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Incidence Rate and Factors Associated with Successful Vaginal Birth after a Cesarean Section at a Tertiary Maternity Hospital

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Abstract

Background and objectives: Globally rates of vaginal birth after one Cesarean section vary significantly. However, in the recent rears it has been gaining popularity due to its potential benefits. The aim of this study is to assess the incidence of successful vaginal birth after Cesarean-section and associated factors

Methods: This study, conducted from January 1, 2023, to January 1, 2024, at Maternity Teaching Hospital in Erbil, Kurdistan, used two designs: a cross-sectional study to determine the incidence of successful vaginal delivery after Cesarean-section and a case-control study to assess associated factors. Factors studied included maternal age, gestational age, antenatal care, parity, inter-delivery interval, labor duration, Bishop score, and newborn weight.

Results: The average age of the cases (28.4 ± 6.1 years) was significantly higher than that of the controls (26.4 ± 6.5 years), (p-value< 0.001). About half (50.6%) of the control group were primiparous, compared to 32.9% of the cases, also significant at $p < 0.001$. The average labor duration for cases was 3.66 hours, significantly longer than the controls' average of 2.88 hours ($p = 0.002$). There was a significant positive correlation between age and the number of previous vaginal deliveries before CS ($rho = 0.343$, $p < 0.001$) and prior vaginal birth after cesarean-section ($rho = 0.415$, $p < 0.001$).

Conclusion: Vaginal birth after Cesarean-section is considered a safe delivery option, and women with at least one Cesarean section should be educated and encouraged to pursue it.

Keywords: Cesarean section, Labor, Vaginal delivery, Vaginal birth after Cesarean-section

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Introduction

Cesarean delivery has become increasingly common worldwide.[1] Selective repeat cesarean sections are associated with a higher risk of maternal and infant complications, including respiratory morbidity, placenta accretion, visceral injury, intensive care admission, hysterectomy, blood transfusion, and extended hospital stay.[2] Vaginal birth after cesarean section (VBAC) is gaining popularity due to potential benefits such as speedier recovery, improved mother and fetal outcomes through shorter hospital stays, elimination of abdominal surgery, lower risk of infections and hemorrhage, and protection of the bladder and colon.[3-5] Vaginal birth after cesarean-section rates vary significantly globally these disparities in the rates between hospitals have become an important cause of concern in recent years.[3] Studies reveal significant disparities, raising concerns about possible inequalities in access and biases in decision-making methods. A study by Maroyi et al. discovered an alarming range of VBAC success rates, ranging from 32.1% to 77.5% among different hospitals, underlining the variability in practice.[6] The main adverse outcome of VBAC trial is uterine rupture. However, research has shown that women who wait more than 18 months between deliveries have a lower chance of experiencing this complication.[6] Controversies also surround the risk factors that influence VBAC success. While research has identified characteristics such as maternal age, parity, and fetal position as potentially relevant, their interpretations and use in clinical contexts differ significantly.[7] This mismatch might cause confusion and difficulty in providing evidence-based counseling and care to women seeking VBAC. Numerous models have been developed to predict the success of a VBAC. One notable example is the Grobman model, which utilizes data that can be assessed during a patient's initial prenatal visit.[6] Despite the existence of these models, none have been validated for use in Iraq, as far as we know. Looking ahead, it is essential to either validate a universal prediction model for the Iraqi population or create a new model tailored specifically to the unique needs and circumstances of this region. This effort would enhance the accuracy and reliability of VBAC predictions, ultimately improving maternal and fetal outcomes. The objective of this study was to investigate the incidence as well as factors that contribute to successful VBAC in a specific group of women. Identifying these characteristics is critical for improving maternal and newborn outcomes in women attempting VBAC after one cesarean section.

Patients and methods

A cross-sectional study was conducted to determine the incidence rate of successful vaginal delivery after Cesarean section (VBAC). A case-control study design was carried out in order to assess the factors associated with a successful VBAC. All women who delivered successfully, after previous one Cesarean section, were recruited out of in labor ward of Maternity Teaching Hospital located in Erbil city, Kurdistan region, Iraq. Out of 555 women with history of CS, 350 VBAC patients were included. The duration of the study was one year, spanning from January 1st, 2023 until January 1st, 2024.The inclusion criteria for the controls were women who accepted to participate, presented with a term singleton pregnancy, with gestational age between 37-42 weeks. with longitudinal lie, normal placentation, cephalic presentation, and no history of previous lower segment cesarean section delivery the exclusion criteria included pregnant women with history of myomectomy, history of more than one cesarean section, preterm pregnancy, any contraindication to normal vaginal delivery (i.e.: Placenta previa, classic (midline, vertical incision) cesarean section, history of

