Factors influencing the success of trial of labor after one previous caesarean section in a secure inter-delivery interval at Panzi Hospital.

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Research Article

Keywords: Trial of labor after cesarean section, TOLAC, vaginal delivery after caesarean section, VBAC, inter-delivery interval, repeat caesarean delivery

DOI: https://doi.org/10.21203/rs.3.rs-157801/v1

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Abstract

Background: In middle- and low-income countries, the inter-delivery interval is an important parameter considered in the decision of TOLAC.

The objective of this study is to determine influencing factors for success of trial of labor after cesarean in women with secure inter-delivery interval after a cesarean-section at a referral hospital.

Methods: A cross-sectional study was conducted at Panzi hospital on 231 cases in one year period. Women with one previous cesarean section, an inter-delivery interval space at least 18 months and no contracted pelvis were included.

A successful TOLAC was defined as vaginal delivery and failed if cesarean section after trial of labor. Chi-square univariate testing and multi-variate logistic regression were used to understand the relationship between influencing factors the recorded variables and successful TOLAC, with a significance threshold of 5%.

Results: 57.6% (133 cases) successfully completed TOLAC with vaginal delivery. Many obstetric factors have a significant effect on success of TOLAC. Middle cervix was likely to increase success of TOLAC by 61.50 times (OR=61.50, p-value=0.000). Cervical softening was likely to increase success of TOLAC by 5.96 times (OR=5.96, p-value=0.001). Active labor was likely to increase success of TOLAC by 7.79 times (OR=7.79, p-value=0.013). Uterine height also has a significant effect such that every centimeter increase in uterine height decreased likelihood of successful TOLAC by about half (OR= 0.62, p-value=0.000). Every unit increase in Apgar score in the 1st minute after birth increased likelihood of successful TOLAC by 1.71 times (OR=1.71, p-value=0.010). For every increase in parity, the likelihood of successful TOLAC increases by 1.30 (OR=1.30, p-value=0.031). The remaining obstetric factors in the model had no significant effect on success of TOLAC.

Conclusions: Our study shows that within a secure inter-delivery interval, high parity, uterine height less than 34 cm, active labor and cervical parameters such as cervical softening and middle cervix are important contributing factors to the success of TOLAC and VBAC. These factors should be considered by practitioners to influence their decision making regarding TOLAC.

Background

Vaginal birth after cesarean section (VBAC) has been proposed as an option to reduce the increasing caesarean section (CS) rates for women with a history of CS [1].

The WHO states that, once the rate of cesarean increases by 10%, the benefits for maternal morbidity and mortality does not change, making it important to identify the best possible candidates for TOLAC and subsequent VBAC [2]. It’s well established that successful VBAC is associated with the decrease of maternal and neonatal morbidities and in the subsequent pregnancy than a repeat CS [2, 3-5].

Many Factors are known to contribute to VBAC as The strongest predictor for a successful TOLAC is whether the woman had a prior vaginal delivery and a spontaneous labor set [1,6,7]. Existing score models provide reasonable prediction for VBAC, but none have included inter-delivery interval (IDI) as it contributing variable and do not identify consistently which women are at risk of failing the trial of labor [8].

The rate of successful VBAC is affected by secure IDI [9], which is defined as optimal time of more than 18 months after CD [4, 9]. However, a recent study shows that the clinical implication of this statistical association requires further study [9]. Shorter IDI in patients with a previous cesarean has been associated with an increased risk of uterine rupture and higher risk of maternal morbidity and blood transfusion [2, 6, 10-13].

A recent meta-analysis found that women in Africa had the lowest success rate of VBAC at 54% compared to other continents [14]. While a woman’s socioeconomic status has been shown to be significant for the length of an IDI, it is not known whether it is a confounder for other health comorbidities and worse pregnancy outcomes [15,16]. Optimizing time between pregnancy improves the outcome of the subsequent pregnancy [17].

In facilities with modesty of resources where the means of monitoring (cardiotocography) is often lacking, the IDI is always taken in consideration as a criteria for choosing the method of delivery after CS. In addition to this, the condition of the pelvis is needed [18,19].

However, the association between a successful TOLAC and a secure IDI after CS is not well known particularly in resource poor settings highlighting a need for more research into their potential relationship.

