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# Factors Associated with Successful Vaginal Birth after One Caesarean Section (VBAC) in Al-Gomhori Teaching Hospital, Taiz – Yemen

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# Factors Associated with Successful Vaginal Birth after One Caesarean Section (VBAC) in Al-Gomhori Teaching Hospital, Taiz – Yemen

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## Abstract

**Background** A Trial of labor after cesarean section is an attempt to deliver vaginally by a woman who had a previous cesarean delivery and when achieved by a vaginal delivery it is called successful vaginal birth after cesarean section. Vaginal birth after a caesarian section is a preferred method to decrease complications associated with repeated caesarian section delivery for both mother and fetus.

**Study Objectives** To identify factors associated with successful VBAC following TOLAC in women with one prior caesarean section at Al-Gomhory Teaching Hospital.

**Study Design** Hospital _based retrospective study

**Methods and subjects** This study was conducted at Al- Gomhory Teaching Hospital, Taiz Governorate from January2023 to December 2024. A questionnaire was developed for this study, collecting data on each woman who had undergone a previous cesarean section and attempted vaginal birth, such as maternal age, interval between births, prenatal care, and fetal condition, cervical dilation at admission, mode of delivery, maternal complications, and fetal / neonatal complications. All these data were recorded, entered into SPSS software, and analyzed.

**Results**

There were 150 women underwent attempted vaginal birth after one cesarean section. Their mean age was 28.3 ± 6.1 years, and the mean

interval between births was 4.03 ± 3.0 years. 34% of women had interdelivery interval ≤ 2 years, and 66% were over 2 years. 47.3% of women attended prenatal care, while 52.7% did not attend prenatal care. There were 22% of women experienced vaginal birth before cesarean, and 28.7% experienced vaginal birth after cesarean. The mean gestational age at delivery was 38.17 ± 3.05 weeks. There were 82.7% of women had cervical dilated (more than 4 cm), and 17.3% were less than 4 cm at admission. The success rate of vaginal birth was 64%, and the failure rate was 36%. The mean birth weight was 2994.7 ± 430.1 grams. The Apgar score at five-minute ≥ 7 88%, and the complications for newborns were admission to the intensive care unit for 13.3%, while for mothers the complications were uterine rupture for 6.7%, and the study did not record a significant relationship between ante natal health care during pregnancy and rupture of amniotic fluid membranes (P > 0.05).

**Conclusion**

The success rate of VBAC trials of women with previous one scare was 64% in line with global rate. Maternal age between 20-30 years, interdelivery interval > 2 years and women not booked during the current pregnancy were the predominant in our sample size. Almost half of women had previous vaginal delivery either pre or post cesarean section. Gestational age was predominant at term while, the preterm and post term were present in a small proportion of women. A Small proportion of neonates had low birth weight, had low Apgar score at 5 minutes, and admission to NICU were the common fetal outcome. Post-partum hemorrhage and uterine dehiscence were mainly the maternal outcome with high rate of uterine rupture.

**Keywords:** Vaginal Birth after Caesarean (VBAC), Successful VBAC, Factors Associates, Al-Gomhori Teaching Hospital, Taiz, Yemen

## Introduction

Vaginal birth after cesarean section (VBAC) is the term applied to patients who undergo vaginal delivery following cesarean delivery in a prior pregnancy. Patients desiring VBAC delivery undergo a trial of labor (TOL), also known as a trial of labor after cesarean section (TOLAC). TOL is an acceptable, generally safe practice. However, a potential for serious complications is present, including uterine rupture or dehiscence with associated maternal and neonatal morbidity. Clinicians caring for patients with prior cesarean section need to be aware of and able to counsel patients regarding the risks and benefits of attempting TOL, factors that affect the likelihood of successful vaginal delivery, and knowledge regarding intrapartum management of patients undergoing TOLAC [1].

