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Predicting Successful Trial of Labor after Cesarean Delivery: Evaluation of Two Scoring Systems Flamm And Grobman

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ABSTRACT

Background:The chances for success vaginal birth after caesarean section (VBAC) vary significantly on the basis of patient's demographic characteristics and obstetric history and attempting vaginal birth after cesarean section (VBAC) increases the risk of obstetric complications. However, the chance of successful vaginal birth after cesarean (VBAC) can be predicted using Trial of labor after cesarean (TOLAC) calculators, based on the patient's pre-existing demographic and clinical factors. Objective: To predict successful trial of labor after cesarean delivery using two calculators: FLAMM and the Grobman calculator, and to compare the performance of the two calculators in successfully predicting VBAC. Methods: A Prospective cohort study in subjects with previous one lower segment caesarean section, admitted to LR, fulfilling the inclusion criteria, scoring was done under two study VBAC calculator and mode of delivery was studied. Results: A total of 200 subjects with previous one caesarean section were enrolled. One hundred fifty-two subjects consented for TOLAC, 103 (67.8%) underwent successful trial of vaginal birth, and 49 (32.2%) required cesarean section. Sensitivity and specificity were recorded for both the scoring systems, at a cutoff score of 5, the sensitivity of the FLAMM score was 71.84% and specificity was 75.51%. For the Grobman calculator, sensitivity (84.47%) and specificity (46.94%) were seen at a cutoff score of 70%. Conclusion: Patient specific chances of success vaginal birth after previous caesarean section can be predicted by the use of these prediction models. Both, FLAMM and Grobman et al. prediction models are easy to use and could successfully estimate the chances of vaginal birth after previous caesarean, in this study. The decision for women opting for TOLAC can be individualized, which can help in reducing feto-maternal complications.

Keywords: *Previous caesarean, Successful trial, Vaginal Birth.*

INTRODUCTION

After first cesarean delivery, women can choose either elective repeat cesarean delivery or a trial of labor after cesarean (TOLAC) with the aim of achieving vaginal birth after caesarean (VBAC). However, attempting vaginal birth after cesarean section (VBAC) increases the risk of feto-maternal complications. So, the decision to decide the mode of delivery need to be individualized, based on patient characteristics, which will increase their chances of a successful vaginal birth. There is a consensus [National Institute for Health and Care Excellence (NICE), Royal College of Obstetricians and Gynaecologists (RCOG), American College of Obstetricians and Gynecologists (ACOG)/National Institutes of Health (NIH)] that planned VBAC is a clinically safe choice for the majority of women with a single previous lower segment cesarean delivery [1]. Individual counselling regarding mode of delivery should be done by a trained obstetrician and the decision regarding mode of delivery should be finalized before term in most cases..

Having information regarding patient's pre-existing demographic and clinical factors help us to predict the probability of successful VBAC and also improves the decision-making process regarding the mode of delivery [1]. Trial of labor after cesarean (TOLAC) calculators aims to predict the chance of successful VBAC [2–5]. The rate of successful TOLAC can be predicted using several calculators and this information can be used in counselling individual women with decision making. This was a hospital based prospective cohort study undertaken to assess the rate of successful TOLAC in women with previous one cesarean delivery using two calculators: FLAMM [6] and the Grobman calculator (also known as MFMU calculator) [7] and to compare the performance of the two calculators in the successful prediction of VBAC.

SUBJECTS AND METHODS

This was a hospital based prospective cohort study conducted in Department of Obstetrics and Gynecology in Shri Mahant Indiresh Hospital and Shri Guru Ram Rai Institute of Medical & Health Sciences, Dehradun, Uttarakhand. The study was conducted over a period of one year from January 2023 to December 2023. Subjects with previous one lower segment cesarean section who met well-defined inclusion and exclusion criteria were included in the study:

Inclusion criteria

Women with previous one low transverse caesarean section.
With >37-40 weeks of gestation.
Singleton
Cephalic presentation
No known contraindication to Trial of Labor.
Should have given informed consent.

Exclusion criteria

Expected Baby weight of >3 kg.
Morbid obesity.
Diabetes Mellitus
Multiple pregnancy.
Non-cephalic presentation.
Placenta previa/abruption.

The general socio-demographic details of patient regarding their name, age, occupation, socio-economic status, and address were collected. Detailed history was taken with special reference to obstetric history (parity, previous cesarean), pre-existing conditions (hypertension, diabetes) and characteristics of the second pregnancy, including gestational diabetes, pre-eclampsia or eclampsia, premature rupture of membranes and interval between last and index pregnancy in months. A relevant general physical examination, abdominal and systemic examination was done. Intrapartum and post-partum events were recorded. Successful VBAC was defined as a vaginal delivery following attempted TOLAC. Vaginal birth also included instrumental delivery.

MONITORING IN LABOR

Patients were admitted in labor room and partograph was charted. Continuous electronic fetal heart monitoring was done in active labor. After counselling of the patient, mifepristone and Oxytocin were used cautiously for medical induction and augmentation of labor respectively whenever indicated. Subject was monitored continuously for progression of labor, tachycardia and uterine scar tenderness. Decision for termination of TOLAC was taken at the discretion of the supervising consultant on duty if maternal or fetal compromise was suspected or if progress of labor was not found to be satisfactory, and patient was taken for emergency caesarean section.

STATISTICAL ANALYSIS

Data thus collected was recorded in the FLAMM [6] and Grobman ''close-to-delivery'' (CTD) models [7]. Maternal and perinatal outcomes were recorded in the groups with successful and failed TOLAC. Data analysis was performed using Medcalc software for comparison of means and proportions. SPSS trial version 24 was used to derive the ROC curves, for diagnostic tests and for logistic regression analysis.