We hypothesize that TOLAC could succeed up to in the majority of women with secure IDI. Successful TOLAC means the women had a successful vaginal delivery after trial of labor.
Methods

The aim of this study is to understand what obstetric factors have a significant effect on the success of TOLAC for women who have previously had a CS. This study uses a cross-sectional design. Women were only included in this study if they previously had CS, a secure inter-delivery interval between the current labor and past cesarean (at least 18 months), and no indication of a contracted pelvis. The cohort consists of 231 women who met the above criteria between January 1 to December 31, 2018.

The setting of this study is Panzi Hospital in the DRC. It is a center of excellence for health that specializes in treating survivors of violence. It's also a general referral hospital where local clinics refer patients, as they have better resources and are able to take emergency obstetric care and neonatal care. Panzi Hospital supports around 3,000 deliveries per year and facilitates many programs that promote female health, including prenatal counseling and maternal care packages. This study was authorized by an approval committee at Panzi Hospital and each woman in the cohort provided written consent.

The process of choosing women to participate in this study included consent, looking at patient history notes to ensure a previous CS occurred within secure IDI, completion of examination to ensure pelvis was not contracted, and a labor that was not induced. Each patient was followed during the process of labor to track key variables, judge the evolution, and make sure they are successful in giving labor. The labor was followed using a partograph. For the purposes of this study, success of labor means vaginal delivery and failure means cesarean delivery (CD).

The variables recorded in this study are age of mother, place of provenance, prenatal counseling (yes or no), parity, gravity, gestational age, history of previous vaginal deliveries, induction of labor, oxytocin for stimulation of labor, onset of labor spontaneous, cervical softening, middle position of cervix, fetal presentation, fetal weight, uterine height, Apgar score at the first minute, and Apgar score at the fifth minute. Chi-square univariate testing and multi-variate logistic regression were used to understand the relationship between the recorded variables and successful TOLAC, with a significance threshold of 5%.

Results

The results show that 57.6% (133 cases) were successful in TOLAC with vaginal delivery (Table 1). The remaining 42.4% (98) were unsuccessful having delivered with CS. We first look to univariate chi-square tests to evaluate the possible effect of an obstetric factors upon delivery method (vaginal or cesarean section). The chi-square tests only evaluate a single obstetric factor, thus they do not take into account the interaction among more than one obstetric factor upon the delivery method. Results from the chi-square tests are displayed in Table 1. We tested various obstetric factors including previous vaginal delivery, parity, stimulation with oxytocin, spontaneous labor, softening of cervix, middle position of cervix, and age of mother.

We find that many of these variables have p-values less than or equal to .05, meaning there is statistical association between the obstetric factor and delivery method. PNC (prenatal counseling) session performed, oxytocin stimulation, and ultrasound weight were not significantly associated with the mode of delivery at the threshold of 0.05. We find that patients with spontaneous labor were successful in TOLAC (had a vaginal delivery) 3.01 times more often than patients with no spontaneous labor, with a 95% confidence interval of 1.54 and 5.86. Thus, we see a significant association between having a spontaneous labor and delivery method. The remaining obstetric factors in Table 1. can be interpreted in a similar manner. The results from these tests are useful for the evaluation of associations and serve as a preliminary analysis before the logistic regression.

With regard to Table 2, induction of labor was carried out in only 5.6% of women in the study with (OR = 4.92; 95% CI: 1.31-18.40). Induction of labor is significantly associated with the mode of delivery (p <0.05). It appears that in 4% of women who gave birth the presentation was poorly appreciated compared to 96% of cephalic presentation. The association is significant between the presentation and the mode of delivery (p <0.05). Regarding the delivery phase, the majority of Newborns, 52.8%, arrived in the active phase (OR = 13.21; 95% CI: 3.65-47.28) and the association is significant (p <0.05). It also appears that 30 women giving birth, or 12.9%, used contraceptive methods, which does not have a significant association with mode of delivery.