As the cesarean delivery rate has increased, so has the number of patients becoming pregnant who have experienced cesarean section in a prior pregnancy. Patients may undergo vaginal birth after cesarean section either as a planned procedure or due to precipitant labor. [2]

Since 1970, the cesarean delivery rate has increased dramatically from 5% in 1970 to 32.1% in 2022. [1] In the early 1970s, when the cesarean delivery rate first began to rise, it was generally felt that if a patient had had a cesarean section, they should deliver all future babies by this route. Healthcare professionals began to question the dictum, "once a cesarean, always a cesarean, " and subsequently, the number of patients undergoing VBAC delivery began to increase. From the mid-1980s to the mid-1990s, TOLAC was encouraged, and an increase in VBAC delivery was seen, along with a concomitant decrease in the cesarean delivery rate. Between 1985 and 1995, the VBAC rate increased by over 20%, which was associated with reduced cesarean section rates. As VBAC became more common over this time, so did the number of reported significant complications and related malpractice suits, leading to TOLAC again becoming less prevalent in the early 2000s, with a rate reported at 9.2% in 2006.[2] Since 2016, the VBAC rate seems to be increasing once again, with a rate reported at 14.2% in 2021.[3]

Complications in patients undergoing TOLAC can occur; however, appropriately selected patients can benefit from attempting a vaginal delivery in the appropriate setting. When successful, VBAC is associated

with a decrease in maternal morbidity and a decreased risk of complications in future pregnancies. Patients who have undergone successful VBAC benefit from the avoidance of surgical recovery in the postpartum period. An increase in VBAC deliveries will also decrease the overall cesarean delivery rate. More recently, experts recognized that as the number of cesarean sections a patient undergoes increases, so does the risk of significant obstetrical complications, including massive postpartum hemorrhage, placenta previa, and complications related to placenta accreta spectrum disorders.[4] By avoiding multiple cesarean deliveries, patients planning large families may particularly stand to benefit from undergoing vaginal birth after cesarean section [3]

This study aims to identify maternal demographic, past obstetric, and current obstetric factors associated with successful VBAC at Al-Gomhori Teaching Hospital, Taiz. Findings will provide crucial evidence to support physician-patient counselling and shared decision-making regarding TOLAC.

## Study Design

Hospital-based retrospective study.

## Study Setting

The study was conducted at Al-Gomhory Teaching Hospital, Taiz City. This university-affiliated hospital provides 24-hour specialist obstetric care, primarily managed by residents under faculty supervision. TOLAC is offered with informed consent to women meeting criteria:

- One prior lower uterine segment incision
- Non-recurrent prior indication
- Singleton pregnancy
- Cephalic presentation
- Estimated fetal weight ≤ 4kg
- No current contraindication to vaginal delivery.

## Study Period

The study included data of deliveries occurring over two years (between 1st January 2023 and 31st December 2024).

## Study Population

All women with one prior caesarean section who underwent TOLAC at Al-Gomhory Teaching Hospital during the study period.

## Inclusion Criteria

- One documented prior lower uterine segment caesarean section.
- Met institutional criteria for TOLAC (as defined above)
- No contraindication to trial of labor. (No obvious fetopelvic disproportion)
- Patient came with spontaneous labor.

## Exclusion Criteria

- More than one prior caesarean section.
- Contraindication to TOLAC documented at admission.
- Elective repeat caesarean delivery without labor attempt.
- Incomplete medical records for key study variables.
- Any other uterine scar like myomectomy, hysterotomy.
- High risk pregnancy

## Sample Size

Calculated using Epi Info™ version 7.2.5 Assuming a VBAC success rate (P1) of 60% based on regional literature [102, 103], a precision (d) of 7%, a design effect of 1, and a 95% confidence level (Z=1.96), the minimum required sample size is approximately 189.

Anticipating a 10% incomplete record rate, the target sample size is 208 women who underwent TOLAC. All eligible records within the study period is reviewed until the target is met. However, over two years the whole study sample size was 150 women as a purposive sample size.

## Sampling

Consecutive sampling was used. Medical record numbers of all women admitted for delivery with a history of one prior CS was identified from delivery logbooks and admission registers. Charts were retrieved and screened for eligibility (underwent TOLAC). All eligible records meeting inclusion criteria within the study period were included consecutively until the sample size was achieved.

## Variables

### Outcome (Dependent variable)

VBAC Success (Vaginal delivery = Success; Intrapartum Caesarean Delivery = Failure).

### Independent Variables:

1. **Demographic:** Maternal Age (years), Residence (Urban/Rural), Booking Status (Booked/ Unbooked).

