

Factors Influencing Successful Vaginal Birth after Cesarean Delivery

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Background: Cesarean delivery is one of the most common procedures performed worldwide; women giving birth by cesarean delivery are increasing over the past several decades. The demand to decrease the rate of repeat cesarean is an international drive. This goal needs to be achieved through safe approach.

Objective: To evaluate the factors of successful Vaginal Birth after Cesarean (VBAC) Delivery.

Setting: Bahrain Defence Force Hospital, Bahrain.

Design: A Retrospective Study.

Method: Cesarean section patients who had an attempt at vaginal delivery between 1 January 2014 and 31 January 2015 were reviewed. Maternal age, gestation age, maternal weight, birth weight, fetus sex, previous vaginal delivery, previous VBAC, cervical dilation and other patient's characteristics were documented.

Data was analyzed using StatsDirect software and P-value of less than 0.05 was considered statistically significant.

Result: Five hundred sixty-eight patients with history of one previous cesarean delivery attempted VBAC. Successful VBAC was documented in 236 (41.5%). We found significant successful VBAC in patients with previous vaginal birth, high parity, presented with cervical dilatation more than or equal to 4 cm, male fetus and patients with induced labor ($P<0.0001$). Other factors negatively affected the success rate, such as recurrent cause for previous cesarean ($P<0.0001$), short interval ($P<0.0001$), ethnic background ($P=0.0006$), and IVF pregnancies ($P=0.0106$). Patient and fetus weights did not affect VBAC outcome.

Conclusion: Previous vaginal birth, advance cervical dilatation, induction of labor and proper interval after Cesarean increase the success rate of VBAC. Factors which negatively affect the vaginal birth after Cesarean are the history of recurrent indication and maternal diabetes.

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The rate of cesarean delivery is an international concern. Cesarean delivery is one of the most common operative procedures performed worldwide; women giving birth by cesarean delivery are increasing over the past decades. Reported cesarean delivery rates vary considerably across Europe, 15% in Norway and Netherlands, 50% in Chile, Argentina, Brazil and Paraguay and 31.1% in the United States^{1,2,3}. In the United Kingdom, the overall rate of cesarean delivery is at approximately 25% of all births⁴.

An international drive is recommended to reduce cesarean rate through vaginal birth for patients who had prior cesarean delivery. However, rise in cesarean delivery has been associated with decline in vaginal birth after previous cesarean⁵. There is variability in achieving a vaginal delivery after cesarean delivery. The range of successful VBAC is between 56% and 80%. There is a regional variation in women who attempt VBAC. In United Kingdom 6% to 64% of women attempt VBAC^{6,7}. Data from sub-Saharan Africa indicate that the rates

of planned VBAC are up to 97% (range 54% to 97%), with 63% to 84% successful vaginal births⁸.

Counseling women with history of previous cesarean regarding the delivery route is a complex matter; patients must be presented not only with accurate success rates, but also with the risks for mother and fetus. Predicting outcomes after Trial of Labor (TOL) is vital because the increased risk for morbidity in women attempting VBAC is primarily found in those women who fail to achieve vaginal birth⁹. In women who had successful VBAC, the risks associated with a trial of labor, including uterine rupture, infectious and hemorrhage, are low. However, in women with a failed VBAC attempt, both risk of maternal and neonatal morbidity are increased^{10,11}. Therefore, a great effort has been placed into establishing a reliable predictor of successful vaginal birth in patients with previous cesarean scar. Pregnant women with prior cesarean must be provided with full information about their labor and the probability to achieve vaginal delivery to avoid repeat cesarean.

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The aim of this study is to evaluate the potential variables which could predict successful VBAC in women after one lower segment transverse Cesarean delivery.

METHOD

All patients who gave birth between 1 of January 2014 and 31 of January 2015 were reviewed. Five hundred sixty-eight patients were identified to have had one previous lower segment cesarean delivery and have accepted the trial of vaginal birth. Patient age, BMI, gestational age, birth weight, parity, ethnicity, previous normal delivery, number of the normal vaginal delivery, interval between current pregnancy and previous cesarean, induction of labor, cervical dilatation at start of labor, sex of the baby and assisted reproductive technique were recorded.

