

## Research Article

# Predicting the Likelihood of Successful Vaginal Birth after Caesarean Section (VBAC): A Comparative Analysis of the FLAMM and GEIGER Scoring Systems

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## A B S T R A C T

**Introduction:** The increasing global rates of caesarean deliveries are influenced by various factors, including clinical contexts, patient preferences, and maternal demographics. However, vaginal birth after caesarean (VBAC) offers significant advantages by avoiding major surgery and reducing maternal complications. It is important to carefully consider the risks of failure and complications when making decisions regarding the trial of labour after caesarean (TOLAC).

**Methods:** The study involved a prospective observational analysis of 60 pregnant women with a singleton pregnancy at 37 weeks or later who had previously undergone a lower-segment caesarean delivery. Inclusion criteria encompassed specific conditions related to the previous caesarean, vertex presentation, adequate maternal pelvis, and an estimated foetal weight of  $\leq 3.5$  kg.

**Results:** The results indicated that none of the participants scored between 0 and 2 on the FLAMM & GEIGER scale. Participants with a score of 3 exhibited a 100% failure rate of VBAC and underwent a caesarean section. Among those with scores of 4, 61.9% achieved successful VBAC and had a vaginal delivery. Scores 5, 6, and 7, all resulted in 100% successful VBAC and vaginal deliveries. No participant scored above 7. The difference between successful and failed VBAC was statistically significant ( $p < 0.001$ ).

**Conclusion:** The FLAMM & GEIGER scoring system, considering various factors related to the mother and foetus, proved to be a valuable tool in predicting VBAC success.

**Keywords:** Scoring, Vaginal Birth After Caesarean, Trial of Labour After Caesarean

## Introduction

Caesarean delivery rates have been increasing worldwide, with elective caesarean deliveries in subsequent pregnancies being a significant contributing factor.<sup>1</sup> Various factors, including evolving clinical contexts and patient choices, and shifting maternal demographics such as obesity, chronic diseases, and advanced age, have contributed to the rise in caesarean section rates.<sup>1</sup> These factors are associated with higher-risk and more complicated pregnancies and births, leading to an increased likelihood of caesarean delivery. The Society of Obstetricians and Gynaecologists of Canada (SOGC) recommends offering a trial of labour to women with a history of a transverse low-segment caesarean section.<sup>2</sup> However, the decision to undergo a trial of labour after caesarean (TOLAC) is influenced by various variables.<sup>2</sup> While some women may desire a vaginal birth after caesarean (VBAC) to avoid major abdominal surgery and reduce the risk of complications in future pregnancies, there are potential risks associated with TOLAC, including failed attempts and subsequent maternal and neonatal morbidity, potentially leading to an unplanned repeat caesarean delivery.

In low-resource countries like India, where healthcare providers may not consistently adhere to best practices, it is crucial to improve the quality of care and promote normal labour to mitigate the risks associated with increased caesarean delivery rates.<sup>3</sup> While VBAC has demonstrated success in industrialised nations, further research is needed in India to optimise healthcare and increase patient awareness. VBAC has been shown to reduce maternal mortality compared to repeat caesarean delivery.<sup>4</sup> Reducing the primary caesarean delivery rate and increasing the rate of VBAC are essential strategies for reducing the overall caesarean section rate.<sup>5</sup> Both TOLAC and elective repeat caesarean section (ERCS) are considered to be safe delivery options for pregnancies complicated by a previous caesarean section, with low incidences of adverse maternal and foetal outcomes.<sup>4-6</sup> While recurrent caesarean delivery is associated with increased maternal risks, the success of TOLAC remains uncertain.<sup>7</sup>

Therefore, careful patient selection is necessary to minimise morbidity and increase TOLAC success rates. Discussions with patients should include a thorough consideration of the potential risks and benefits associated with TOLAC and elective repeat caesarean birth. Factors influencing the likelihood of complications should be taken into account, enabling women to make informed decisions regarding their preferred mode of birth. VBAC offers advantages such as avoidance of major surgery, reduced incidence of complications like haemorrhage, thromboembolism, and infection, and shorter recovery time compared to planned repeat caesarean deliveries.<sup>8</sup> Furthermore, opting for a VBAC can potentially lower the chances of maternal complications

that often arise from multiple caesarean deliveries. These complications may include the need for a hysterectomy, injuries to the bowel or bladder, transfusion requirements, infections, and abnormal placentation. By choosing VBAC, women with a history of caesarean deliveries can mitigate the risks associated with undergoing repeat caesarean surgeries.<sup>9</sup>

Evidence suggests that women with a high chance of successful VBAC have similar or lower maternal morbidity compared to those undergoing elective repeat caesarean deliveries.<sup>10</sup> Promoting VBAC as a safe alternative to repeat caesarean delivery is crucial in improving maternal and neonatal outcomes. Enhancing healthcare quality, increasing patient knowledge, and utilising effective grading systems, such as the FLAMM & GEIGER scoring model, can contribute to increasing the success rate of TOLAC and reducing the overall caesarean delivery rate. By implementing these measures, we can strive to improve the mode of birth following a previous caesarean section, ensuring the well-being of mothers and infants.

