

## The Failure Rate, Related Factors, and Neonate Complications of Vaginal Delivery after Cesarean Section

### Abstract

**Background:** The rate of Cesarean Section (CS) is high in Iran. A successful Vaginal Birth After Cesarean (VBAC) section can protect mothers against the risk of having multiple CS. This study aimed to evaluate the success rate of VBAC, related factors, and the causes of failure. **Materials and Methods:** This cross-sectional study was conducted on 150 pregnant women who were candidates for VBAC and admitted at maternity hospitals in Qom from 2016 to 2018. The required data were collected from the patients' records and entered into the checklist. Then, the success rate of VBAC was estimated, and related factors together with the causes of failure were determined by *t*-test, Chi-square, and independent-samples *t*-tests in SPSS v. 18 software. **Results:** The mean (SD) maternal age was 32 (5.20) years and ranged from 21 to 45 years old. The success rate of VBAC was estimated to be 85.33%, and 14.67% of the patients had to repeat a CS after failure in vaginal delivery. The mean time between previous CS and present delivery was statistically significant between successful and failure groups ( $t_{125} = 2.32, p = 0.002$ ). The results also revealed that the most important causes of VBAC failure were prolonged labor [odds ratio (OR) = 4.70], full arrest (OR = 2.70), and decline fetal heart (OR = 5.31). **Conclusions:** The success rate of VBAC in our study was high. However, VBAC was more successful when the interval between inter-deliveries was long, and lower complications were reported when the interval was 2–4 years.

**Keywords:** Cesarean, cesarean section, trial of labor, vaginal birth after cesarean

### Introduction

Cesarean Section (CS) delivery is a painful experience for mothers due to fear, anxiety, and relevant complications.<sup>[1]</sup> CS is related to different complications such as increased neonatal and maternal mortality rate, lower Apgar score, and higher respiratory distress in newborn babies.<sup>[1,2]</sup> Vaginal Birth After Cesarean (VBAC) is a strategy to control the ever-increasing rate of cesarean section.<sup>[3]</sup> VBAC is a successful natural delivery after a CS that can protect women from the risk of having to repeat CS. The successful VBAC is associated with a lower risk of maternal morbidity and fewer complications in future pregnancies for mothers.<sup>[4,5]</sup>

Repeat cesarean and VBAC have some advantages and disadvantages.<sup>[6-8]</sup> In comparison to repeated cesarean, VBAC risks include hemorrhage, need for blood transfusion, uterine rupture, prenatal death, and Hypoxic-Ischemic Encephalopathy (HIE). Moreover, women who experienced

repeated cesarean are exposed to higher rates of surgical complications and placenta accrete.<sup>[5,9]</sup> In contrast, mothers who experience VBAC run lower risks of morbidity and mortality than those who undergo repeat cesareans.<sup>[10]</sup>

Based on the World Health Organization's (WHO) recommendations, the expected rate of cesarean should be lower than 15%.<sup>[11,12]</sup> Yet, according to a review study, 48% of all deliveries in Iran have been repeat cesarean sections. The cesarean prevalence in urban areas has been reported to range from 38% to 48% in different studies and has increased up to 72% in the capital city of Iran, Tehran. Moreover, CS is related to higher risks of neonatal respiratory distress and other complications, such as lower Apgar and mortality.<sup>[2]</sup> In addition, the prevalence of repeated cesareans following previous ones has been reported to be 14.40% in the United States<sup>[6]</sup> and 42.25% in Iran.<sup>[2]</sup>

According to the results of recent studies, maternal age <40 years, normal Body

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Mass Index (BMI), gestational age  $\leq 40$  weeks, neonate weight  $>4000$  g, and inter-delivery interval  $\geq 2$  years are the related factors affecting successful VBAC.<sup>[13,14]</sup> Nevertheless, lack of previous vaginal delivery, induction of labor, and preterm delivery are some risk factors for VBAC failure.<sup>[15]</sup> VBAC and Elective Repeat Cesarean (ERC) are two choices for women who have had the previous CS in their next pregnancy.<sup>[16]</sup> The chance of achieving vaginal birth by VBAC has been reported to range from 65% to 83.3% in different studies.<sup>[7,17,18]</sup> In a study by Naji, the success rate of VBAC was reported to be 61% in the United Kingdom<sup>[19]</sup> and 85% in Bengal; in another study, Humton observed that the success rate was 75%.<sup>[18]</sup> In line with the health sector evolution plan in Iran, the rate of CS has decreased from 64.7% to 58.6% in Shiraz.<sup>[20]</sup> Therefore, according to the benefits of VBAC and recommendations to reduce the number of CS in the Iranian health system, the current study aimed to evaluate the success and failure rate of VBAC in mothers with one previous CS and to determine the related factors and causes of VBAC failure.

