



FLAMM AND GEIGER SCORING SYSTEM: PREDICTION OF SUCCESSFUL VAGINAL BIRTH AFTER CAESAREAN SECTION (VBAC)

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Vaginal birth after Caesarean (VBAC), Flamm and Geiger score, trial of labor after Caesarean (TOLAC), Caesarean section, predictive model, cervical effacement, prior vaginal delivery, maternal outcomes, obstetric care, low-resource settings.

Abstract:

Background: Vaginal birth after caesarean section (VBAC) offers numerous maternal and neonatal benefits when appropriately selected. Predicting the success of VBAC is essential to reduce maternal morbidity and optimize delivery outcomes. The Flamm and Geiger scoring system is a validated tool to assess the likelihood of successful VBAC based on clinical parameters. **Objective:** To evaluate the predictive value of the Flamm and Geiger scoring system for successful VBAC among a prior caesarean delivery case.

Methods: This prospective observational study was conducted in the Department of Obstetrics and Gynecology of a private clinic and tertiary level hospital. A total of 62 pregnant women with one previous lower-segment caesarean section who were willing to undergo a trial of labor after caesarean (TOLAC) were initially enrolled.

Result: In the present study, out of 62 initial enrolled cases, 40 were finally selected. Among them 45% had successful VBAC and 55% had to undergo emergency LSCS. Among successful VBAC cases, 83.3% patients had spontaneous vaginal delivery while 16.7% had vacuum assisted. No cases of forceps-assisted delivery were recorded. Most of the patients with total Flamm and Geiger score < 3 at the time of admission had emergency caesarean section while most of the patients with score > 4 had successful VBAC.

Conclusion: The Flamm and Geiger scoring system proved to be a reliable predictor of VBAC success, with scores ³ 5 significantly associated with favorable outcomes. Prior vaginal delivery, non-recurrent CS indications, and favorable cervical conditions at admission also enhanced success rates. This tool can support individualized counseling and reduce unnecessary repeat Caesareans, especially in low-resource settings. Its integration into routine practice may improve maternal outcomes and promote safer trial of labor after Caesarean.

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Introduction

Caesarean section (CS) is one of the most commonly performed surgical procedures in obstetric practice and has significantly contributed to reducing maternal and perinatal mortality when performed for valid indications.^{1,2} However, in recent decades, the global

CS rate has increased alarmingly, often without commensurate improvements in maternal or neonatal outcomes.^{3,4} In South Asia, including Bangladesh, urban and private sectors have reported CS rates exceeding 30%, far above the World Health Organization's recommended range of 10–15%.^{5,6}

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The growing reliance on CS has led to a proportional rise in repeat surgeries, which are linked to increased complications in subsequent pregnancies, such as uterine rupture, placenta accreta spectrum, adhesions, and surgical trauma.^{7,8} Vaginal birth after Caesarean (VBAC) is a clinically supported alternative for women with a previous lower segment CS and no contraindications. When successful, VBAC is associated with lower maternal morbidity, reduced postpartum infection, decreased hemorrhage, shorter hospital stays, and quicker recovery.⁹⁻¹²

Despite these benefits, VBAC remains underutilized in many low- and middle-income countries (LMICs) due to lack of prediction tools, limited clinician experience, fear of uterine rupture, and medico-legal concerns.^{9,12,13} This gap in VBAC implementation necessitates the use of reliable predictive models to guide clinical decision-making.

One such model is the Flamm and Geiger scoring system, which evaluates five variables at the time of admission: maternal age, prior vaginal delivery, indication for the previous CS and cervical dilation.¹⁴ It is a validated, easy-to-use, low-cost tool that can stratify women into likely and less likely candidates for VBAC, improving counseling and outcomes. Its effectiveness has been documented across various populations, including studies from India and Pakistan

that confirmed its predictive accuracy and regional applicability.¹⁵⁻¹⁷

Given the ongoing rise in CS rates and underutilization of VBAC, this study was designed to evaluate the Flamm and Geiger scoring system's predictive value in a private hospital setting in Bangladesh, aiming to contribute toward safer, evidence-based labor management strategies.