Patients were divided into two groups. The first group includes patients who had previous cesarean due to possible repeated factors, such as cephalic pelvic disproportion, large for date, post-date and failure to progress. The second group include other none repeated cause of previous cesarean, such as malpresentation, fetal distress, premature rupture of membrane, intrauterine growth restriction, prematurity, cord prolapse, congenital abnormality, maternal causes hypertension, preeclampsia, diabetes, anti-partum hemorrhage, scar tenderness, myomectomy, other maternal disease, and maternal request. Interval between current pregnancy and previous cesarean section were also divided into two groups based on 18-months interval. This interval calculated on time gap between the two events, even if the patient managed to deliver vaginally in between. Patients with previous normal delivery identified as any patient with at least one previous normal vaginal delivery. Ethnicity was divided into three groups: group one, all Bahraini; group two Indian/Pakistani patients and group three other Middle Eastern patients. Cervical dilatation at start of labor was divided into two groups: cervical dilatation of less than 4 cm in one group and those with cervical dilatation equal and more than 4 cm in the second group. Our induction of labor protocol uses prostaglandin E2 of 3 mg up to 3 doses at 12 hours intervals for patients with Bishop Score of 4 to 6.

Data was analyzed using StatDirect software. P-value of less than <0.05 was considered statistically significant.

RESULT

Five hundred sixty-eight patients met the inclusion criteria for VBAC. Successful trial was documented in 236 (41.5%) labors. Patients with recurrent reason for cesarean were significantly less likely to succeed in achieving vaginal birth after trial of VBAC, 26 (4.6%) compared to 210 (36.9%) with P-value of <0.0001, see table 1.

Table1: Previous Recurrent Cause of Cesarean on VBAC Success

	Non-Recurrent Cause (441)	Recurrent Cause (127)
Failed VBAC (332)	231 (40.7%)	101 (17.7%)
Successful VBAC (236)	210 (36.9%)	26 (4.6%)
TOTAL = 568	441 (77.6%)	127 (22.4%)
Chi-square P-value < 0.0001		

Older patients in the successful group were found with mean age of 31.8 years compared to 30.8 years in the failed group P=0.046. Furthermore, gestational age was significantly higher in the successful group with median of 39 weeks compared to 38 weeks in the failed group P<0.0001. The difference remained constant after excluding all preterm birth. Patients with more vaginal deliveries and higher parities had a better chance to deliver vaginally. On contrary to well-known argument regarding the effect of obesity on vaginal birth after cesarean, no difference in BMI was found between the two groups, P=0.117. There was no difference in the birth weight between the two groups P=0.052. Our study found no difference in the sex of the baby between the two groups, P=0.2384. There were significantly more patients with assisted reproductive technique in the failed group, 3.6 compared to 0.4 in the successful group, P=0.0106, see table 2.

Table 2: Patient’s Characteristics

	Failed VBAC	Successful VBAC	P-value
Maternal Age Years	30.8 (29.1-31.3)	31.8 (30-33.5)	Unpaired t test P=0.0465
Gestational Age Weeks	38 (37-38.1)	39 (38.7-39.5)	Mann-Whitney U test Two sided P<0.0001
BMI Kg/m ²	33.5 (32.2-36.4)	32.4 (30.3-34.4)	Unpaired t test Two sided P=0.1179
Parity	1 (1.4-2.1)	3 (3-4.1)	Mann-Whitney U test Two sided P<0.0001
Birth Weight Kg	3.1 (2.9-3.2)	3.2 (3.1-3.5)	Mann-Whitney U test Two sided P=0.0527
N of Previous Delivery	0 (0.4-1)	2 (1.9-3)	Mann-Whitney U test Two sided P<0.0001
Male Gender %	162/332 (48.8%)	127/236 (53.8%)	Chi-square P=0.2384
ART Procedure	12/332 (3.61%)	1/236 (0.42%)	Fisher-Freeman-Haltonexact

Bahraini women had less successful rate compared to other ethnic groups, 113 (19.9%) compared to 100 (17.6%). Indian and Pakistani group achieved similar success to that of Bahraini, see table 3.

Table 3: Mode of Delivery and Ethnicity

	Group One: Bahraini (318)	Group Two: Indian and Pakistani (61)	Group Three: Middle Eastern (189)
Failed VBAC (332)	205 (36%)	38 (6.7%)	89 (15.7%)
Successful VBAC (236)	113 (19.9%)	23 (4%)	100 (17.6%)
TOTAL = 568	318 (55.9%)	61 (10.7%)	189 (33.2%)
Chi-square P=0.0005			

Short interval had significant impact on the success of VBAC. Patients who failed to wait at least 18-months inter-delivery, the VBAC success rate dropped to 18 (3.2%) compared to 218 (38.4%) for those patients who waited 18 months or more P<0.0001, see table 4.