## Materials and Methods

This cross-sectional study was conducted on 150 pregnant women who were a candidate for VBAC, without the need for induction, admitted at three different maternity governmental educational hospitals in Qom from 2016 to 2018. The sample size calculation was conducted based on the results of a recent study,<sup>[19]</sup>  $p = 0.61$ ,  $\alpha = 0.05$ , and precision ( $d = 0.03$ ). The patients were selected by convenience sampling method. The inclusion criteria included those women who were a candidate for VBAC in the past year, whose gestational age was after 37 week, who aged from 18 to 50 years old, who had a CS in their reproductive history, and who were not affected by eclampsia and hypertension. Exclusion criteria included women whose records were incomplete, and those who were unwilling to participate in the study. All eligible women were selected during the study period, and data were collected from the patients' records and were entered in the checklist.

The data were recorded by gynecologists immediately after delivery and under the supervision of an experienced obstetrician in academic hospitals at patients' records. Then, the required data were gathered and entered in a checklist with three different sections, including (1) demographic characteristics (including nationality, maternal age and weight, gestational age, mode of delivery in present pregnancy, gravidity, parity, abortion, the interval between previous cesarean sections, and current delivery), (2) maternal and pregnancy variables (including the cause of previous CS, current delivery type, the condition of the rupture of membrane at the time of admission, mother's contractions during admission, the causes of current cesarean, and some pregnancy problems such as diabetes, preeclampsia, hypertension, and hypothyroidism), and (3)

clinical neonatal variables (such as neonate gender and weight, Apgar score at first and the 5<sup>th</sup> min after delivery, and fetal complications such as fetal distress and major neonatal conditions [including Respiratory Distress Syndrome (RDS), tachypnea, meconium excretion, and retraction]). The validity checklist was approved by four experts, including gynecologists and methodologists at Qom University of Medical Sciences. The reliability of this questionnaire was estimated by Cronbach alpha as 0.76.

The main outcome of this study was the VBAC successful. Therefore, the patients were divided into the successful group (if they had a vaginal delivery) or failure group (if they did not have a vaginal delivery and had to undergo a CS). Descriptive statistics were used to determine the mean, SD, and percentage of variables. The independent samples *t*-test was used to compare mothers' age, mothers' weight, gravidity, parity, the interval between previous CS and present delivery, newborn weight, and Apgar score between the two groups. The Chi-square test was used to compare two groups regarding VBAC success and failure. The data were analyzed by the Statistical Package for Social Sciences (SPSS) software version 18 (SPSS, Chicago, IL). The *p* value of less than 0.05 was considered significant in all analyses.

## Ethical considerations

The study proposal was approved by the Research Vice-Chancellor of Qom University of Medical Sciences. The Medical Ethics Committee (MEC) of Qom University of Medical Sciences approved the study protocol by IR.MUQ.REC.1397.125 code. All the acquired information about mothers is protected as confidential. Moreover, informed consent was obtained from all patients.

## Results

Of 150 eligible cases, 85.33% had successful VBAC, and 14.67% underwent a repeat CS. The mean (SD) of maternal age was 32 (5.21) years (range: 21–45 years) and the mean (SD) of gestation age was 38.20 (2.19) weeks (range 37–40 weeks). The mean (SD) of maternal weight was 75.8 (11.40) kg (ranging from 46 to 106 kg). Of all cases, 63.30% (95 cases) were Iranian and 36% (54 cases) had experienced some clinical outcomes, including hypothyroidism 16.67% (25 cases), gestational diabetes 8.00% (12 cases), minor thalassemia 0.71% (1 case), Prelabor Rupture Of Membranes (PROM) 16.67% (25 cases), and chronic hypertension 5.33% (8 cases). The mean (SD) of neonatal weight was 3214 (454) gram, and 59.67% (89 neonates) were girls and 3.33% (5 neonates) needed resuscitation.

The most common causes of previous CS were breech status (12.70%, 19 cases), fetal distress (6%, 9 cases), meconium (6.00%, 9 cases), and twin pregnancy (5.33%, 8 cases). Resuscitation need was observed in 2.67% (4 neonates) of the newborn babies at the delivery room. In

our study, the causes of VBAC failure were prolonged labor (8%, 12 cases), decline fetal heart rate (3.33%, 5 cases), and full arrest in the second phase (1.33%, 2 cases). Vacuum delivery was performed in three VBAC cases (2.00%) and postpartum hemorrhage was observed in three cases (2.00%). Besides, one case was reported to have a uterine rupture. The maternal characteristics of all patients in the study are shown in Table 1.