Materials and Methods

Study Design and Setting

This prospective observational study was conducted in the Department of Obstetrics and Gynecology at a private clinic and tertiary level hospital in Bangladesh over a one-year duration, from January to December 2024. The primary objective was to evaluate the predictive accuracy of the Flamm and Geiger scoring system in determining the likelihood of successful vaginal birth after Caesarean section (VBAC) among women with a history of one prior lower segment Caesarean section (LSCS).

Study Population and Sampling Technique

A total of 62 pregnant women were initially enrolled using purposive sampling. All participants were admitted for delivery and consented to attempt a trial of labor after Caesarean (TOLAC). Among 62 cases,

Table-I
Flamm and Geiger Scoring System

Parameter	Finding	Points
Woman's age	< 40 years	2
	≥ 40 years	0
Vaginal birth history	Before and after first caesarean section	4
	After first caesarean section	2
	Before first caesarean section	1
	None	0
Reason for first CS	Failure to progress	0
	Other reason	1
Cervical effacement on admission	> 75%	2
	25–75%	1
	< 25%	0
Cervical dilatation on admission	≥ 4 cm	1
	< 4 cm	0

22 cases changed their mind and took decision in favor of cesarean section at the very early onset of this study. So, they were excluded at the beginning of the study.

Following the application of specific inclusion and exclusion criteria, 40 eligible women were included in the final analysis.

Inclusion Criteria

- Singleton pregnancy with cephalic presentation
- Gestational age \geq 37 weeks
- History of one previous LSCS with a low transverse uterine incision
- No obstetric or medical contraindications to vaginal delivery
- Informed consent to undergo TOLAC

Exclusion Criteria

- More than one previous CS
- Classical (vertical) uterine incision or history of uterine rupture
- Malpresentation or multiple gestation
- Placenta previa or known placental abnormalities
- Any maternal or fetal condition requiring elective Caesarean delivery

Data Collection and Application of the Flamm and Geiger Scoring System

Upon admission, detailed obstetric and medical histories were recorded, followed by a comprehensive clinical examination. Each patient's Flamm and Geiger score was calculated based on five clinical parameters: maternal age, prior vaginal delivery, indication for previous CS, cervical dilation, cervical effacement, and fetal station.¹⁴

Each variable was assigned a score according to the original scoring criteria, with the total score ranging from 0 to 10. Higher scores were hypothesized to correlate positively with VBAC success. All patients received routine labor management in accordance with hospital protocol, including continuous fetal monitoring and readiness for emergency surgical intervention if required.

Statistical Analysis

All collected data were entered into IBM SPSS Statistics for Windows, Version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize baseline characteristics. Continuous

variables such as maternal age and total Flamm and Geiger score were presented as mean \pm standard deviation (SD). Categorical variables were expressed as frequencies and percentages. The independent samples t-test was applied to compare mean scores between successful VBAC and emergency Caesarean groups. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board/Ethics Committee of the EAST WEST MEDICAL COLLEGE DHAKA. Written informed consent was obtained from all participants prior to enrollment, and confidentiality of patient information was strictly maintained throughout the study.

Results:

A total of 62 pregnant women were initially enrolled, of whom 40 met the inclusion criteria and consented to trial of labor after Caesarean (TOLAC). Among these, 18 women (45%) achieved successful vaginal birth after Caesarean (VBAC), while 22 women (55%) required emergency Caesarean section (CS). The association between clinical characteristics, Flamm and Geiger score, and delivery outcomes was systematically analyzed.

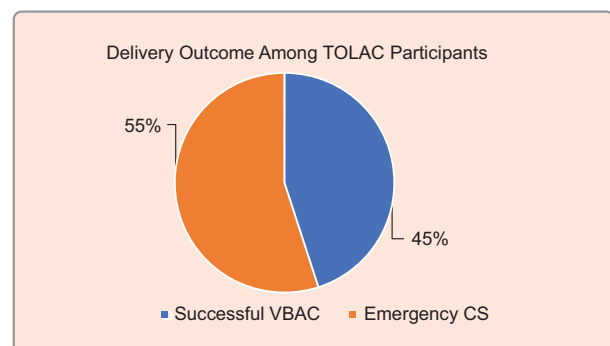


Figure 1: Distribution of Delivery Outcomes in Women Undergoing TOLAC

The pie chart illustrates the mode of delivery among 40 women who underwent a trial of labor after Caesarean (TOLAC). Of these, 18 (45%) achieved successful vaginal birth after Caesarean (VBAC), while 22 (55%) required emergency Caesarean section (CS).

