaths and long-term neurologic impairments (12).

For VBAC, the benefit of the meta-analysis of randomized controlled trials remains limited due to ethical challenges in the design and conduct of such trials because the decision on delivery options depends on variables including the couple's preference and the healthcare provider's experience, among others (6, 7, 8, 9). The recent meta-analysis on factors associated with successful VBAC concluded that diabetes, hypertensive disorder complicating pregnancy, Bishop score, labor induction, macrosomia, age, obesity, previous vaginal birth, and the indications for the previous CS should be considered as the factors affecting the success of VBAC (13). On the other hand, a meta-analysis of clinical interventions that influence VBAC rates concluded that there is insufficient high-quality evidence to inform optimal clinical interventions among women attempting a trial of labor after a prior CD (14). Therefore, there is a need to gather additional evidence on the factors affecting the success and outcome of VBAC, especially in low-income countries. This study aims to measure the success rate of VBAC, the predictors of success as well as the maternal and neonatal outcomes.

Methods

Study design and Study population

This was a prospective comparative study conducted at the Department of Obstetrics and Gynaecology, University of Ilorin Teaching Hospital, Ilorin, Kwara State, Nigeria. The participants consisted of women with one previous CD who attempted VBAC at the study site (subject) and women without any previous uterine scar (control) matched for maternal age, parity, and gestational age.

Inclusion and exclusion criteria

The inclusion criteria for subjects included one previous CD scar, singleton cephalic fetus, clinically adequate pelvis, and no contraindication to vaginal delivery. The control group consisted of women with singleton pregnancies admitted in labor without previous uterine scar matched for maternal age, parity, and gestational age to the study group. Women with multiple

previous CDs, previous myomectomy, classical uterine scar, uterine perforation or rupture, multiple pregnancies, or other contraindications to vaginal delivery were excluded from the study.

Sample size determination:
The sample was determined by using this formula (15).

$$n = \left\{\frac{Z\alpha\sqrt{\pi 0(1-\pi 0)} - Z\beta\sqrt{\pi 1(1-\pi 1)}}{\pi 0 - \pi 1}\right\}^2$$

n = minimum sample size of each arm of the study group.
α = probability of making Type 1 error usually set at 5% level (i.e. 0.05)
β = probability of making Type 2 error is usually fixed at 20% (i.e. 0.2)
Zα is two tailed value of Z related to α = ± 1.96
Zβ is one tailed value of Z related to β = - 0.84
π_0 is the proportion associated with α (standard value).
Current CD rate in the study center= 20.7% (5), thus vaginal delivery rate = 79.3%.
π_0 = 79.3% = 0.793 = 0.8.
Anticipating a VBAC success of 60% (π_1 = 0.6), the difference in vaginal delivery rate between subjects and controls ($\pi_0 - \pi_1$ = 0.8 – 0.6) was 0.2. Sample size (n) was then calculated as 35.73, approximately 36 participants. With provision for a 20% attrition rate, i.e., 7, the minimum allowed sample size (n) summed up to 36+7= 43 participants in each study's arm.

Sampling method
A purposive non-probability sampling method was employed, in which all consecutive eligible and consenting women were recruited until the sample size was completed.

Recruitment
Participants were recruited by the 20th week of gestation at the study site's booking or antenatal clinic.