The results of the independent samples *t*-test are shown in Table 2. As observed, the mean of the interval between

previous CS and present delivery was statistically significant between successful and failure groups ( $p = 0.002$ ), but there was no significant difference regarding mothers' age ( $p = 0.180$ ) and mothers' weight ( $p = 0.065$ ), gravidity ( $p = 0.197$ ), newborns' weight ( $p = 0.927$ ).

As seen in Figure 1, the highest success rate of VBAC was observed in women who had inter-delivery intervals between 2 and 4 years, and this rate was significantly higher than those in other groups ( $p = 0.002$ ). Table 3 shows the outcomes of successful VBAC in the study cases. The Chi-square test showed that the diabetes of mother was the most important mother problems that could affect the risk of success and failure of VBAC (OR = 4.10, CI 95%: 1.70–8.40). Moreover, prolonged labor OR = 4.70 (CI 95%: 2.57–9.50), full arrest OR = 2.70 (CI 95%: 1.50–5.90) and decline fetal heart OR = 5.31 (CI 95%: 3.29–8.04) were the most important factors related to VBAC failure. The rate of RDS and three contractions, less than 10 min, were significantly higher in the successful and failure groups.

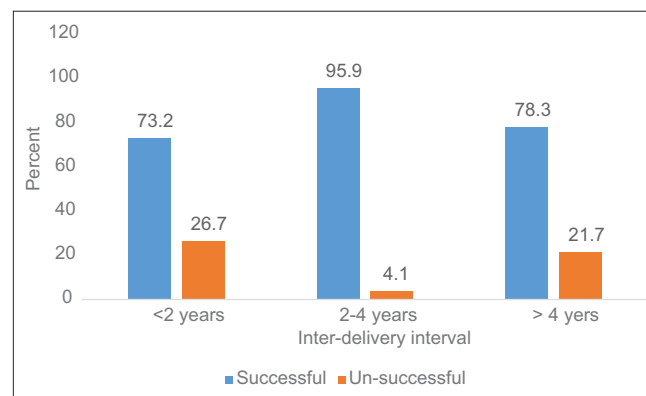
### Discussion

The results of the study revealed that the VBAC success rate was 85.33% in the researched population. The results of other recent studies have shown that success rates

**Table 1: Demographic and obstetric characteristics of the studied patients**

Variables	N (%)
Group	
Successful	128 (85.33)
Failure	22 (14.77)
Nationality	
Iranian	95 (63.33)
Non-Iranian	55 (36.77)
Amniotic fluid	
Clear	138 (92.00)
Meconium	10 (6.70)
Bloody	2 (1.33)
ROM status	
Normal	125 (83.33)
PROM	25 (16.67)
Delivery' complications	
Postpartum hemorrhage	3 (2.00)
Uterine rupture	1 (0.71)
Gender of baby	
Girl	89 (59.30)
Boy	61 (40.71)
Infant' complications	
RDS	5 (3.33)
Tachypnea	1 (0.67)
Meconium excretion	11 (7.33)
Retraction	16 (10.67)

ROM=Rupture of Membranes, PROM=Prelabor Rupture of Membranes, RDS=Respiratory Distress Syndrome



**Figure 1: The successful rate of Vaginal Birth After Cesarean based on inter-delivery intervals**

**Table 2: The Mean (SD) of quantitative related variables in successful and failure groups**

Variables	Group Mean (SD)		<i>t</i>	df	<i>p</i> *
	Successful	Failure			
Mother age	32 (5.29)	34 (4.80)	0.57	148	0.180
Mother's weight	75.1 (11.20)	80.3 (12.1)	1.89	148	0.065
Gravidity	2.92 (1.23)	3.32 (1.20)	1.06	147	0.197
Parity	1.73 (1.15)	1.63 (0.76)	0.45	145	0.708
Abortion	1.26 (0.45)	1.29 (0.49)	0.11	24	0.913
The interval between previous CS and present delivery	4.26 (2.57)	6.64 (3.38)	-2.32	125	0.002
Newborn weight	3212.00 (452.00)	3222.00 (475.00)	0.50	148	0.927
1 Min Apgar Score	8.61 (1.54)	8.74 (0.73)	0.45	148	0.728
5 Min Apgar Score	9.63 (1.73)	9.79 (0.42)	0.47	148	0.698