Table-II
Baseline characteristics of study population (n = 40)

Variable	Successful VBAC (n = 18)	Emergency CS (n = 22)	p-value
Mean maternal age (years)	26.4 ± 3.8	28.1 ± 4.1	0.041C ^{''}
History of vaginal delivery	10 (55.6%)	6 (27.3%)	0.037G ^{''}
Non-recurrent CS indication	13 (72.2%)	9 (40.9%)	0.029G ^{''}
Cervical dilation ≥3 cm	12 (66.7%)	6 (27.3%)	0.012G ^{''}

p-values obtained using C^{''} unpaired t-test and G^{''} Chi-square test; p < 0.05 considered statistically significant.

As shown in Table II, women who achieved successful VBAC were significantly younger than those who required emergency Caesarean section (26.4 ± 3.8 vs. 28.1 ± 4.1 years, p = 0.041). A prior history of vaginal delivery was more common among the VBAC group (55.6% vs. 27.3%, p = 0.037), suggesting it as a favorable prognostic factor. Non-recurrent indications for the previous Caesarean were also significantly associated with VBAC success (72.2% vs. 40.9%, p = 0.029). Moreover, cervical dilation of ≥3 cm at admission was strongly predictive of successful VBAC (66.7% vs. 27.3%, p = 0.012).

had a markedly higher mean score compared to those who required emergency Caesarean section (5.1 ± 1.2 vs. 2.8 ± 0.9, p < 0.001). As detailed in Table III and depicted in Figure 2, the success rate of VBAC increased progressively with rising scores: 90.9% among those with scores ≥5, 46.2% with scores of 3–4, and only 12.5% in those scoring <3. These findings underscore the predictive accuracy of the Flamm and Geiger scoring system and highlight its clinical utility in stratifying patients undergoing a trial of labor after Caesarean.

Table-III
Distribution of Flamm and Geiger Scores and VBAC outcomes

Score Range	Total Patients (n = 40)	Successful VBAC (n)	VBAC Success Rate (%)
<3	16 (40.0%)	2	12.5%
3–4	13 (32.5%)	6	46.2%
≥5	11 (27.5%)	10	90.9%

The Flamm and Geiger score demonstrated a robust and statistically significant association with VBAC outcomes. Patients who achieved successful VBAC

Table-IV
Mode of delivery in VBAC group (n = 18)

Mode of Delivery	Number of Cases	Percentage (%)
Spontaneous vaginal	15	83.3%
Vacuum-assisted	3	16.67%
Forceps-assisted	0	0.0%

Among the 18 women who achieved successful vaginal birth after Caesarean (VBAC), the majority (83.3%) delivered spontaneously, while 16.7% required vacuum assistance. No cases of forceps-assisted delivery were recorded.

Most patients (90%) had no prior vaginal birth. However, those with a history of vaginal delivery after previous CS had a higher VBAC success rate (11.1%) compared to others. This supports existing literature that prior vaginal delivery increases VBAC success odds.

Cervical effacement at admission was significantly associated with VBAC outcomes (p < 0.001). Patients with 25–75% effacement had the highest rate of VBAC success (72.2%), while 81.8% of those with effacement <25% underwent emergency Caesarean. Notably, all patients with >75% effacement achieved successful VBAC, reinforcing the value of cervical