Management
After recruitment, participants were educated about the study, including take-home material stating the likelihood of success, the possibility of an emergency CD if the VBAC attempt failed, possible VBAC complications, and the management options to prevent or treat the complications. The partner or any other individual preferred by the participant was involved in the birth plan. At 36 weeks gestation, obstetric ultrasound was performed on participants to assess fetal viability, presentation and weight, liquor volume, placental location, and scar thickness. Clinical fetal weight estimation was carried out using the abdominal palpation method of Ojwang modified by Dare et al., (16). This method was obtained by calculating the product of the symphysio-fundal height and abdominal girth at the umbilical level measured in centimeters and expressed in grams to estimate the fetal weight at term in-utero. One pint of blood was grouped and saved for each patient in the blood bank.
To be considered for VBAC at the study site, the woman must have had only one previous CD; the fetus must be a singleton in cephalic presentation, and ultrasound estimated fetal weight less than 3500g (8, 9, 13, 14).
The setting provided room for access to an ultrasound scan machine in the labor ward, and labor is routinely monitored with Pinard fetal stethoscope or hand-held fetal Doppler device; high-risk women in labor (including those with previous CD) are monitored with the cardiotocograph (CTG). Compatible cross-matched blood is always available for patients with one previous CD in labor within 30 to 60 minutes after admission, while there was 24-hour coverage by anesthetists, theatre staff, and neonatologists for emergencies.
The third stage of labor was managed actively with parenteral oxytocic administration (10 IU) within one minute of the baby's delivery. The placenta was delivered by Brandt-Andrew's method of controlled cord traction and examined under running water to confirm completeness. All participants were monitored in the labor room for two hours before transfer to the postnatal ward, where they spent at least 24 hours before discharge if there were no complications during and after delivery. They were followed up in the postnatal clinic with their babies until six weeks post-delivery. Women with failed trials of labor and those without previous CD scars who could not achieve vaginal delivery were delivered by emergency CD and were discharged on the fifth-day post-surgery.
The participants and their babies were followed up until discharge from the hospital and reviewed at the hospital postnatal follow-up visit six weeks postpartum.

Data collection
The labor and delivery records, intrapartum, postpartum, intra-operative, and postoperative complications, including the length of hospital stay, were documented for all participants. The neonatal outcome measures included Apgar scores at first and fifth minutes, birth weight, neonatal intensive care unit (NICU)

admission, indication(s) for admission in NICU, and length of hospital stay.

Data management

The data collection sheet was coded, and the data obtained was fed into the statistic package for social sciences (SPSS) software package (version 22.0; Chicago, Illinois, USA). The result was expressed as percentages and means with standard deviation. For the continuous variables, the test of significance was carried out using the student's t-test, while for the categorical variables, the test of significance was carried out using the chi-squared test. Multivariable logistic regression was carried out to identify the predictors of VBAC. Co-variates that were statistically significant at the univariate level were included in the multivariable binary logistic regression to control for confounding. All tests of hypotheses were two-tailed with a type 1 error rate fixed at 5%.

Results

During the study period, there were 1,768 deliveries, out of which 684 women had CD (CD rate 38.7%). One hundred and five (5.9%) had one previous CD, among whom 60(57.1%) were recruited into the study together with 60 women without previous CD as controls. The mean maternal age (30.67+4.07 vs. 30.67+4.16) years, parity (2.83+0.96 vs. 2.85+0.95), and gestational age at delivery (38.83+1.66 vs. 38.83+1.66) weeks were similar between cases and controls.

From table 1, the booking status (p=0.059), level of formal education (p=0.131), social class (p=0.271), and marital status (p=0.604) were comparable between women with and those without previous CD. There was no statistically significant difference between subjects (women with one previous CD) and controls (women without uterine scar) in terms of vaginal delivery (36 vs. 43), vacuum delivery (1 vs. 3), and CD (23 vs. 14) p=0.149. Table 2 shows the relationship between indications for primary CD and the outcome of index pregnancy among women who had previous CD (subjects). The successful VBAC rate was 100% for abruptio placenta, cord prolapse, twin gestation with an abnormal lie or poor labor progress, fetal macrosomia, fetal distress, abnormal lie while it was 75% for severe preeclampsia with an unfavorable cervix, 54.2% for CPD, 50% for eclampsia and placenta praevia, 33.3% for hand prolapse. The repeat CD rate was 66.7% for hand prolapse, 50% for eclampsia and placenta praevia, 45.8% for CPD, and 25% for severe preeclampsia with an unfavorable cervix.