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uterine rupture), or women who rejected to participate. Written informed consent was obtained from participants prior to their enrollment in the study. The aim and scope of the study were explained thoroughly to each participant by the primary investigator. Ethical approval was granted by the Research Protocol Ethics Committee of Kurdistan Higher Council of Medical Specialties. No. 208, 22. Jan. 2023.Data collection was done by using a designed questionnaire, in which each lady was assigned with a code for identification in order to preserve the anonymity and privacy of the patients. The first part of the questionnaire was composed of demographic data such as age, occupation, residency, and BMI.[8] The second part of the questionnaire comprised information regarding the current and previous pregnancies, such as gestational age of the current pregnancy, antenatal care (according to the antenatal classification of WHO 2016 where it's recommended that pregnant women have at least 8 contacts with contacts with a physician, a visit during the 1st trimester, two visits during the 2nd trimester, and five visits during the 3rd trimester), parity, number of previous vaginal deliveries, indications for previous one C-section, Malpresentation, inter-delivery interval (The period between the last two deliveries).[9,10] The third part of the questionnaire comprised data regarding the delivery of the current pregnancy, such as duration of labor after admission, Bishop score, on admission, categorized into Bishop score <4 and ≥4, membrane status, newborn's weight in grams and categorized according to the WHO's newborn average weight standards.[11-13]

Data were analyzed using SPSS (version 26). The Chi-square test compared proportions between two groups, and Fisher's exact test was used when over 20% of cells had expected values less than 5. The student's t-test compared the means of two independent samples. Spearman's rho was calculated to assess correlation strength. A p-value of ≤ 0.05 indicated statistical significance.

Results

Seven hundred women were included in the study. The incidence of VBAC was 63.6%. The mean (±SD) age of cases (28.4 ±6.1 years) was significantly ($p < 0.001$) higher than that of the controls (26.4 ±6.5 years). Almost all (98.3%) of the women were housewives. The majority (78.3%) of the women were living in rural areas. The mean (±SD) BMI of the cases (27.99 ±2.7) was significantly ($p<0.001$) lower than that of the controls (28.61±2.7), the gestational age of 92.1% of them was 37-40 weeks, but there were no significant differences between the groups regarding residency ($p = 0.714$) and gestational age ($p = 0.068$) as presented in Table (1).

Table (1): Basic characteristics of the study groups.

	Case	Control	Total	
	No. (%)	No. (%)	No. (%)	p value
Age (years)				
< 20	17 (4.9)	49 (14.0)	66 (9.4)	
20-24	88 (25.1)	112 (32.0)	200 (28.6)	
25-29	95 (27.1)	77 (22.0)	172 (24.6)	
30-34	78 (22.3)	60 (17.1)	138 (19.7)	
≥ 35	72 (20.6)	52 (14.9)	124 (17.7)	< 0.001*
Mean (SD)	28.4 (6.1)	26.4 (6.5)	27.4 (6.4)	< 0.001**
Occupation				
Housewife/unemployed	346 (98.9)	342 (97.7)	688 (98.3)	
Employed	4 (1.1)	8 (2.3)	12 (1.7)	0.244*

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Residency				
Urban	78 (22.3)	74 (21.1)	152 (21.7)	
Rural	272 (77.7)	276 (78.9)	548 (78.3)	0.714*
Mean BMI	27.99 ±2.7	29.22±2.6	28.61±2.7	<0.001**
BMI Category				
Normal weight	40 (11.4)	16 (4.6)	56 (8%)	
Overweight	230 (65.7)	199 (56.9)	429 (61.3)	
Obese	80 (22.9)	135 (38.6)	215 (30.7)	<0.001*
Gestational age (weeks)				
37-40	329 (94.0)	316 (90.3)	645 (92.1)	
> 40	21 (6.0)	34 (9.7)	55 (7.9)	0.068*
Total	350 (100.0)	350 (100.0)	700 (100.0)	

*By Chi square test. **By unpaired t test.

Around half (50.6%) of the controls were primiparous women, compared with 32.9% of cases ($p < 0.001$). The mean parity of cases (2.6) was significantly ($p < 0.001$) higher than that of the controls (2.05). The membrane was ruptured in 40.3% of the women of the control group, which was significantly ($p = 0.023$) higher than that of the cases (32%). Almost all (99.4%) of the women had a Bishop score of four or higher, and the difference was not significant between the groups ($p = 0.624$). No significant difference was detected between the two groups regarding the frequencies (and percentages) of the number of antenatal care visits ($p = 0.119$), the mean of the number of visits among cases was 2 and among controls was 1.9 ($p = 0.430$), as presented in Table (2).