In order to evaluate significance of the recorded obstetric factors on success of TOLAC in multivariate, a logistic regression was performed. Taken globally the model is significant at the 5% level (P-chi2 = 0.0000 <0.05) which confirms that the model is valid. The model includes age of the woman giving birth in years, PNC, parity, age of pregnancy in weeks, indicator for previous vaginal delivery, indicator for induction of labor by misoprostol, indicator for spontaneous labor, indicator for cervical softening, indicator for middle cervix, uterine height in centimeters, indicator for active labor delivery phase (≥ 4 cm), Apgar score in the 1st minute, and Apgar score in the 5th minute.
Table 2. presents logistic regression results on how obstetric factors influence success of TOLAC. Middle position of the cervix was likely to increase success of TOLAC by 61.50 times (OR=61.50, p-value=0.000). Cervical softening was likely to increase success of TOLAC by 5.96 times (OR=5.96, p-value=0.001). Delivery phase was likely to increase success of TOLAC by 7.79 times (OR=7.79, p-value=0.013). Uterine height also has a significant effect such that every centimeter increase in uterine height decreased likelihood of successful TOLAC by about half (OR= 0.62, p-value=0.000). Every unit increase in Apgar score in the 1st minute after birth increased likelihood of successful TOLAC by 1.71 times (OR=1.71, p-value=0.010). For every increase in parity, the likelihood of successful TOLAC increases by 1.30 (OR=1.30, p-value=0.031). The remaining obstetric factors in the model had no significant effect on success of TOLAC.

Table 3 presents logistic regression results on how obstetric factors influence success of TOLAC. Odds ratio (OR) refers to the likelihood of having the listed obstetric factor i.e. spontaneous labor, cervical softening, etc. and success of TOLAC with corresponding standard error (S.E), Wald statistic, and p-value.

Discussion

The focus of this study is understanding what factors are most important for a successful TOLAC for women with secure IDI. Considered various measures of obstetric information on success VBAC. Previous studies [9,20] have considered both long and short IDI, but this study is directly focused on the importance of other obstetric factors associated to VBAC on secure IDI in our selected patient population at Panzi hospital in the DRC.

We place particular emphasis on patients with secure IDI to attempt TOLAC. The success rate of vaginal delivery in this case was 57.6%. Almost half of the patients had secure interval space and still were not able to succeed in vaginal delivery. This leads to consideration of what other obstetric factors are important for a successful TOLAC. The rate found in this study is similar to the one found in Africa compared to the other continents [20].

Some studies [14,20,21] have shown that an IDI greater than 18 months is a good indicator of VBAC success. In this study, the rate shows that this secure IDI is a major element to consider, but it is not enough to ensure or even indicate VBAC success.

Traditionally, a secure IDI is considered a reassuring and safety factor during TOLAC, as it minimizes complications of childbirth like uterine rupture. Additionally, it reassures a high success rate of TOLAC and vaginal delivery. However, it is important to consider if the timing between pregnancies is related to the need for CS and success of VBAC [14,20]. IDI less than 19 months is associated with a decreased rate of successful VBAC in patients who had to be induced, but this was not the case in spontaneous labor [20]. The success rate of VBAC was 79% with an IDI less than 19 months and 85% success rate greater than 19 months [20], although a recent meta-analysis [14] only found minimal studies about the potential association with IDI and outcomes of TOLAC. It is currently well known that IDI affected positively the rate of successful VBAC and protects the patient from the higher risk that comes with each subsequent CS [9, 22].

TOLAC for VBAC should be particularly motivated by a good selection of cases. In addition, a good follow-up during labor will be very important to avoid possible complications [23]. Although TOLAC is a success, published data show that for these women, it is difficult to predict the risk of having another CS and the number of children in the future without risking complications [24,25]. This remains an overwhelming concern in middle- and low-income countries.

Some authors [8,9,26,27] suggest that IDI as an antepartum factor, should be integrated into current predictive scoring models for success of TOLAC.

It is therefore important to encourage a secure IDI by contraception, in the context of a high birth rate such as in sub-Saharan Africa [28]. Good post caesarean delivery counseling is of paramount important to improve this antepartum factor and avoid IDI less than 18 months since the last CS [29].

Using multiple regression, our study found that the success of VBAC was associated with several contributing factors including parity, cervical softening, cervix, uterine height, and active labor at admission in the delivery room. These results show us that there are important obstetric elements to consider from the beginning that can guide practitioners before labor and entrance into the delivery room. These more clinical elements—cervical softening, uterine height require a good assessment of the patient in the delivery room and of the labor for a better outcome. Studies [3,14,30,31,32] have shown that prior vaginal delivery and spontaneous labor were the strongest predictor for a successful TOLAC. In the country with low VBAC success rate, patients-related parameters, some obstetric information and obstetrical practice are also very important for the success of TOLAC [33,34]. Our study shows that within secure IDI, high parity, uterine height less than 34 cm, active delivery phase and cervical parameters such as cervical softening and middle cervix are important contributing factors to the success of TOLAC and VBAC.
These factors should be considered by practitioners who contribute to the prognosis and the success of TOLAC. Thus, their decision in the correct selection of candidates should then be influenced. The higher rates of TOLAC and VBAC will be then observed in mothers and increased in association with certain interventions and practitioner characteristics as thought by Wingert A et al [5].