Table 1: Biosocial characteristics and the mode of delivery of participants

Parameter	Subjects n=60 (%)	Control n=60 (%)	χ^2	P-value
Biosocial characteristics				
Booking status				
Booked	45 (75.0)	53 (88.3)	3.56	0.059
Unbooked	15 (25.0)	7 (11.7)		
Level of formal education				
None	3 (5.0)	2 (3.3)	5.58	0.131
Primary	5 (8.3)	5 (8.3)		
Secondary	18 (30.0)	8 (13.3)		
Tertiary	34 (56.7)	45(75.0)		
Social class				
High	15 (25.0)	23 (38.4)	2.68	0.271
Middle	37 (61.7)	29 (48.3)		
Low	8 (13.3)	8 (13.3)		
Marital status				
Single	1 (1.7)	0 (0.0)	1.01	0.604
Widowed	1 (1.7)	1 (1.7)		
Married	58 (96.6)	59(98.3)		
Mode of delivery				
Vaginal	36(60.0)	43 (71.7)	3.81	0.149
Instrumental delivery	1 (1.7)	3 (5.0)		
Caesarean delivery	23 (38.3)	14 (23.3)		
Indication for cesarean delivery				
Cord presentation	0 (0.0)	1 (7.1)	5.62	0.231
Cord prolapse	3(13.0)	1 (7.1)		
Cervical dystocia	5 (21.7)	0 (0.0)		

Fetal distress	4 (17.4)	4 (28.6)
Cephalopelvic disproportion	11 (47.8)	8 (57.1)

Table 2: Relationship between indications for primary CD and the outcome of index pregnancy among subjects.

Indication for previous CD	•Vaginal delivery N=37	Successful VBAC rate (%)	Repeat CD N=23	Repeat CD rate (%)
Abruptio placentae with live fetus (n=1)	1	100%	NA	NA
Twin gestation with poor progress of labor (n=1)	1	100%	NA	NA
Cord prolapse (n=1)	1	100%	NA	NA
Fetal macrosomia (n=1)	1	100%	NA	NA
Fetal distress (n=1)	1	100%	NA	NA
Eclampsia (n=2)	1	50%	1	50%
Twin gestation with leading twin breech (n=2)	2	100%	NA	NA
Abnormal lie (n=3)	3	100%	NA	NA
Hand prolapse (n=3)	1	33.3%	2	66.7%
Severe preeclampsia with unfavorable cervix (n=4)	3	75%	1	25%
Placenta previa (n=8)	4	50%	4	50%
••Others (n=9)	5	55.6%	4	44.4%
Cephalopelvic disproportion (n=24)	13	54.2%	11	45.8%

•Vaginal delivery included Spontaneous vertex delivery=36 and Vacuum delivery=1
••Others: Advanced maternal age, background infertility, oligohydramnios, intrauterine growth restriction, and prolonged pregnancy.

From table 3 after multivariable logistic regression, the significant predictive factors for successful VBAC were cervical dilatation >4cm on admission in labor (p=0.003), maternal age≥ 35years (p=0.019) and augmentation of labor (p=0.020). The other factors namely inter-delivery interval (p=0.265) parity (p=0.706), estimated gestational age at delivery (p=0.128), maternal height (p=0.777), maternal weight (p=0.882), body mass index (p=0.240), previous vaginal delivery (p=0.108), estimated fetal weight (p=0.658), mode of onset of labor (p=1.000), fetal sex (p=0.122) and birth weight (p=0.131) were not significant predictors of VBAC among women with successful compared to failed VBAC.

Table 3: Evaluation of predictive factors for successful VBAC among participants

Variables	Successful VBAC n=37(%)	Failed VBAC n=23(%)	COR (95%CI)	AOR (95%CI)	p-value
Age					
<35years	29(78.4)	21(91.3)	0.165(0.019-0.417)	0.008(0.000-0.461)	0.019*
>35years	8(21.6)	2(8.7)			
Parity					
<5years	35(94.6)	22(95.7)	0.795(0.068-9.301)	2.070(0.047-90.898)	0.706
>5years	2(5.4)	1(4.3)			
EGA					
<40weeks	28(75.7)	21(91.3)	0.296(0.058-1.517)	0.090(0.090-0.004)	0.128
>40weeks	9(24.3)	2(8.7)			
Maternal height					
<154cm	5(13.5)	1(4.3)	3.438(0.357-31.479)	0.516(0.005-49.931)	0.777
>154cm	32(86.5)	22(95.7)			
Maternal weight					
<90Kg	34(91.9)	22(95.7)	0.515(0.570-5.273)	0.630(0.001-277.990)	0.882
>90Kg	3(8.1)	1(4.3)			
Body mass index					
<30Kg/m2	25(67.6)	15(65.2)	1.111(0.370-3.338)	4.427(0.370-52.998)	0.240