CS=Cesaren Section, \*based *t*-test

**Table 3: Comparing the qualitative related variables in successful and failure groups**

Variables	Group		$\chi^2$	df	p*	OR (CI 95% OR)
	Successful N (%)	Un-successful N (%)				
Nationality						
Iranian	81 (85.26)	14 (14.74)	1.73	1	0.187	1.62 (0.62-4.25)
Non-Iranian	47 (85.45)	8 (14.54)				
Gender infant						
Boy	51 (87.930)	7 (12.06)	0.05	1	0.475	0.97 (0.86-1.10)
Girl	77 (59.20)	12 (63.20)				
Mother's problems						
No	88 (91.66)	8 (8.34.11)	4.54	1	0.033	2.44 (1.07-5.75)
Yes	40 (74.07)	14 (25.92)				
Type of Mother's problems						
Hypothyroidism	20 (15.81)	5 (23.80)	0.90	1	0.318	1.70 (0.73-4.50)
Diabetes	7 (5.50)	5 (23.81)	8.29	1	0.009	4.10 (1.70-8.40)
PROM	19 (15.00)	6 (28.50)	2.49	1	0.093	2.30 (0.97-5.40)
Preeclampsia	3 (2.30)	0 (0.00)	0.50	1	0.666	1.14 (1.07-1.22)
Failure cause						
Prolonged labor	1 (0.70)	12 (57.11)	80.12	1	<0.001	4.70 (2.57-9.50)
Full arrest	0 (0.00)	2 (9.52)	12.45	1	0.015	2.70 (1.50-5.90)
Decline fetal heart	0 (0.00)	5 (23.81)	31.77	1	<0.001	5.31 (3.29-8.04)
Maternal Complications VBAC						
Post-partum hemorrhage	3 (2.00)	0 (0.00)	1.93	1	0.36	1.15 (1.08-1.23)
Uterine rupture	1 (0.70)	0 (0.00)	0.50	1	0.664	1.14 (1.07-1.22)
Complication infant						
RDS	1 (0.79)	4 (19.00)	18.71	1	0.001	4.73 (4.04-14.81)
Meconium	9 (7.11)	2 (9.50)	0.17	1	0.474	1.48 (0.39-5.60)
Retraction	12 (9.51)	4 (19.00)	1.80	1	0.123	2.23 (0.84-5.90)

CI=Confidence interval, OR=Odds Ratio, PROM=Prelabor Rupture of Membranes, RDS=Respiratory Distress Syndrome, \*Based Chi-square test

can vary from 60% to 80%;<sup>[18,19]</sup> the results of this study agree with Qu *et al.*'s<sup>[21]</sup> and Xing *et al.*'s<sup>[22]</sup> findings. Mirteymouri *et al.*'s study,<sup>[23]</sup> however, reported a higher rate of VBAC success (91.00%), while another study has reported lower rates.<sup>[24]</sup> For example, Melamed observed that the success rate of VBAC was 61.00%<sup>[25]</sup> as a possible result of previous CS.

It seems that VBAC is more difficult and impossible in cases with a history of prolonged labor. Among all studied patients, 23.67% (43 out of 150) had an antenatal indication for their previous cesarean deliveries, and the most common indication was a breech presentation (12.60%). The most common causes of CS in Boyle *et al.*'s study were labor arrests and fetal distresses. Therefore, the abnormal presentation of the embryo (breech) can be regarded as one of the most important causes of the need for a CS.<sup>[26]</sup>

Based on our results, maternal age, parity, and gravidity factors were not related to VBAC success or failure. Most of the women with successful VBAC were less than 40 years of age (95.20%). Knight *et al.* showed that younger women, aged 24 or less, were more likely to attempt a VBAC (60%) than women aged over 34 years (45.00%). According to the findings of this study, two-thirds (63%) of the women who had

a VBAC had a successful natural delivery.<sup>[27]</sup> Other studies have shown that some factors including maternal age over 40 years, white ethnicity, BMI  $\leq 25$  kg/m<sup>2</sup>, gestational age  $\leq 40$  weeks, infant birth weight more than 4 kg, inter-delivery interval  $\geq 2$  years, and higher admission bishop score are the most important prognostic factors in having a successful VBAC.<sup>[13,14]</sup>

Both groups in this study were the same regarding the average neonatal weight. The mean of neonatal birth weight was not different between women with successful and unsuccessful VBAC, and the weight of the newborn babies was the same in both groups. Based on the findings reported in Elkousy *et al.*'s study, the uterine rupture rate could occur in 3.60% of deliveries which had neonatal birth weight over 4 kg.<sup>[28]</sup> However, in this study, the main cause of the uterine rupture was the opening of the incision place resulting from previous CS.