The limitations of this study include that it's a cross-sectional study and we cannot draw causational conclusions based on these data alone. There could be potential confounders affecting these outcomes that we are unaware of. Secondly, Panzi hospital is a referral hospital where comprehensive emergency services are provided, and this could affect the C-section numbers. The strengths of this study is that it is one of the first of its kind for a regional hospital and it has appropriate power for its sample size.

**Conclusions**

A secure IDI space alone is not sufficient to ensure success of TOLAC in the case of one previous caesarean-section. Other obstetrical parameters must be taken into account during gestation for childbirth counselling and on arrival of labor in a delivery room. These obstetrical parameters include high parity, uterine height less than 34 cm, active labor and cervical parameters such as cervical softening and middle cervix. Practitioners should use good monitoring of these factors in their decision making in order to achieve successful vaginal delivery. Supporting women in successful vaginal birth in the DRC will help them avoid shame connected to caesarian sections and prove their strength in childbirth.

**List Of Abbreviations**

- TOLAC: Trial of Labor After Cesarean
- Trial of labor: TOL
- VBAC: Vaginal Birth After Cesarean;
- IDI: inter-delivery interval
- CS: Caesarean Section
- CD: Cesarean Delivery
- SD: Standard deviation
- OR: Odds Ratio
- CI: Confidence interval
- cm: centimeter
- DRC: The Democratic Republic of Congo.

**Declarations**

**Ethics approval and Consent to participate**

The present study followed the tenets of the Helsinki Declaration, ethics approval was obtained through the "Comité National D’éthique de la Santé" Bukavu-DRC (approval number CNES/001/DPSK/1018PP/2018) and each participating woman gave informed consent.

**Consent for publication**

Not applicable.

**Availability of data and materials**

The datasets used and/or analyzed during the current study is available in the supplementary files.
Competing interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Authors' contributions

Conceptualization of idea: RM, BN, DM.; Data collection: RM, BN; Data analysis: RM, CI; Draft manuscript: RM, NB, CI, RN and DM; Review of manuscript: RM, BN, RN, CI, DM; Writing-original draft: RM, CI

Acknowledgements

To all the patients and Panzi hospital

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Table 1. Results from chi-square univariate tests for associations between various obstetric factors and delivery method.

| Variables                        | Delivery mode | OR (95% CI) | P-value |
|----------------------------------|---------------|-------------|---------|
|                                  | Together n = 231(%) | C-Section n = 98 (%) | Vaginal n = 133(%) |         |
| Parity                           | 4.19 ± 2.35    | 3.74 ± 2.51 | 4.51 ± 2.18 | 0.014   |
| Fetal weight (gr)                | 3434.58 ± 2895.27 | 3690.23 ± 3677.94 | 3029.27 ± 293.35 | 0.254   |
| Uterine Height (cm)              | 30.99 ± 2.47    | 31.77 ± 3.01 | 30.42 ± 1.79 | 0.000   |
| APGAR at 1st min                 | 8.25 ± 2.06     | 7.61 ± 2.10  | 8.72 ± 1.79  | 0.000   |
| APGAR at 5th min                 | 9.13 ± 2.08     | 8.70 ± 2.29  | 9.44 ± 1.85  | 0.000   |
| PNC                              |               |             |           |
| No                               | 86 (20.0)      | 33 (38.4)   | 53 (61.6)   | 0.76 (0.445-1.320) | 0.337 |
| Yes                              | 145 (80.0)     | 65 (44.8)   | 80 (55.2)   | 1       |
| Previous Vaginal Delivery        |               |             |           |
| No                               | 72 (31.2)      | 39 (54.2)   | 33 (45.8)   | 2 (1.03-3.52) | 0.015 |
| Yes                              | 159 (68.8)     | 59 (37.1)   | 100 (62.9)  | 1       |
| Oxytocin stimulation             |               |             |           |
| No                               | 181 (78.0)     | 75 (41.4)   | 106 (58.6)  | 0.83 (0.44-1.55) | 0.563 |
| Yes                              | 50 (22.0)      | 23 (46.0)   | 27 (54.0)   | 1       |
| Spontaneous Labor                |               |             |           |
| No                               | 184 (80.0)     | 30 (63.8)   | 17 (36.2)   | 3.01 (1.54-5.86) | 0.001 |
| Yes                              | 47 (20.0)      | 68 (37.0)   | 116 (63.0)  | 1       |
| Cervical softening               |               |             |           |
| No                               | 45 (19.0)      | 33 (73.3)   | 12 (26.7)   | 5.11 (2.47-10.58) | 0.000 |
| Yes                              | 186 (81.0)     | 65 (34.9)   | 121 (65.1 ) | 1       |
| Middle cervix                    |               |             |           |
| No                               | 41 (18.0)      | 40 (97.6)   | 1 (2.4)     | 91.03 (12.22-678.19) | 0.000 |
| Yes                              | 190 (82.0)     | 58 (30.5)   | 132 (69.5)  | 1       |