>30Kg/m2	12(32.4)	8(34.8)			
Previous vaginal delivery					
Yes	24(64.9)	9(39.1)	0.348(0.119-1.021)	0.128(0.010-1.570)	0.108
No	13(35.1)	14(60.9)			
Inter-delivery interval					
<15months	4(10.8)	4(17.4)	0.576(0.129-0.571)*	0.108(0.002-5.423)	0.265
>15months	33(89.2)	19(82.6)			
Estimated fetal weight					
<3500g	16(43.2)	6(26.1)	2.159(0.694-6.719)	1.718(0.156-18.882)	0.658
>3500g	21(56.8)	17(73.9)			
Mode of onset of labor					
Spontaneous	36(97.3)	23(100.0)	0.973(0.922-1.027)	0(0.000-0.000)	1.000
Induced	1(2.7)	0(0.0)			
Augmentation of labor					
Yes	19(51.4)	6(26.1)	0.334(0.108-1.037)	0.048(0.004-0.615)	0.020*
No	18(48.6)	17(73.9)			
Cervical dilatation on admission					
<4cm	15(40.5)	21(91.3)	0.065(0.013-0.319)	0.01(0.001-0.202)	0.003*
>4cm	22(59.5)	2(8.7)			
Fetal sex					
Male	21(56.8)	10(43.5)	1.706(0.597-4.876)	0.144(0.012-1.675)	0.122
Female	16(43.2)	13(56.5)			
Birth weight					
<3500g	25(67.6)	12(52.2)	1.910(0.656-5.563)	0.165(0.016-1.710)	0.131
>3500g	12(32.4)	11(47.8)			

COR (Crude odds ratio), AOR (Adjusted odds ratio), CI (Confidence Interval), *Significant at p≤0.05

From table 4, 37(61.7%) women with previous CD had successful VBAC compared to 46(76.7%) for those without previous CD; there was no morbidity among 34(87.2%) women who had previous CD compared to 43(89.6%) for those without previous CD, while other morbidities were comparable. Also, 23(38.3%) women had repeat CD compared to 14(23.3) women who had EMCS among those without previous CD; there was no morbidity among 18(75.9%) women who had failed VBAC and 12(85.7%) of controls. The maternal (p=0.145) and neonatal (p=0.424) outcomes were similar between the two groups irrespective of the mode of delivery. Although the mean blood loss at delivery was higher for women who had repeat CD among the subjects compared to those who had primary CD among the controls (756.52±423.54 vs. 692.86±208.34), it was not statistically significant (p=0.174). The mean maternal hospital stay was higher for women with VBAC among subjects compared with those who had vaginal delivery among controls (2.22±0.82 vs. 1.39±-.71) or repeat CD compared to those with EMCS (7.35±1.23 vs. 6.86±1.03), although these were not statistically significant (p=0.600). The mean duration of stay at the neonatal intensive care unit was higher for women with previous CD irrespective of the mode of delivery for index pregnancy, although it was not statistically significant (p=0.091).

Table 4: Maternal and neonatal outcomes among participants

Outcome	**Vaginal delivery**		**Cesarean delivery**	
	Subjects n=37(%)	**Control n=46(%)**	**Subjects n=23(%)**	**Control n=14(%)**
Maternal outcome				
No morbidity	34(87.2)	43(89.6)	18(75.9)	12(85.7)
Postpartum hemorrhage	3(7.7)	2(4.2)	1(4.2)	0(0.0)
Uterine rupture	0(0.0)	0(0.0)	2(8.4)	0(0.0)