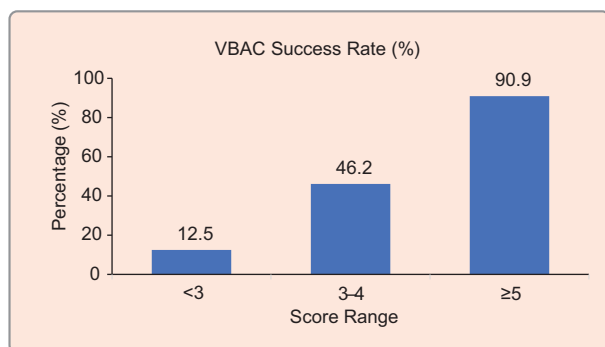


Figure 2: VBAC Success Rate According to Flamm and Geiger Score Range

Table-V*Distribution of patients according to vaginal birth history and VBAC outcome*

Vaginal Birth History	Successful VBAC (n = 18)	Emergency CS (n = 22)	Total (n = 40)
Before and after previous CS	0 (0.0%)	0 (0.0%)	0 (0.0%)
After previous CS	2 (11.1%)	1 (4.5%)	3 (7.5%)
Before previous CS	1 (5.6%)	0 (0.0%)	1 (2.5%)
No vaginal birth	15 (83.3%)	21 (95.5%)	36 (90.0%)

Table-VI*Distribution of Patients According to Cervical Effacement at Admission and VBAC Outcome (n=40)*

Cervical Effacement	Successful VBAC (n = 18)	Emergency CS (n = 22)	p-value
>75%	2 (11.1%)	0 (0.0%)	<0.001
25–75%	13 (72.2%)	4 (18.2%)	
<25%	3 (16.7%)	18 (81.8%)	
Total	18 (100.0%)	22 (100.0%)	

p-value obtained using Chi-square test

Table-VII*Maternal Complications by Delivery Outcome and Statistical Comparison*

Complication Type	Successful VBAC (n = 18)	Emergency CS (n = 22)	Total (n = 40)	p-value
Postpartum Hemorrhage	1 (5.6%)	3 (13.6%)	4 (10.0%)	0.611
Perineal Tear	3 (16.7%)	0 (0.0%)	3 (7.5%)	0.085
Wound Infection	0 (0.0%)	2 (9.1%)	2 (5.0%)	0.497
No Complications	14 (77.8%)	17 (77.3%)	31 (77.5%)	1.000

p-values obtained using Fisher's exact test

readiness as a favorable predictor for vaginal delivery in women undergoing TOLAC.

Table VII presents the distribution of maternal complications stratified by delivery mode. No statistically significant differences were observed between the VBAC and emergency Caesarean groups in terms of postpartum hemorrhage (5.6% vs. 13.6%, $p = 0.611$), perineal tear (16.7% vs. 0.0%, $p = 0.085$), or wound infection (0.0% vs. 9.1%, $p = 0.497$). Overall, maternal outcomes were favorable in both groups, with approximately 77% of patients experiencing no complications ($p = 1.000$). Importantly, no cases of uterine rupture or neonatal death occurred, reinforcing the safety of trial of labor after Caesarean (TOLAC) in appropriately selected women.

Discussion

This prospective observational study aimed to assess the predictive accuracy of the Flamm and Geiger

scoring system in determining the likelihood of successful vaginal birth after Caesarean (VBAC) in a private hospital setting in Bangladesh. The study found a VBAC success rate of 45%, which is consistent with findings from other regional studies using similar models—such as the 50.9% reported by Sahu et al¹⁵ and 59.1% by Ferwa et al¹⁶. These findings confirm the continued relevance of VBAC as a feasible and safe option when carefully selected.

The Flamm and Geiger score demonstrated a strong and statistically significant correlation with VBAC outcome in our study. Women with a score ≥ 5 had a success rate of 90.9%, while those with a score < 3 had only 12.5% success ($p < 0.001$). The mean score among successful VBAC cases was 5.1 ± 1.2 , compared to 2.8 ± 0.9 in the emergency CS group. This aligns closely with earlier research¹⁵ and affirms the model's predictive validity across different populations.

In addition to the total score, individual predictors also significantly influenced outcomes. A prior vaginal delivery and non-recurrent indication for the previous Cesarean were significantly more common among successful VBAC cases ($p < 0.05$). Likewise, favorable cervical conditions, particularly cervical dilation ≥ 3 cm at admission, were strongly associated with successful outcomes (66.7% vs. 27.3%, $p = 0.012$), reinforcing the importance of intrapartum readiness for VBAC success. These findings are in agreement with Grobman et al¹³ and Guise et al⁹, who emphasized the role of both prior vaginal birth and labor characteristics in VBAC success.