## Objectives

- To study caesarean section rate at different scores of FLAMM & GEIGER scorings
- To study the factors affecting the mode of delivery among the study group

## Material and Methods

The methodology employed in this study was a prospective observational design conducted at the Department of Obstetrics & Gynaecology in Nehru Hospital, BRD Medical College, Gorakhpur. The study aimed to investigate the outcomes of VBAC in pregnant women who had previously undergone a lower-segment caesarean delivery. The study population consisted of all pregnant women admitted to the department with a singleton pregnancy in a cephalic presentation at 37 weeks of gestation or beyond. The study was conducted over a period of one year, from July 2021 to June 2022. Inclusion criteria were established to ensure the relevance and homogeneity of the study sample. The study included women who had undergone a previous caesarean section for non-recurring reasons, such as placenta previa, malpresentation, malposition, failed induction of labour, and post-term pregnancy. Furthermore, only women with a single intrauterine pregnancy, vertex presentation, estimated foetal weight not exceeding 3.5 kg, and a sufficient maternal pelvis were eligible to participate. Exclusion criteria were applied to eliminate cases that could introduce confounding variables or increase the risk of adverse outcomes. Women with upper segment uterine scars (previous classical caesarean section or myomectomy), antepartum haemorrhage (placenta previa or abruption placenta), severe hypertension, uncontrolled diabetes mellitus, clinically estimated foetal weight exceeding 3.5 kg,

intrauterine growth restriction, and post-term pregnancies were not included in the study.

A sample size of 60 participants was determined based on feasibility considerations. Data collection was carried out by recording relevant information using standardised data collection forms. The data collected in the study were entered into Microsoft Excel 2010 software for subsequent analysis. Statistical analysis was conducted using either EpiInfo 7.0 software or SPSS version 23.0, employing relevant statistical tools such as data sorting, tabulation, and visualisation through pie charts and histograms. In order to maintain ethical standards, written informed consent was obtained from all participants, and the study protocol received ethical approval from the Institutional Ethics Committee of the University. The collected data underwent thorough statistical analysis to evaluate the outcomes and assess the success rate of VBAC in the study population. This analysis aimed to provide valuable insights into the safety and effectiveness

of VBAC as an alternative mode of delivery for women with a previous lower segment caesarean section.

## Results

The sociodemographic profile of the study participants showed that most participants were aged 26-30 years (48.3%), with the ages of the remaining participants being 20-25 years (41.7%) and 31-36 years (10%). The mean age of the study subjects was  $26.8 \pm 3.6$  years. The majority of participants were Hindu (93.3%), while 6.7% were Muslim. All participants were literate, with 40% having education up to high school, 33.3% having completed intermediate education, and 26.7% being graduates or above. The majority (60%) belonged to the lower-middle class, while 38.3% were in the lower class. In terms of residence, 63.3% lived in rural areas and 36.7% in urban areas. Vegetarian participants accounted for 63.3%, while 36.7% were non-vegetarian (Table 1).

**Table 1. Sociodemographic Profile of the Participants (N = 60)**

Variables	Frequency	Percentage
<b>Age (years)</b>		
20-25	25	41.7
26-30	29	48.3
31-36	06	10.0
> 36	00	0.0
<b>Mean age (years)</b>	$26.8 \pm 3.6$	
<b>Religion</b>		
Hindu	56	93.3
Muslim	04	6.7
<b>Education</b>		
Illiterate	0	0.0
Up to high school	24	40.0
Up to intermediate	20	33.3
Graduate or above	16	26.7
<b>Socioeconomic status</b>		
Lower class	23	38.3
Lower-middle class	36	60.0
Middle class	01	1.7
<b>Residence</b>		
Rural	38	63.3
Urban	22	36.7
<b>Dietary habit</b>		
Vegetarian	38	63.3
Non-vegetarian	22	36.7