2. **Past Obstetric:** Indication for Primary CS (Categorised: Non-recurrent vs Potentially Recurrent), Inter-delivery Interval (months), History of Prior Vaginal Delivery (Yes/No - specify if before or after CS if possible), History of Stillbirth (Yes/No).
3. **Current Obstetric & Fetal:** Gestational Age at delivery (weeks), Parity, Membrane Status at Admission (Intact/Ruptured, Duration of Rupture if applicable), Cervical Dilatation at Admission (cm), Position of Presenting Part, Presence of Meconium (Yes/No), Use of Oxytocin Augmentation (Yes/No), Duration of Labor (hours), Birth Weight (grams), Neonatal Outcome (APGAR scores, Admission to NICU).

## Data Collection

A structured, pre-tested data abstraction form was used. Trained research assistants (residents or midwives) retrospectively extracted data from eligible patient medical records after obtaining hospital numbers from logbooks. Data included socio-demographics, past obstetric history, current pregnancy and labor details, and birth outcomes.

## Data Analysis

Data analysis was performed using Statistical Package for Social Scientists (SPSS; Version 24.0; Armonk, NY; IBM Corp) software system. The variables were expressed as frequencies and percentages for categorical variables; means (± standard deviations) or medians (interquartile ranges) for continuous variables, depending on distribution normality (assessed using Shapiro-Wilk test). P value < 0.05 was considered statistically significant.

## Results

***Table (1):***

***Distribution of the maternal age according to success VBAC.***

| Age (year) | Vaginal | | Cesarean | | Total |
|---|---|---|---|---|---|
| | No. | % | No. | % | |
| < 20 | 3 | 37.5 | 5 | 62.5 | 8(5.3) |
| 20 – 29 | 56 | 67.4 | 27 | 32.5 | 83(55.3) |
| 30 – 39 | 33 | 66.0 | 17 | 34.0 | 50(33.4) |
| > 40 | 3 | 37.5 | 5 | 62.5 | 8(5.3) |
| Subtotal | 96 | 64.0 | 54 | 36.0 | 150(100) |
| <0.001<br>$X^2 = 34.959$ | | | | | |

***Table (2):***

***Relationship between booking status and success VBAC.***

| Booking status | Delivery mode | | Total |
|---|---|---|---|
| | Vaginal (success) | Cesarean (failed) | |
| Booked | 44(61.9) | 27(38) | 71(47.3) |
| Unbooked | 52(65.8) | 27(34.1) | 79(52.7) |
| Subtotal | 96(64) | 54(36) | 150 |
| Chi-Sq = 0.241, P 0.37<br>OR = 1.182<br>95% CI for OR 0.606-2.304 | | | |

***Table (3):***

***Relationship between gestational age and success VBAC trial.***

| GA | Delivery mode | | Total |
|---|---|---|---|
| | Success (Vaginal) | Failure (Cesarean) | |
| 28 – 35 | 11(100) | 0 | 11(7.3) |
| 36 – 37 | 20(66.7) | 10(33.3) | 30(20) |
| 38 – 40 | 54(61.3) | 34(38.6) | 88(58.7) |
| > 40 | 11(52.3) | 10(47.6) | 21(14) |
| Subtotal | 96(64) | 54(36) | 150(100) |
| Chi-Sq = 18.087, P <0.001 | | | |

## Birth weight and success TOLAC

***Table (4):***

***Relationship between birth weight and success VBAC.***

| Birth weight (g) | Mode of delivery | | Total |
|---|---|---|---|
| | Success (Vaginal) | Failure (Cesarean) | |
| < 2500 | 10(66.7) | 5(33.3) | 15(10) |
| 2500 – 4000 | 85(62.9) | 50(37) | 135(90) |
| Subtotal | 96(64) | 54(36) | 150(100) |
| Chi-Square = 49.462, P 0.01 | | | |

## Uterine rupture and mode of delivery

*Table (5):*

*Relationship between uterine rupture and mode of delivery.*

| Uterine rupture | Mode of delivery | | Total |
|---|---|---|---|
| | Success (Vaginal) | Failure (Cesarean) | |
| Yes | 5(50) | 5(50) | 10(6.7) |
| No | 91(65) | 49(35) | 140(93.3) |
| Subtotal | 96(64) | 54(36) | 150(100) |
| Chi-Sq = 0.911, P 0.26<br>OR 1.857<br>95% CI 0.513-6.72 | | | |