Among the 18 women who achieved successful VBAC, 83.3% delivered spontaneously and 16.7% required vacuum assistance. This modest use of instrumental delivery aligns with common practices in low- and middle-income countries, where vacuum is employed selectively to shorten the second stage of labor.¹¹ While not indicative of failure, it highlights the need for skilled birth attendants and continuous monitoring to ensure safe VBAC outcomes.

In our cohort, as shown prior vaginal birth—especially those following a previous Cesarean—was more commonly associated with successful VBAC (11.1% vs. 4.5%), even though small subgroup sizes limited statistical significance. This observation aligns with findings from large meta-analyses demonstrating that women with any prior vaginal delivery have approximately 3.4-fold increased odds of VBAC success.⁹ Moreover, data from the US Maternal-Fetal Medicine Units (MFMU) network report VBAC success rates exceeding 90% in women with prior VBAC episodes, further reinforcing the role of previous vaginal deliveries as a strong predictive factor.¹⁸ While our sample was modest, the trend observed offers supporting evidence of the prognostic value of vaginal birth history—consistent with seminal global literature.

In this study reveals a clear, statistically significant relationship between cervical effacement at admission and VBAC success ($p < 0.001$). Patients with effacement of 25–75% achieved a 72.2% success rate, and notably, all those with $>75\%$ effacement delivered vaginally. These findings mirror recent validations of labor prediction models—including simplified Bishop scores—that integrate dilation, station, and effacement as key predictors. Advanced cervical effacement is associated with higher VBAC success even after adjusting for other variables.¹³ Collectively, our results

emphasize that cervical readiness at admission, much like prior vaginal delivery, is a robust predictor of successful TOLAC in well-screened patients.

Maternal outcomes were favorable in both groups. No cases of uterine rupture or neonatal death were reported. The rate of postpartum hemorrhage was slightly higher in the emergency CS group (13.6%) than the VBAC group (5.6%), although not statistically significant ($p = 0.611$). Perineal tears, as expected, were exclusive to the VBAC group but were not associated with severe morbidity. These complication rates fall within globally accepted safety margins and echo findings from similar observational studies.⁸

Despite these encouraging results, several limitations warrant consideration. The sample size was relatively small and limited to a single center, which may affect generalizability. Additionally, neonatal outcomes such as Apgar scores, cord pH, or NICU admissions were not assessed in this study and should be included in future research. Larger, multicenter trials with long-term follow-up are needed to further validate the scoring system in diverse settings.

In summary, the Flamm and Geiger scoring system remains a simple, reliable, and evidence-based tool for predicting VBAC success. Its routine use in clinical practice—particularly at the time of admission—can improve patient counseling, promote informed decision-making, and help reduce the growing rates of unnecessary repeat Cesarean sections in resource-limited settings.

Conclusion

This study reaffirms the Flamm and Geiger scoring system as a practical, reliable, and evidence-based tool for predicting successful vaginal birth after Cesarean (VBAC). A score of ≥ 5 was strongly associated with VBAC success, supported by other favorable predictors such as prior vaginal delivery, non-recurrent CS indications, and favorable cervical status at admission. These findings underscore the importance of structured, evidence-based assessment in guiding labor management decisions. In resource-limited settings where unnecessary repeat Cesarean sections remain a growing concern, incorporating this scoring model into routine obstetric care can enhance patient selection, improve outcomes, and reduce surgical interventions. Broader use of such tools—backed by further research across varied populations—can help optimize VBAC strategies and contribute to safer, more efficient maternity care worldwide.

Limitation

This study has several limitations. The sample size was relatively small. Neonatal outcomes were not evaluated, and multivariable analysis could not be performed due to sample size constraints. Future multicenter studies with larger sample sizes and inclusion of neonatal outcomes are recommended.

Conflict of interest:

None to declare.

Ethical approval:

Approved by IRB, East West Medical College.

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