Table (2): Factors associated with NVD after CS.

	Case	Control	Total	
	No. (%)	No. (%)	No. (%)	p value
Primiparous	115 (32.9)	177 (50.6)	292 (41.7)	
Multiparous	191 (54.6)	145 (41.4)	336 (48.0)	
Grand multiparous	44 (12.6)	28 (8.0)	72 (10.3)	< 0.001*
Mean (SD)	2.6 (1.7)	2.05 (0.08)		< 0.001†
Membrane status on admission				
Intact	238 (68.0)	209 (59.7)	447 (63.9)	
Rupture	112 (32.0)	141 (40.3)	253 (36.1)	0.023*
Bishop score				
< 4	1 (0.3)	3 (0.9)	4 (0.6)	
≥ 4	349 (99.7)	347 (99.1)	696 (99.4)	0.624**
Mean (SD)	8.7 (2.4)	8.2 (3.1)		0.028†
Birth weight (g)				
2500-4000	304 (86.9)	308 (88.0)	612 (87.4)	
> 4000	46 (13.1)	42 (12.0)	88 (12.6)	0.648*
Mean (SD)	3644.7 (500.1)	3616 (483.2)		0.440†
Number of antenatal care visits				
None	221 (63.1)	223 (63.7)	444 (63.4)	
1-7	122 (34.9)	126 (36.0)	248 (35.4)	
≥ 8	7 (2.0)	1 (0.3)	8 (1.1)	0.119**
Mean (SD)	2.0 (2.8)	1.9 (2.6)		0.430†
Total	350 (100.0) †	350 (100.0)	256 (100.0)	

*By Chi square test. **By Fisher's exact test. †By unpaired t test. †Note that the total is not the same for all the variables.

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The most common indications of CS were fetal distress (26.6%), breech presentation (25.4%), and maternal request (10.6%), in addition to other causes mentioned in Table (3).

Table (3): Indications of the previous CS.

Indications	No.	(%)
Fetal distress	93	(26.6)
Breech presentation	89	(25.4)
Other causes	69	(19.7)
Maternal request	37	(10.6)
Poor progress in 1st stage of labor	22	(6.3)
Antepartum hemorrhage (APH)	18	(5.1)
Unknown cause	10	(2.9)
CPD	8	(2.3)
Malpresentation	4	(1.1)
Total	350	(100.0)

The mean duration of labor of cases (3.66 hours) was significantly ($p = 0.002$) higher than the mean of controls (2.88). No significant ($p = 0.204$) difference between the groups in the means of inter-delivery interval Table (4).

Table (4): Means of duration of labor and inter-delivery interval of the two study groups.

	Case		Control		
	Mean	(SD)	Mean	(SD)	P*
Duration of labor after admission in (hours)	3.66	(3.45)	2.88	(3.10)	0.002
Inter-delivery interval (months)	57.46	(40.65)	53.81	(35.11)	0.204

*By unpaired t test.

Positive significant correlation was detected between age and No. of previous vaginal deliveries before CS (rho = 0.343, $p < 0.001$), and also between age and No. of prior VBAC (rho = 0.415, $p < 0.001$). Negative weak significant correlation was detected between No. of prior VBAC and No. of previous vaginal deliveries before CS (rho = -0.211, $p < 0.001$), as presented in Table (5).

Table (5): Correlations between age, No. of previous vaginal deliveries before CS, and No. of prior VBAC.

Variable 1	Variable 2	rho*	P
Age (years)	No. of previous vaginal deliveries before CS	0.343	< 0.001
Age (years)	No. of prior VBAC	0.415	< 0.001
No. of prior VBAC	No. of previous vaginal deliveries before CS	-0.211	< 0.001

*Spearman rho correlation coefficient.

Discussion

A growing number of researches has been conducted in recent years to support the safety of VBAC and to encourage healthcare providers to recommend it more frequently.[14] The incidence of successful vaginal birth after Cesarean section in Maternity Teaching Hospital, in Erbil city was 63.6%, this finding is lower than the rate reported by Al-Sheikh et al.'s study, in which they reported 72% successful VBAC.[15] while Afework et al. reported a lower incidence rate of successful VBAC (51.1%) in their study, compared to ours.[16] This discrepancy in the incidence rate can be attributed to a higher range of difficult cases and less antepartum care in women who had a trial of VBAC in our hospital. Current study revealed a significant difference between the mean age of women with history of previous one C/S compared to the women with no history of C/S. This finding is in contrast to Charitou et al. and David et al,'s studies, in which they found no significant difference between the mean age of women who underwent normal vaginal delivery and those who underwent VBAC.[17,18] This difference can be attributed to the age group of their patients whom were older than 30 years. Srinivas et al., reported in their study,