*Table (6):*

*Relationship between mode of delivery and admission to NICU.*

| NICU | Mode of delivery | | Total |
|---|---|---|---|
| | Success (Vaginal) | Failure (Cesarean) | |
| Yes | 9(45) | 11(55) | 20(13.3) |
| No | 87(66.9) | 43(33) | 130(86.7) |
| Subtotal | 96 | 54 | 150(100) |
| Chi-Sq = 3.616, P 0.057<br>OR = 2.473<br>95% CI 00.953-8.418 | | | |

*Table (7):*

*Factors influencing the VBAC trial.*

| Factor | % | Chi-Squear | P value |
|---|---|---|---|
| Age (mean ± SD) | 28.478 ± 6.16 | | |
| Interdelivery interval (%) | | | |
| ≤ 2 | 34 | 325.773 | <0.001 |
| > 2 | 66 | | |
| Booking status | | | |
| Yes | 47.3 | .427 | 0.37 |
| No | 52.7 | | |
| Prior vaginal birth | | | |
| Yes | 50.7 | 18.280 | <0.001 |
| No | 49.3 | | |

| Factor | % | Chi-Squear | P value |
|---|---|---|---|
| **Gestational age** | | | |
| **Preterm** | **27.3** | **177.787** | **<0.001** |
| **Term** | **58.7** | | |
| **Post term** | **14** | | |
| **Cervical dilation (cm)** | | | |
| **≤ 4** | **17.3** | **53.733** | **<0.001** |
| **> 4** | **82.7** | | |
| **Station** | | | |
| **-1** | **94.7** | **254.280** | **0.6** |
| **0** | **5.3** | | |
| **Birth weight** | | | |
| **< 2500** | **9.3** | **365.852** | **<0.001** |
| **2500 - 4000** | **90.7** | | |

## Discussion

The present study aimed to assess the factors associated with success of VBAC in Al-Gomhory hospital, Taiz governorate. The optimal mode of subsequent delivery of women with prior one cesarean section remains subject of intense research and debate in the contemporary obstetric practice especially in low resource settings.

The present study found that the maximum age group of women experienced VBAC attempt was between 20-29 years (55.3%) followed by age group of 30-39 years (34%). These findings are comparable to a study by Tesfahun et al [5] which reported that the age between 26-30 years accounted for almost a half of women (49.3%) followed by age between 21-23 years (23.2%). Similar distribution has been reported in a study from Ain Shams, Egypt by Mansour and colleagues [6] which described the age group between 26-30 years represented 36% followed by age group 20-24 years among 34.5%. It is found that maternal age between 20-30 years had odds ratio of 2.71, 95% CI 1.21-6.08 of undergoing VBAC attempt [5]. In a study from Ain Shams [6] it is reported that maternal age group between 25-29 years is associated with 96% success VBAC trial. However, the maternal age of this group representing the most reproductive age period. In

agreement with the present study, it is stated that women who were of advanced maternal age (> or=35 years) were more likely to experience an unsuccessful trial of labo r (OR = 1.14 [95% CI1.03, 1.25], P = 0.009). In addition, women >or=35 years of age had 39% more risk of experiencing one of the VBAC-related operative complications (OR = 1.39 [1.02, 1.89], P = 0.039). As women increase in age, they are less likely to attempt VBAC and more likely to have an unsuccessful labour trial. While teenage patients do not appear to be at increased risk for VBAC-related complications [18].

The present study found that less than half of women (47.3%) had attended antenatal care during the index pregnancy while the remaining (52.7%) did not attend antenatal check-up. Antenatal care utilization is reported to affect the success rate of VBAC because such service is the main entry point to counsel women after cesarean delivery on the mode of future deliveries [5]. A study from Ethiopia [106] by Mamo and colleague reported that antenatal care was irregular among 31.2% (<3 visits), regular in 50%, and > 4 times among 18.8%of women.

The discrepancy with our results could reflect the low education in our society and low awareness level of women and their families about the repeat cesarean section complications. We suggest that regular antenatal care is a predictor of success VBAC in terms of maternal counseling, planning of the place and type of delivery.