Table 4: Effect of Inter-Pregnancy Interval on VBAC Success

	> 18 Months (97)	≥ 18 Months (471)
Failed VBAC (332)	79 (19.9%)	253 (44.5%)
Successful VBAC (236)	18 (3.2%)	218 (38.4%)
TOTAL = 568	97 (17%)	471 (82.9%)
Chi-square P < 0.0001		

Patients with previous vaginal delivery managed to deliver vaginally in 190 (33.5%) of cases compared to 46 (8%) in cases with no previous vaginal birth, $P < 0.0001$, see table 5.

Table 5: Vaginal Birth and VBAC Success

	No Previous Vaginal Delivery (265)	Previous Vaginal Delivery (303)
Failed VBAC (332)	219 (38.6%)	113 (19.9%)
Successful VBAC (236)	46 (8%)	190 (33.5%)
TOTAL = 568	265 (46.7%)	303 (53.4%)
Chi-square $P < 0.0001$		

The initial pelvic examination at the time of admission was recorded for each woman attempting VBAC. Women who start labor with cervical dilatation of equal to or more than 4 cm had higher success rate, 64 (11.3%) compared to 172 (30.3%) who had less cervical dilatation ($P < 0.0001$), see table 6.

Table 6: Effect of Cervical Dilatation on VBAC Success

	< 4 cm (496)	≥ 4 cm (72)
Failed VBAC (332)	324 (57%)	8 (1.4%)
Successful VBAC (236)	172 (30.3%)	64 (11.3%)
Total = 568	496 (87.3%)	72 (12.6%)
Chi-square $P < 0.0001$		

The induction of labor was positively related to the success rates. Women who entered spontaneous labor without induction achieved vaginal birth in 185 (32.5%) compared to 51 (8.9%) in the induction group, $P < 0.0001$, see table 7.

Table 7: Induction of Labor and Success Rate

	No Induction of Labor (490)	Induction of Labor (78)
Failed VBAC (332)	305 (53.6%)	27 (4.7%)
Successful VBAC (236)	185 (32.5%)	51 (8.9%)
TOTAL = 568	490 (86.2%)	78 (13.7%)
Chi-square $P < 0.0001$		

DISCUSSION

Previous studies found that there is high variability in successful VBAC. The majority were ranging from 56% to 80%^{12,13}. However, a recent Australian cohort trial reported a VBAC success rate of 43%, which is similar to our findings of 41.5% success rate¹⁴. The difference in the success rate between these studies and our study might be due to the fact that 26 (4.6%) of our patients had previous cesarean due to cephalo pelvic disproportion (CPD). Furthermore, the high incidence of type 1 and type 2 diabetes in our population had a significant impact on our decision. Gyamfi et al found that diabetic and recurrent indication for cesarean delivery, each significantly decreased VBAC success¹⁵.

Spacing pregnancies is crucial to the integrity of the uterine scar, which would automatically affect our decision regarding the mode of delivery, a two to three-fold increase in the risk of uterine scar rupture for women with a short inter-delivery interval¹⁶.

Huang et al found that an inter-delivery interval of less than 19 months was associated with a decreased rate of VBAC success, but no increase in rupture of the uterus¹⁷. Bujold et al found that an inter-delivery interval of 24 months or less was associated with a two to three-fold increase in uterine rupture, but found no difference in VBAC success rates¹⁶. In the National Institute of Child Health and Human Development (NICHD) study, women undergoing planned VBAC whose previous cesarean birth was within 2 years of their labor had an increased risk of cesarean birth compared with women of more than 2 years from their previous cesarean (32% compared to 25%, respectively)¹⁸. We found that a short interval of less than 18 months is associated with reduced success rate, 19% compared to 46%. Due to the evaluation being retrospective, it was not possible to address the effect of the interval on uterine rupture.

A previous successful VBAC increases the probability of success with future attempts. Gyamfi et al found that patients with a history of one or more previous successful VBAC attempts had subsequent successful VBAC of 94.6%. This is significantly higher than the 70.5% VBAC success rate for patients without prior successful VBAC¹⁵. Edwards et al reported 87% to 90% subsequent vaginal birth after successful VBAC^{10,14,19-21}.

Our data indicated that 303 (53.4%) of our patients had previous vaginal delivery. The success rate of VBAC in this group was 190 (33.5%) compared to 46 (8%) in the group with no previous vaginal birth.