Uterine scar dehiscence	0(0.0)	0(0.0)	1(4.2)	0(0.0)
Surgical site infection	0(0.0)	0(0.0)	1(4.2)	0(0.0)
Blood transfusion	2(5.1)	2(4.2)	1(4.2)	2(4.3)
Endometritis	0(0.0)	1(2.1)	0(0.0)	0(0.0)
	χ^2 9.56	**P=0.145**		
Neonatal outcome				
No morbidity	29(67.4)	43(81.1)	13(41.9)	13(72.2)
Neonatal intensive care admission	7(16.3)	7(13.2)	8(25.8)	4(22.2)
Perinatal asphyxia	3(7.0)	2(3.8)	5(16.1)	0(0.0)
Neonatal sepsis	2(2.7)	0(0.0)	2(6.5)	0(0.0)
Neonatal jaundice	1(2.3)	0(0.0)	2(6.5)	0(0.0)
Hypoxic ischemic encephalopathy	0(0.0)	0(0.0)	0(0.0)	1(5.6)
Neonatal death	0(0.0)	0(0.0)	1(3.2)	0(0.0)
	χ^2 4.93	**P=0.424**		
Mean maternal blood loss at delivery (ml)	308.11±211.65	321.74±225.75	756.52±423.54	692.86±208.34
	χ^2 1.85	**P=0.174**		
Mean maternal hospital stay (days)	2.22±0.82	1.39±0.71	7.35±1.23	6.86±1.03
	χ^2 0.28	**P=0.600**		
Mean neonatal intensive care stay (hours)	84.0±73.65	52.0±37.74	84.0±72.57	30.67±6.11
	χ^2 0.14	**P=0.091**		

Discussion

This study reports a successful VBAC rate of 61.7%, the successful VBAC rate was highest among women whose previous CD was for abruptio placenta, cord prolapse, fetal macrosomia, fetal distress, abnormal lie, and twin gestation with an abnormal lie or poor progress of labor. The significant predictive factors for successful VBAC were cervical dilatation >4cm on admission in labor, maternal age≥ 35years, and augmentation of labor; parity, estimated gestational age at delivery, maternal height, body mass index, previous vaginal delivery, mode of onset of labor and birth weight were not significant. However, maternal, and neonatal outcomes were not significantly different among the study participants when those who attempted VBAC were compared with those without a previous uterine scar.

The observed successful VBAC rate in this study was higher than 46.7% (10) and 48.1% (17) from a study from Nigeria and 46% from India (18); but lower than 69.1% (11) from another study in Nigeria, 65% from Tanzania (19), 71.2% from Eritrea (20) and 73.7 from the Kingdom of Saudi Arabia (21). The local, national, and international variations in successful VBAC rate have been attributed to differences in patient selection criteria and hospital policies, intrapartum monitoring protocols, the experience of the attending obstetrician, indication for the previous CD, the desire of the parturient, and the skill of the healthcare worker to expedite delivery when indicated (10).

Researchers have explored the influence of certain factors on the success or otherwise of VBAC. A cervical dilatation at admission in labor of 4cm or greater was a statistically significant positive predictive factor for successful VBAC in this study, similar to previous reports (7, 12, 22). Although previous vaginal birth was reported as a significant predictive factor for successful VBAC (7, 12, 22), women with previous vaginal delivery had higher success at VBAC in this study, but it was not statistically significant.

Surprisingly, maternal age ≥ 35years was a significant predictive factor for successful VBAC in this study. This is contrary to previous studies associating advanced maternal age with VBAC failure (7, 12, 22, 23). This finding may be because women ≥35 years of age are likely to have had previous vaginal deliveries before the CD or a previous VBAC which are favorable factors for successful VBAC.

Augmentation of labor was also a statistically significant predictive factor for VBAC in this study. The 41.7% augmentation rate was similar to the 39.8% reported in a recent meta-analysis of observational studies on oxytocin use in the trial of labor after CD and its relationship with the risk of uterine rupture (24). Although augmentation of labor improves the success rate of VBAC, it comes with the possibility of uterine rupture as was reported in one participant (1.7%) in this study. Although, prompt delivery was expedited via emergency CD with no fetal mortality. This finding was similar to the pooled rate of uterine rupture (1.4%) in women who received oxytocin augmentation during the trial of scar in a previous report (24). The similarities observed may be due to the strict inclusion criteria for the study

participants. The most important step to avoid poor outcomes when using oxytocin augmentation is to inform the pregnant woman and her partner of the two- to three-fold increased risk of uterine rupture and around 1.5-fold increased risk of CD in augmented labor compared with spontaneous VBAC labor (9). This will prepare their minds to give consent when intervention is inevitable.