It was also found in this study that the gestational age was not a significant factor in VBAC failure and all deliveries were conducted before the 40<sup>th</sup> week of gestational age. Nevertheless, other studies have reported that 31.33% of VBAC failure occurred in the 40<sup>th</sup> week or beyond.<sup>[14]</sup> Thus, the failure rate of VBAC is higher in mothers who are admitted to the hospital with three contractions in less



than 10 min. In our study, the successful VBAC cases were presented with cervical dilatation equal to or higher than 4 cm. The cervical dilatation in the studied cases on admission was significantly higher in the successful VBAC group than in the failure group. These results are in agreement with the findings reported in the previous literature.<sup>[14,29]</sup> However, Sakiyeva *et al.* reported that the successful VBAC could be related to cervical dilatation  $\geq 4$  cm.<sup>[14]</sup>

In this study, the failed VBAC rate was 14.67%, and prolonged labor, full arrest, and decline fetal heart rate were the causes of VBAC failure. Failed VBAC is associated with increased maternal and neonatal complications and is somewhat predictable. For example, Oboro *et al.* observed that the failure rate of VBAC was 32.6%, showing that deliveries at a young age, lack of previous vaginal delivery, induction of labor, and fetal weight over 4,000 g were among the most important risk factors for VBAC failure.<sup>[15]</sup>

In this study, neonatal complications including RDS, meconium, and retraction were significantly higher in the failure group compared to the successful VBAC group. This finding is confirmed by previous studies.<sup>[15,23,30]</sup> To state an example, Tsai reported an increase in the risks of neonatal morbidities and HIE after successful and unsuccessful VBACs.<sup>[31]</sup> Based on the results of this study, three mothers experienced VBAC complications as postpartum hemorrhage (2.00%), and one of them needed a transfusion. The postpartum hemorrhage might be related to the high BMI of mothers, high neonate birth weight, or a placenta hemorrhage. Likewise, previous research shows that postpartum hemorrhage can occur in 2.20% of women<sup>[25]</sup> and 2.71% of women with successful VBAC.<sup>[23]</sup>

We observed that none of the pregnant women died. Maternal and neonatal death did not happen in our study, similar to Mirteymouri *et al.*'s research.<sup>[23]</sup> In the same vein, Mone and Qustudies confirmed that VBAC was not associated with a higher mortality rate.<sup>[8,21]</sup> Damle also showed that long-term complications were less in the VBAC group.<sup>[32]</sup> In this study, only one case (0.70%) was complicated by uterine rupture, and the short interval between pregnancies was the cause of the uterine rupture. The risk of uterine rupture in an unscarred uterus is extremely rare at 2 per 10,000 deliveries, and this risk is mainly confined to multiparous women in labor.<sup>[5]</sup> Some studies have reported that the incidence of uterine ruptures can differ between 0.20 and 1.00% in women with previous CS.<sup>[33]</sup> However, Frass has recommended that an 18-month interval between previous CS and VBAC could suffice.<sup>[30]</sup> The mean of inter-delivery interval in the successful group in our study was 4 years, and this interval was 6 years in the failure group. Therefore, it seems that the inter-delivery interval between 2 and 4 years is the best interval time

for successful VBAC. Similarly, Sakiyeva *et al.*'s study showed that an inter-delivery interval which is more than 2 years can result in more successful VBACs.<sup>[14]</sup>

This study was the first of its kind in the Iranian context and tried to estimate the success rate of VBAC. Nevertheless, because of some limitations in data collection procedures in the medical patients' records regarding their complications and the VBAC outcomes after discarding, we faced some limitations. For example, it was difficult for us to call patients and complete the required data in some cases. Moreover, physicians in state hospitals did not want to do VBAC. Besides, the effects of the number of previous vaginal deliveries could not be assessed in this study. Therefore, longer studies with larger sample sizes might result in more accurate and comprehensive findings. It should be noted that our results are based on the data from a single setting acquired from those women who were admitted to the hospitals with a previous CS.

## Conclusion

The success rate of VBAC as a safe and feasible method of delivery after a CS is high, especially when the inter-delivery interval ranges from 2 to 4 years. Therefore, most cases with a previous CS and none-repeated indications may enjoy the chance to undergo a VBAC, particularly in centers with the appropriate emergency facilities for doing CS. Nevertheless, more studies with larger sample sizes are needed for the future so that the results of this study are checked against a more comprehensive data set.

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## Conflicts of interest

Nothing to declare.

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