Patients who had failed to deliver vaginally were younger than patients who achieved vaginal birth. This simply could be due to the fact that older patients in our group had been exposed to vaginal birth prior to their attempted VBAC and had been disadvantaged by having cesarean section due to non-recurrent causes. Emmanuel et al found that patients who are 35 years or older are more prone to have a failed VBAC²². Marian et al found that patients 35 years or older should be counseled regarding lower success rate, despite the fact that more than 50% of them had a prior vaginal delivery²³.

It has been proposed that women beyond 40 weeks of gestation could attempt VBAC, although there an increasing risk of VBAC failure. The American College of Obstetric and Gynecology guidelines assert that postdated women VBAC success rate might reach 69%, which is within the range of successful VBAC worldwide¹³. However, the Royal College of Obstetric and Gynecology guideline suggested that women with preterm babies considering VBAC should be informed that the planned preterm VBAC has similar success rates to planned term VBAC but with a lower risk of uterine rupture^{10,14}.

In our study, higher gestational age in the successful group was found. Preterm deliveries in general have a higher tendency toward cesarean delivery due to multiple pregnancies, malpresentation and iatrogenic preterm due to fetal or maternal causes.

A birth weight of more than 4,000g significantly impacted VBAC success. Gyamfi et al found that the average birth weight significantly lower for those patients with a successful VBAC compared to those who failed. Patients whose infants weighed 4,000g or more had 67.5% VBAC success compared to 78.1% for infants weighed under 4,000g^{15,18}. There was no apparent effect of birth weight on the success VBAC in our population.

Obesity is an independent risk factor for failed TOL in patients with previous cesarean delivery²⁴. Perpetua et al found that VBAC success rates as high as 70% even in the morbidly obese patients. Lisa et al found that inter-pregnancy BMI affects the success of VBAC²⁵. In our study, no effect of patients BMI on success rate was found. This could be due to the fact that approximately three quarters of our patients were of Indian or Bahraini background, which share almost similar pelvic shape characteristics that lead to increase in cephalo pelvic disproportion. Patients in these groups achieved only 36% to 38% of successful vaginal birth irrelevant to their BMI compared to 53% success rate in other ethnic groups. The impact of maternal ethnicity is enhanced further by the high rate of primary cesarean and small family size in Indian/Pakistani populations. It is suggested that African American and Hispanic females are significantly less likely than Caucasian females to achieve successful VBAC²⁶.

The Royal College of Obstetric and Gynecology Guidelines found that male infants are factors that decreased the likelihood of VBAC success²⁷. Fifty-one percent of our deliveries were male infants had higher success rate compared to female babies, but did not reach statistical significance. Out of the 13 patients who conceived after IVF treatment, only one managed to have a successful VBAC. This obviously reflects the level of stress and anxiety exhibited by both patients and carers during the counseling process.

Singh et al found that 62.5% of women with ruptured uterus had a previous section; therefore, advised that oxytocin should be used in titrated dose²⁸. Our patients who were found to be more than or equal to 4 cm dilatation at the time of admission had 64 (11.3%) success rate compared to 8 (1.4%) for patients with less favorable cervical dilatation.

Induced labor increased the risk of uterine rupture by two to three-folds and increased the cesarean rate by approximately 1.5-fold compared with spontaneous labors¹⁴. Previous studies reported that induction of labor was associated with reduction in successful vaginal birth^{18,29}. In our study, 78 (13.7%) of the patients were induced; VBAC induction rate was at 51 (8.9%).

It was found that patients with VBAC who accepted induction of labor had a higher rate of vaginal delivery compared with the trial without induction of labor, 65% compared to 38%. The failed VBAC group consisted of patients who allowed vaginal birth, but presented with other obstetrical causes, such as fetal distress or other maternal causes necessitating cesarean delivery. A possible reason to the lower success rate of VBAC in patients who were not induced, could be the high incidence of large babies due to diabetes and postdate.

The social impact on VBAC success was not evaluated in our study. Some patients are eager to achieve normal delivery at all cost due to personal reasons.

Because the evaluation was retrospective, it was not possible to address the impact of anesthesia on VBAC rate and the effect of inter-pregnancy changes in the BMI on the VBAC success rate. It would also be useful to know the incidence of instrumental delivery in women who delivered vaginally, which would indicate the level of birth difficulties.

CONCLUSION

Our VBAC success rate is acceptable given the distinctive ethnic background with increased CPD risk. Favorable factors include higher parities with previous vaginal birth, proper interval prior to VBAC and advanced cervical dilatation of more than 4 cm. Induction of labor was positively related to success rate in our analysis.

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