Table presents chi-square univariate analysis results on how obstetric factors influence delivery method. Odds ratio (OR) refers to the likelihood of having the listed obstetric factor i.e. spontaneous labor, PNC (prenatal counseling) softening of cervix, etc. and success of TOLAC with corresponding 95% confidence interval (CI) and p-value.
| Parameters                      | Method of delivery | OR (95% CI) | P-value |
|--------------------------------|--------------------|-------------|---------|
|                                | Total (n=231)      | CS (n = 98) | Vaginal (n = 133) |
| **Labor induction**            |                    |             |         |
| No                             | 218 (94.4)         | 88 (40.4)  | 130 (59.6) |
| Yes                            | 13 (5.6)           | 10 (76.9) | 3 (23.1)   |
| **Cephalic presentation**      |                    |             |         |
| Yes                            | 222 (96.0)         | 89 (40.1)  | 133 (59.9) |
| No                             | 9 (4.0)            | 9 (100)    | 0 (0.0)    |
| **Labor phase**                |                    |             |         |
| Active < 8cm                   | 122 (52.8)         | 48 (39.3)  | 74 (60.7)  |
| Active ≥ 8cm                   | 30 (13.0)          | 3 (10.0)   | 27 (90.0)  |
| Latent                         | 79 (34.2)          | 47 (59.5)  | 32 (40.5)  |
| **Contraception after CS**     |                    |             |         |
| No                             | 201 (87.1)         | 85 (42.3)  | 116 (57.7) |
| Yes                            | 30 (12.9)          | 13 (25.0)  | 17 (75.0)  |

Table 3. Logistics regression results on the factors influencing the success of TOLAC.

| Variables                          | Coefficient | SE    | Wald  | Df | P-value | Odds Ratio (95%CI) |
|------------------------------------|-------------|-------|-------|----|---------|--------------------|
| Woman’s age                        | -0.049      | 0.045 | 1.188 | 1  | 0.276   | 0.95               |
| PNC                                | 0.211       | 0.418 | 0.254 | 1  | 0.615   | 1.23               |
| Parity                             | 0.265       | 0.123 | 4.656 | 1  | 0.031   | 1.30 (1.024-1.65)  |
| Age of pregnancy                   | -0.014      | 0.098 | 0.020 | 1  | 0.887   | 0.98               |
| Previous Vaginal Delivery          | 0.026       | 0.483 | 0.003 | 1  | 0.956   | 1.02               |
| Induction of labor                 | -1.812      | 1.193 | 2.306 | 1  | 0.129   | 0.16               |
| Spontaneous Labor                  | 0.640       | 0.573 | 1.249 | 1  | 0.264   | 1.89 (0.62- 5.83)  |
| Cervical Softening                 | 1.785       | 0.531 | 11.300 | 1 | 0.001   | 5.96               |
| Middle cervix                      | 4.119       | 1.096 | 14.123 | 1 | 0.000   | 61.50              |
| Cephalic Presentation              | 22.646      | 1040.47 | 000  | 1  | 0.998   | 68.51              |
| Uterine Height (<34 cm)            | -0.467      | 0.105 | 19.599 | 1 | 0.000   | 0.62               |
| Active labor delivery phase        | 2.053       | 0.830 | 6.116 | 1  | 0.013   | 7.79               |
| Apgar 1st minute *                 | 0.538       | 0.210 | 6.562 | 1  | 0.010   | 1.71               |
| Apgar 5th minute                   | -0.243      | 0.205 | 1.404 | 1  | 0.236   | 0.78               |

P-Chi-square = 0.000 <0.05
R²: 0.642
Obs: 231