Other factors like obesity, induction of labor, fetal macrosomia, and male fetal gender have been reported to be associated with a decreased likelihood of successful VBAC in the literature (7, 22, 25). The difficulty in finding an association between these factors and the outcome of VBAC after one previous CD in this study may be due to the hospital-based design and the limited sample size with a constraint on the level of inferences that can be made from the measured parameters. While several attempts have been made to establish a predictive model to guide clinical practice on VBAC, available evidence suggests that no such model has been approved as the evidence has shown no completely reliable predictive model for the management of women with one previous CD (7, 25).

Uterine rupture is a major concern in VBAC; out of the two cases of uterine rupture in the study, one had augmentation of labor with oxytocin infusion followed by live birth through emergency CD. However, the second case presented with fetal distress in the second stage of labor, but surgery was delayed due to the couple's refusal to consent to eventual stillborn via abdominal delivery. While researchers have documented uterine rupture following failed VBAC (10, 22, 26) early identification and prompt intervention can limit further complications. However, the outcome is worsened by a delay in expediting delivery through the abdominal route. For women with a previous CD, who wished to attempt VBAC, the importance of timely consent for repeat CD should be emphasized during counseling to prevent unnecessary delays that could lead to poor outcomes. The male partners often play a crucial role in the decision-making in Africa and should therefore be involved.

The attitude to induction of labor among women with previous CD varies due to concerns about its safety. Although one participant had successful VBAC following cervical ripening (transcervical Foley catheter) and oxytocin infusion in this study, the power is insignificant to warrant an appropriate recommendation. In a previous report on labor induction after one CD, 3.0% (27/910) had uterine rupture; of these, six had oral Cytotec®, 14 received Minprostin®, and seven had balloon catheters for labor induction (27). According to the RCOG, there is a 2 to 3-fold risk for uterine rupture and a 1.5-fold risk for repeat CD following induction or augmentation of labor in women attempting VBAC compared to spontaneous labor (9).

However, there was no record of peripartum hysterectomy, third or fourth-degree perineal laceration, or maternal mortality during the study. In low-resource countries, cultural and economic values still drive aversion to CD such that abdominal delivery is viewed as a sign of weakness that women insist on vaginal delivery in the face of danger with visits to unskilled birth attendants (28). Although there was more perinatal and neonatal morbidity among women with previous CD who either had vaginal or abdominal deliveries, these differences were not statistically significant. The neonatal admission rate for women with previous CD in the study (25%) was higher than in previous reports (26, 29). The only perinatal death reported in the study was for a participant who had failed VBAC with fetal distress and initially refused surgery, giving a perinatal mortality rate of 16.7 per 1,000 live births, which compares to 15.2 per 1000 from Benin-City, Nigeria (17), although higher than 3.9 per 1,000 from Europe (29). Failed VBAC has been associated with a significantly increased risk for NICU admission, neonatal intubation, and perinatal death compared to elective repeat CD (30).

Limitations

This study is limited by its single-center design and the sample size. Further multicenter studies with large sample sizes are recommended to answer critical questions regarding risk factors and outcomes of VBAC. In addition, the study lacks sufficient power to make a recommendation on routine oxytocin augmentation of labor during VBAC.

Conclusion

In conclusion, the study reports that VBAC is safe and associated with comparable maternal and perinatal outcomes to women without previous CD in selected cases. Therefore, it should be encouraged with the provision of adequate antenatal counseling, education, partner involvement, and appropriate patient selection. The study's strength is the comparison of women who attempted VBAC to matched controls without previous CD.

List of abbreviations

CD: Caesarean Delivery
CPD: Cephalopelvic Disproportion
CTG: Cardiotocograph
IU: International Unis
NICU: Neonatal Intensive Care Units
OR: Odd Ratio
PPH: Postpartum Haemorrhage
RCOG: Royal College of Obstetrician and Gynaecologist
SPSS: Statistical Package for Social Sciences
VBAC: Vaginal Birth After Caesarean delivery

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the University of Ilorin Teaching Hospital's ethical review committee before the commencement of the study (NHREC/02/05/2010), while written informed consent was obtained from all participants.