The clinical profile of the study subjects revealed that most participants were categorised as gravida status G2 (60%). Primiparous women constituted 76.7% of the participants, while 23.3% were multiparous. The majority (85%) had one child. Of the remaining, 8.3% had two children and 6.7% had no child. All participants had undergone a single previous lower-section caesarean section (LSCS). Reasons for previous LSCS included breech presentation (26.7%), transverse lie (15%), foetal distress (11.7%), meconium-stained liquor (11.7%), placenta previa (10%), severe oligohydramnios (10%), obstructed labour (5%), and other factors. None of the participants experienced bladder or bowel injury or underwent caesarean hysterectomy. The mean hospital stay after delivery was  $5.67 \pm 3.4$  days, with 56.7% staying for 1-5 days, 41.7% staying for 6-10 days, and 1.7% staying for 11-14 days (Table 2). Successful 34 (56.7%) and failed 26 (43.3%) VBAC scores were assessed. None had scores of 0-2. Among those with a score of 3 (18 participants), all failed VBAC and underwent LSCS. For participants with scores of

4, 5, 6, and 7, 61.9%, 100%, 100%, and 100% respectively had successful VBAC scores and underwent normal vaginal delivery (NVD). Scores above 7 were not observed. The difference between successful and failed VBAC scores was statistically significant ( $p < 0.001$ ) (Table 3). A comparison was made between standard VBAC probabilities and the study's observed VBAC probabilities. Participants with a score of 4 had a standard probability of 67% for NVD, which aligned with the study's findings (61.9% underwent NVD). Participants with scores of 5, 6, and 7 had standard probabilities of 77%, 89%, and 93% for NVD, respectively, and in the present study, all achieved NVD. Scores above 7 were not observed (Table 4). Factors affecting the mode of delivery were analysed, but none showed significant associations with the failure or success probability of VBAC scores in the present study. These factors included age, socioeconomic status, education, gestational age, foetal weight for gestational age, and parity (Table 5).

**Table 2. Clinical Profile of the Participants (N = 60)**

Variables	Frequency	Percentage
<b>Gravida</b>		
2	36	60.0
3	12	20.0
4	10	16.7
5	2	3.3
<b>Parity</b>		
1	46	76.7
2	11	18.3
3	3	5.0
<b>Number of live children</b>		
0	4	6.7
1	51	85.0
2	5	8.3
<b>Number of abortions</b>		
0	46	76.7
1	7	11.7
2	6	10.0
3	1	1.7
<b>Number of previous caesarean section</b>		
1	60	100.0
> 1	0	0.0
<b>Reason of previous caesarean section</b>		
Breech presentation	16	26.7
Abruptio placentae	1	1.7
CPD	2	3.3
Foetal distress	7	11.7

Hydrocephalous	1	1.7
MSL	7	11.7
Nil liquor	1	1.7
Obstructed labour	3	5.0
Placenta previa	6	10.0
Severe pre-eclampsia	1	1.7
Severe oligohydramnios	6	10.0
Transverse lie	9	15.0
<b>Duration of hospital stay (days)</b>		
1-5	34	56.7
6-10	25	41.7
11-14	1	1.7
<b>Mean hospital stay (days)</b>	5.67 ± 3.4	

**Table 3. Association of Successful and Failed VBAC Score of the Participants (N = 60)**

VBAC Score	Successful VBAC	Failed VBAC	Total	p Value
0-2	0 (0.0)	0 (0.0)	0	< 0.001*
3	0 (0.0)	18 (100.0)	18	
4	13 (61.9)	8 (38.1)	21	
5	10 (100.0)	0 (0.0)	10	
6	8 (100.0)	0 (0.0)	8	
7	3 (100.00)	0 (0.0)	3	
8-10	0 (0.0)	0 (0.0)	0	
Total	34 (56.7)	26 (43.3)	60	

\*Statistically significant

**Table 4. Comparison of Standard VBAC Probability to Current Study's VBAC Probability**

Standard VBAC Score	Predicted Probability of NVD (%)	Observed Probability of NVD	
		n	%
0-2	49	0	0.0
3	60	0	0.0
4	67	13	61.9
5	77	10	100.0
6	89	8	100.0
7	93	3	100.0
8-10	95	0	0.0