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that as women ages, their likelihood of attempting VBAC decrease, and they are more prone to experiencing unsuccessful trials of labor.[19] They also concluded that, teenage patients do not seem to face a higher risk of complications related to VBAC, whereas, older women exhibit an elevated rate of composite VBAC-related operative complications. Moreover, Mekonnin et al. identified ages of less than 25 years, as well as, ages between 25-29 years as independent predictors of successful VBAC.[20] additionally, Addisu et al., also reported that women younger than 30 years of age were significantly associated with successful VBAC.[21] Age was also positively correlated with the number of prior VBAC, meaning as age increases, the number of prior VBAC increases. Eden et al. reported in their study that women aged 40 years and younger had twice the likelihood of VBAC.[22] This finding supports our result as it indicates women in their younger ages were more likely to have a VBAC resulting in a higher accumulated number of previous VBAC in their older ages. Another age-related finding in our study was that age and number of previous vaginal deliveries before C/S were positively correlated. This means that as age increases, number of vaginal deliveries before C/S also increases and vice versa. According to Mekonnen et al.'s metanalysis of 6 studies, previous vaginal birth was associated with a higher chance of successful VBAC, they calculated the pooled OR and found that women with previous vaginal birth were 3 times more likely to have a successful VBAC compared to women without history of vaginal birth.[23] In this study, the difference between the two groups in relation to BMI was statistically significant. We found that the majority of the VBAC group in this study were of overweight, Durnwald et al. reported that successful VBAC was more common among overweight women than obese women when compared with women with normal BMI.[24] Rietveld et al. claimed a significant association between successful VBAC and BMI.[25] Hence maternal obesity is a predictor of unsuccessful VBAC.[26] In the current study, we found no significant difference between the gestational age of the women undergoing VBAC and those undergoing normal vaginal delivery without history of C/S. This finding is in accordance with Charitou et al., and David et al.'s studies, where they also reported no significant difference in gestational age between women who had VBAC and those without history of C/S who delivered normally.[17,18] The majority of the women with history of previous one CS were multiparous, whereas the majority of the controls were primiparous. The mean parity of cases was significantly higher than that of the controls. In Balachandran et al.'s study, it was observed that higher parity was linked to a rise in the rate of successful VBAC.[27] Furthermore, Zamzami et al., reported VBAC in women with a history of multiple pregnancies is a widely accepted, safe, and effective practice.[28] Increased parity, often associated with previous vaginal deliveries, serves as a positive prognostic factor and can also indicate a successful outcome for VBAC.[28] In this study, ruptured membrane on presentation was significantly less common among the cases (32%), compared to that of the controls (40%). Mekonnen et al., conducted a metanalysis in which they reported that women who presented with spontaneous ruptured membrane were more likely to have a successful VBAC, in addition, Addisu et al., reported that ruptured amniotic membrane on presentation, were significantly associated with successful VBAC. [23,21] The mean Bishop score was significantly higher among women with history of previous one C/S (8.7 ± 2.4) compared to the bishop score of controls (8.2 ± 3.1). However, when categorized into two groups (Bishop score <4 and ≥4) there was no

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statistically significant association between the cases and the controls. In Bujold et al.'s study, it's observed that the success rate of VBAC showed a notable correlation with the modified Bishop's score.[29] Among the indications for previous C/S, we found that fetal distress and breech presentation were the most common. This finding is in accordance with Birara et al.'s study, in which they also reported fetal distress and fetal malpresentation as common inductions for previous C/S among women undergoing trial of labor after C/S.[30] Birara et al. also reported that indications of previous C/S such as fetal distress and failed induction were associated with low success rate of VBAC.[30] It's worth mentioning that in our study, 10.6% of the indications for previous C/S was based on maternal request.The duration of labor for the women with previous one C/S was significantly longer (3.66 ± 3.45 hours) than women with no history of previous C/S (2.88 ± 3.1). This finding is in accordance with Charitou et al.'s study, in which they found that the labor duration was significantly extended for women attempting VBAC in comparison to first-time mothers who delivered vaginally.[17] In the current study, number of prior VBAC was negatively correlated with the number of previous vaginal deliveries before C/S. This means that as the number for prior VBAC increases, the number of previous vaginal deliveries before C/S decreases. Wu et al. identified number of previous vaginal deliveries before CS as a significant indicator of successful VBAC.[12] Our findings can be attributed to the fact that 32.9% of the VBAC patients were primiparous.

Conclusion

We conclude that younger maternal age, BMI, increased parity, Bishop score ≥4, Intact membrane, lower fetal weight are all factors associated with successful VBAC.

Conflict of interest

The authors declare no conflict of interest.

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