Consent for publication

All the authors gave consent for the publication of the work under the creative commons CC Attribution-Non-Commercial 4.0 license.

Availability of data and materials

The data and materials associated with this research will be made available by the corresponding author upon reasonable request.

Competing interests

The authors have no competing interests to declare.

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Authors' contributions

Conceptualization: AAA
Study design: AAA, AAF, MAI, AAS, KTA
Drafting of the manuscript: AAA, AAF, MAI, AAS, KTA.
Data collection: AAA, AAS, KTA.
Data analysis: AAA, AAS, KTA
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All authors read and approved the final manuscript.

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References

1. Mukherjee SN. Rising cesarean section rate. J Obstet Gynecol India. 2006 Jul 1;56(4):298-300.
2. Menacker F. Recent trends in cesarean delivery in the United States. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2010. https://doi.org/10.3886/icpsr29022
3. Ebrashy AE, Kassab A, Nada A, Saleh WF, Soliman A. Caesarean section in a university and general tertiary hospitals in Cairo; Egypt: rates, indications and limits. Kasr Al Aini Journal of Obstetrics and Gynecology (KAJOG). 2011;2(1):20-6.
4. Morhason-Bello IO, Oladokun A, Adedokun BO, Obisesan KA, Ojengbede OA, Okuyemi OO. Determination of post-caesarean wound infection at the University college hospital Ibadan Nigeria. Nigerian Journal of clinical practice. 2009;12(1).
5. Ijaiya MA, Aboyeji PA. Caesarean Delivery: The trend over a Ten-year period at Ilorin, Nigeria. Nigerian Journal of Surgical Research. 2001;3(1):11-8. https://doi.org/10.4314/njsr.v3i1.12212
6. American College of Obstetricians and Gynecologists. ACOG practice bulletin no. 205: vaginal birth after cesarean delivery. Obstet Gynecol. 2019 Feb;133(2):e110-27. https://doi.org/10.1097/aog.0000000000003078
7. Dodd JM, Crowther CA, Huertas E, Guise JM, Horey D. Planned elective repeat caesarean section versus planned vaginal birth for women with a previous caesarean birth. Cochrane Database of Systematic Reviews. 2013(12). https://doi.org/10.1002/14651858.cd004224.pub2
8. National Collaborating Centre for Women's and Children's Health. Caesarean Section. London: RCOG Press. 2011.
9. Royal College of Obstetricians and Gynaecologists. Birth after previous caesarean birth. RCOG Green-top Guideline No. 45. 2015.
10. Ikechebelu JI, Mbamara SU, Afuba AN. Vaginal birth after one caesarean section: A review of the practice at Nnewi, southeast Nigeria. J Medicine Med Sci. 2010; 1(7):309 – 313.