The interdelivery interval observed in this study was ≤ 2 years among 34% and > 2 years in almost two thirds of women (66%) and the mean duration of interdelivery interval was 4.03 ± 3 years. It is found that when the interdelivery interval is less than 2 years, the chance of success VBAC is low. in A study by Maurya [8] from India found that when the interval was less than 2 years only 13% had VBAC attempt and the maximum VBAC trial was detected among women who had interdelivery interval of > 2-4 years (60%). The low rate of VBAC attempt at interval less than 2 years could be secondary to the possibility of scar dehiscence. A meta-analysis and systematic review which included 94 studies of 239006 pregnant women [9] reported that interdelivery interval was not associated with a VBAC success. It is reported that when interdelivery interval shorter than 24 months does not relate to VBAC failure. Only one study reported the association between the interdelivery interval shorter than 18 months and the likelihood of VBAC trial [10].

Regarding the prior vaginal delivery either pre or post cesarean section the present study found that almost half of the study sample did not experience vaginal delivery while the other half had post cesarean section vaginal delivery (28.7%) and 22% experienced pre cesarean vaginal delivery. There is evidence in the literature that having experienced a vaginal birth either before cesarean section or after it, tripled the success rates of VBAC [9]. The previous VBAC was a stronger predictor of success than previous vaginal birth before cesarean section. These finding confirm that the history of past vaginal delivery is of the utmost importance [9]. A study of Maurya [8] reported that women who had a vaginal delivery following cesarean section are significantly more likely to have a successful VBAC compared to those who had one vaginal delivery prior to cesarean section. Mansour and colleagues [6] from Ain Shams reported that higher success rate of VBAC was found in women with previous vaginal birth than in women without vaginal birth (100% vs 81.8%).

Regarding the results of abdominal and per vaginal examination the present study found that occipito anterior position was the predominant (94.7%), cervical dilatation (≥ 4 cm) was found among 82.7%, station of (-1) in 94.7%. These results are comparable to the study of Mansour and colleagues [6] which reported the cervical dilatation (≥4cm) was found among 83.71% and station of (-1) in 90% of cases. These findings suggest that cervical dilation (≥4cm) and station of -1 to zero are predictors of success VBAC trial.

The success rate of VBAC observed in the present study was 64%. This figure is in agreement with other studies. Tesfahun et al [5] reported that the overall VBAC success rate was 69.5%. A study in Addis Ababa University reported the success rate as 69.4% [11]. The success rate in our study is higher than some other studies such as that reported in Mizan Tepi University teaching hospital as 41% [12], South Africa (36%) [13], Nigeria (33.8%) [14], New Delhi, India (40%) [14]. On the other hand, the success rate of our study is lower than reported in Ain Shams as 86.7% (6). However, different studies have reported that the general success rate of vaginal birth after cesarean (VBAC) lies in the range of 50-80% [7]. The success rate of 64% in our study is lower than the commonly reported global average, which typically ranges from 50% to 80% in well-selected

candidates [15]. According to the FIGO Good Practice Recommendations, VBAC is considered a safe and effective alternative to repeat cesarean section (CS) in appropriately selected women, with success rates often exceeding 70% [16]. Multiple factors influencing lower success rates may include inadequate candidate selection, such as including women with unfavorable obstetric histories (e.g., prior failed VBAC, short interdelivery interval, or non-cephalic presentation). Also the protocols of our center that may not fully support VBAC (e.g., lack of continuous fetal monitoring or immediate surgical backup). And finally maternal factors such as obesity, advanced maternal age, or comorbidities.

We think that the success rate is largely dependent on the strict criteria of women selection. All cesarean section performed in our study were intrapartum indicating the failure to progress of VBAC trial.