**Table 5. Association of Factors Affecting Mode of Delivery of the Participants (N = 60)**

	Factors	NVD	LSCS	p Value
Age (years)	20-25	14 (41.2)	11 (42.3)	0.924
	26-30	17 (50.0)	12 (46.2)	
	31-36	3 (8.8)	3 (11.5)	
	> 36	0 (0.0)	0 (0.0)	
Socioeconomic status	Lower class	10 (29.4)	13 (50.0)	0.206
	Lower-middle class	23 (67.6)	13 (50.0)	
	Middle class	1 (2.9)	0 (0.0)	
	Upper-middle class	0 (0.0)	0 (0.0)	
	Upper class	0 (0.0)	0 (0.0)	
Education	Illiterate	0 (0.0)	0 (0.0)	0.737
	Up to high school	14 (41.2)	10 (38.5)	
	Intermediate	10 (29.4)	10 (38.5)	
	Graduate and above	10 (29.4)	6 (23.1)	
Gestational age (weeks)	≤ 37	8 (23.5)	9 (34.6)	0.345
	38-42	26 (76.5)	17 (65.5)	
	> 42	0 (0.0)	0 (0.0)	
Foetal weight for gestational age	AGA	29 (85.3)	22 (84.6)	0.942
	SGA	5 (14.7)	4 (15.4)	0.942
	LGA	0 (0.0)	0 (0.0)	N/A
Parity	1	25 (73.5)	21 (80.8)	0.802
	2	7 (20.6)	4 (15.4)	
	3	2 (5.9)	1 (3.8)	

## Discussion

In terms of participant characteristics, the study reported that the majority of participants were between 26 and 30 years old, belonged to the Hindu religion, and had education up to high school. Similarly, the studies conducted by Maykin et al.<sup>11</sup> and Sakiyeva et al.<sup>12</sup> also included participants within a similar age range. Regarding socioeconomic status, the study revealed that most participants belonged to the lower middle class. This difference was not statistically significant between the NVD and LSCS groups, and it is worth noting that socioeconomic status did not appear to be a significant factor influencing the success or failure of VBAC in the study. Gestational age, foetal weight, and parity were also examined in relation to VBAC success. The study found that these factors did not show significant differences between the NVD and LSCS groups. Similarly, the study conducted by Maykin et al. reported that the mean gestational age did not significantly differ between successful and unsuccessful VBAC groups.<sup>11</sup>

Regarding the VBAC scoring system, the study observed that the VBAC score was significantly associated with the success or failure of VBAC. Specifically, higher scores were

associated with a higher probability of successful VBAC. This finding is in line with the studies conducted by Fonseca et al.<sup>13</sup> and Kiwan and Al Qahtani<sup>14</sup> which also reported a positive association between the VBAC score and successful VBAC. Comparing the observed probabilities of NVD based on the VBAC scores to the probabilities predicted by the standard VBAC scoring scale, it was found that the study participants who scored 4 had a 67% probability of NVD, which was slightly higher than the actual rate of NVD observed in the study. For those who scored 5, the predicted probability was 77%, while the observed rate of NVD in the study was 100%. Similarly, for those who scored 6, the predicted probability was 89%, but the observed rate of NVD was 100%. Finally, for those who scored 7, the predicted probability was 93%, and all of them had NVD in the study. Other studies, such as the one conducted by Fonseca et al., found that the real probability of VBAC for each decile of success probability was lower than expected, except in the highest decile (91%-100%), where the proportion of VBAC was 64.1%.<sup>13</sup> Kiwan et al. reported a statistically insignificant difference between the induced and spontaneous VBAC groups in terms of vacuum deliveries.<sup>14</sup>

In the present study, factors such as age, socioeconomic status, education, gestational age, foetal weight, and parity did not significantly affect the success of the VBAC trial, but in contrast, in a study conducted by Wollmann et al., it was observed that women who opted for VBAC were more likely to be younger, have a lower BMI, experience spontaneous onset of labour, and deliver in a hospital with a lower rate of unplanned caesarean deliveries in subsequent deliveries.<sup>15</sup> Similarly, in the study by Sakiyeva et al., it was found that VBAC was successful in 68.9% of the women included in the study.<sup>12</sup> There were no significant differences in terms of age, weight, duration of the second stage of labour, foetal birth weight, and Apgar score between the successful and unsuccessful VBAC groups. However, the mean BMI and height were significantly different, with lower BMI and higher height associated with successful VBAC.

A study conducted by Tilden et al. revealed contrasting findings.<sup>16</sup> The study found that neonates born outside of the hospital setting during VBAC were more than 8 times as likely to experience neonatal seizures and nearly twice as likely to have lower Apgar scores as compared to infants delivered in a hospital. However, the study also reported a decrease in NICU admissions and birth injuries among out-of-hospital VBAC deliveries.

## Conclusion

The FLAMM & GEIGER scoring system for VBAC considers various factors related to the mother and foetus. The study subjects with extreme scores had a higher likelihood of failed VBAC, while those with middle-range scores had successful VBAC. This difference was statistically significant. The FLAMM & GEIGER scoring system effectively predicted VBAC success, with higher scores indicating higher chances of successful VBAC and NVD. Factors such as age, socioeconomic status, education, gestational age, foetal weight, and parity did not significantly affect the success of the VBAC trial.

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