11. Ezechi OC, Kalu BKE, Njokanma FO, Ndububa V, Nwokoro CA, Okeke GCE. Trial of labour after a previous Caesarean section delivery: A private hospital experience. Ann Afr Med. 2005; 4(3):113 – 117. https://doi.org/10.4314/wajm.v24i1.28161
12. Jones RO, Nagashima AW, Hartnett-Goodman MM, Goodlin RC. Rupture of low transverse cesarean scars during trial of labor. Obstet Gynecol 1991; 77:815 – 817.
13. Wu Y, Kataria Y, Wang Z, Ming W-K, Ellervik C. Factors associated with successful vaginal birth after a cesarean section: a systematic review and meta-analysis. BMC Pregnancy and Childbirth 2019; 19:360. https://doi.org/10.1186/s12884-019-2517-y
14. Wingert A, Hartling L, Sebastianski M, Johnson C, Featherstone R, Vandermeer B, Wilson RD. Clinical interventions that influence vaginal birth after caesarean delivery rates: Systematic Review & Meta-Analysis. BMC Pregnancy and Childbirth 2019; 19:529. https://doi.org/10.1186/s12884-019-2689-5.
15. Nair VR, Babu PK. Sample size in Clinical Studies. In: Yelikar K. (Ed). Essentials of research methodology and dissertation writing. First Edition. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd. 2009; 54 – 62. https://doi.org/10.5005/jp/books/10297_7
16. Dare FO, Ademowore AS, Ifaturoti OO, Nganwuchu A. The value of symphysiofundal height/abdominal girth measurement in predicting fetal weight. Int J Gynaecol Obstet 1990; 31:243 – 248. https://doi.org/10.1016/0020-7292(90)91018-l
17. Aisien AO, Oronsaye AU. Vaginal birth after one previous caesarean section in a tertiary institution in Nigeria. J Obstet Gynaecol. 2004; 24(8):886 – 890. https://doi.org/10.1080/01443610400018742
18. Nigam A, Anand R, Jain N. Study of obstetric and fetal outcome of post caesarean pregnancy. Int J Reprod Contracept Obstet Gynaecol 2015; 4(1):215 – 218. https://doi.org/10.5455/2320-1770.ijrcog20150238
19. Pembe AB, Othman MK. Pregnancy outcome after one previous caesarean section at a tertiary university teaching hospital in Tanzania. Tanz J Health Res 2010; 12(3):1 – 10. https://doi.org/10.4314/thrb.v12i3.53779
20. Sebhatu B. An experience with trial of scar in 66 Ethiopian women. East Afr Med J. 1994; 71(10):676 – 678.
21. Alkhamis F. Pregnancy outcome in women with previous one caesarean section, experience from Kingdom of Saudi Arabia. Egyptian J Hospital Med 2019; 77(3): 5109 – 5113. https://doi.org/10.21608/ejhm.2019.50257
22. Rossi AC, D'Addario V. Maternal morbidity following a trial of labour after caesarean section vs. elective repeat caesarean delivery: a systematic review with meta-analysis. Am J Obstet Gynecol 2008; 224 – 231. https://doi.org/10.1097/01.aoa.0000350612.83991.5e
23. Tsai H-T, Wu C-H. Vaginal birth after cesarean section – the world trend and local experience in Taiwan. Taiwanese J Obstet Gynecol. 2017; 56: 41 – 45. https://doi.org/10.1016/j.tjog.2016.03.007
24. Zhang H, Liu H, Luo S, Weirong GU. Oxytocin use in trial of labour after cesarean and its relationship with risk of uterine rupture in women with one previous cesarean section: a meta-analysis of observational studies. 2021; 21:11. https://doi.org/10.1186/s12884-020-03440-7
25. Smith GCS, White IR, Pell JP, Dobbie R. Predicting caesarean section and uterine rupture among women attempting vaginal birth after prior caesarean section. PLoS Med 2005; 2: e252. https://doi.org/10.1371/journal.pmed.0020252
26. Hibbard JU, Ismail M, Wang Y, Te C, Karrison T, Ismail M. Failed vaginal birth after a caesarean section: How risky is it? Am J Obstet Gynecol 2001; 184:1365 – 1373. https://doi.org/10.1067/mob.2001.115044
27. Wallstrom T, Bjorklund J, Frykman J, Jarnbert-Petersson H, Akerud H, Darj E, Gemzel-Danielson K, Wiberg-Itzel E. Induction of labour after one previous Caesarean section in women with an unfavourable cervix: A retrospective cohort study. PLoS ONE 2018; 13(7): e0200024. https://doi.org/10.1371/journal.pone.0200024
28. Ball E, Hinshaw K. The current management of vaginal birth after previous caesarean delivery. The Obstet Gynaecol 2007; 9:77 – 82. https://doi.org/10.1576/toag.9.2.077.27307
29. Tan PC, Subramaniam RN, Omar SZ. Predictors for caesarean delivery and

neonatal admission after trial of labour in women with one previous lower segment caesarean scar. Singapore Med J 2008; 49(3):188 – 192.
30. Charitou A, Charos D, Vamenou I, and Vivilaki VG. Maternal and neonatal outcomes for women giving birth after previous caesarean. Eur J Midwifery 2019; 3:8. https://doi.org/10.18332/ejm/108297