The present study found that 14 fetuses (9.3%) delivered with low birth weight (<2500g) and the mean birth weight was 2994.71 ± 430.138g. A study by Mamo and colleagues [7] from Ethiopia reported the rate of low birth weight was 3.8%, normal weight was 95% and large for gestation age (LGA) in 1.2% which are comparable to our study results. The absence of LGA in our study indicates well selection of women for VBAC trial. The Apgar score recorded in our data was 88% of ≥ 7 score at 5 minutes and only 2.7% had stillbirth (zero score). A study from UAE [17] reported that among successful VBAC group low Apgar score was detected among 47.2% compared to 52.8% of failed group, and high Apgar score was found among 84.3% compared to 15.7% of the failed group. The high rate ≥ 7 Apgar score in our study suggests that continuous fetal monitoring during labor and delivery was performed for women who were candidate for VBAC attempt. It is recommended that VBAC trial should be conducted in place where continuous fetal monitoring and emergency cesarean section is available [17].

The present study found that rupture of uterus has been observed among 10 cases (6.7%). All of these ruptures were incomplete (dehiscence), and half of diagnosed during cesarean section while the other half diagnosed after vaginal delivery discovered immediately after delivery with post-partum hemorrhage (PPH). All had repaired the scar dehiscence and recovered completely. The reported uterine rupture rate of 6.7% is

significantly higher than the global average, which is typically 0.5% to 1% in women undergoing a trial of labor after cesarean (TOLAC)[15]. This elevated rate raises concerns and warrants further investigation into labor management protocols, including the use of labor induction or augmentation agents like oxytocin or prostaglandins, which are known to increase rupture risk. Also type of uterine incision in the previous CS (e.g., classical vs. low transverse) and monitoring practices during labor and the availability of emergency surgical intervention which may increase the risk of rupture

The American Journal of Obstetrics and Gynecology emphasizes that uterine rupture, while rare, is a serious complication that requires immediate response to prevent maternal and neonatal morbidity [15].

A recent cohort study (2024) reported a uterine rupture rate of approximately 0.8% among women undergoing VBAC in a tertiary hospital setting [19]. Similarly, a systematic review of studies published between 2014 and 2024 confirmed that the overall risk of uterine rupture in VBAC is generally below 1% in well-selected cases [20]. In another large analysis, the absolute risk of uterine rupture during VBAC was reported at 0.87%, further supporting the low incidence of this complication in modern obstetric practice. However the rate observed in this study (6.5%) is markedly elevated. Several explanations may account for this difference. First, studies from low-resource settings have consistently shown higher complication rates due to delayed referral, prolonged labor, and limited intrapartum monitoring. Second, suboptimal selection of VBAC candidates, including women with unknown uterine scar characteristics or short interpregnancy intervals, may increase the risk of rupture. Third, inadequate use of standardized protocols for induction and augmentation of labor can significantly raise the likelihood of uterine rupture**.**

**Study limitations**

A key limitation of this study is that the achieved sample size was smaller than initially calculated, which may have reduced the statistical power to detect some associations and may limit the generalizability of the findings. Further studies with adequate sample size are required.

## Conclusion:

- The success rate of VBAC trials of women with previous one scar was 64% in line with global rate.

- Maternal age between 20-30 years, interdelivery interval > 2 years and women not booked during the current pregnancy were the predominant in our sample size.
- Almost half of women had previous vaginal delivery either pre or post cesarean section.
- Gestational age was predominant at term while the preterm and post term were present in a small proportion of women.
- On examination, cervical dilation, station and fetal presentation were favorable for vaginal birth attempt.
- A Small proportion of neonates had low birth weight, had low Apgar score at 5 minutes, and admission to NICU were the common fetal outcome.
- Post-partum hemorrhage and uterine dehiscence were mainly the maternal outcome with high rate of uterine rupture.

## Recommendations

Careful selection of women for trial of labor after cesarean (TOLAC) should be based on clinical assessment, hospital protocols, and updated international guidelines to improve the likelihood of successful VBAC.

Women with previous cesarean section should receive adequate counseling regarding the benefits and risks of VBAC compared with elective repeat cesarean delivery to support informed decision-making.

Continuous intrapartum monitoring and a multidisciplinary approach are essential to ensure maternal and fetal safety and allow timely intervention in case of complications.

Induction and augmentation of labor during TOLAC should be performed cautiously; Foley catheter and low-dose oxytocin may be used with close monitoring, while prostaglandins should generally be avoided because of the increased risk of uterine rupture.

Further studies are recommended to identify predictive factors associated with successful VBAC and uterine rupture risk in different populations to improve clinical outcomes and reduce unnecessary cesarean section rates.

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