RESULTS

During the study period of one year, a total number of 200 subjects with previous one cesarean section who met the inclusion criteria were enrolled in the study. One hundred fifty-two subjects consented for TOLAC, out of which 103 (67.8%) underwent successful trial of vaginal birth and 49 (32.2%) required emergency cesarean section (Fig. 1).

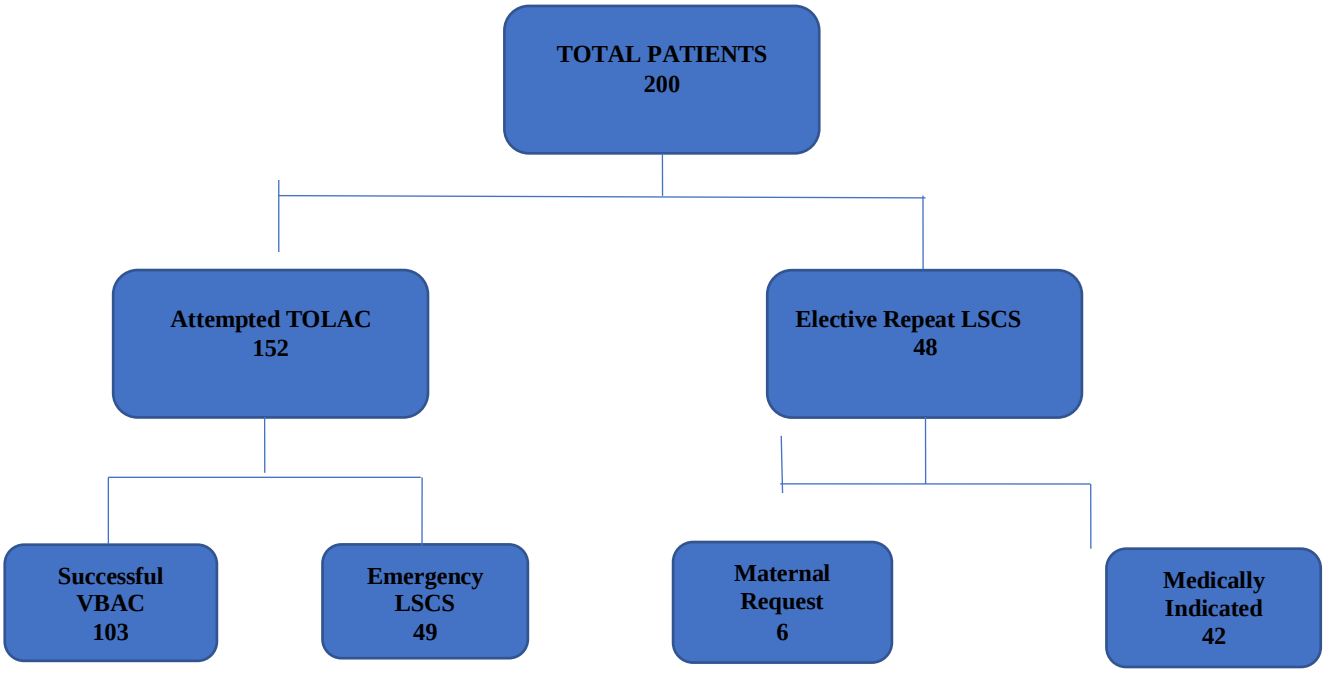

Fig. 1 Distribution of study subjects with previous one cesarean during study period.

Table 1 shows that among the successful TOLAC group, 75(72.8%) patients went into spontaneous labour, however induction of labour was required in 28 (27.2%) patients.

Mechanism of Labor	**Number of Subjects (N=103)**
Spontaneous Labor	75 (72.8%)
Induced Labor	28 (27.2%)

Table 2 shows that 50 patients among the successful VBAC group had spontaneous delivery, whereas instrumental delivery was done in 53 patients, out of which Ventouse was applied in 48 patients and instrumental delivery was done in 5 patients.

Mode of Delivery		**Number of Subjects (N=103)**
Spontaneous Delivery		50
Instrumental Delivery	Ventouse	48
	Forceps	5

Table 2 Mode of Delivery in successful VBAC group

Table 3 shows various indications for emergency LSCS in attempted TOLAC group, total 49 patients underwent Emergency LSCS, failed induction of labor being the most common reason seen in 23(46.9%) patients, followed by fetal distress in 14(28.6%) patients, non-progressive labor in 10(20.4%) patients and uterine scar dehiscence in 2(4.1%) patients.

Indication for emergency LSCS	**Number of Subjects (N=49)**
Failed Induction of Labor	23(46.9%)
Fetal Distress	14(28.6%)
Non-Progressive Labor	10(20.4%)
Uterine scar dehiscence	2(4.1%)

Table 3 Indications for emergency LSCS in TOLAC group

Table 4 shows observed versus predicted TOLAC success rate by FLAMM model. 17 subjects had a score of 3, out of which 3(17.6%) had successful TOLAC. Of the 49 subjects with a score of 4, 26 (53.1%) delivered vaginally. At a score of 5, 53 (84.1%) subjects out of 63 delivered vaginally. Of the 19 subjects with a score of 6, 17(89.5%) had successful TOLAC. 4 subjects had score of >6 and all of them delivered vaginally. The area under the curve (AUC) for the receiver operating characteristic curve (ROC) curve for this model was 0.773 (95%CI 0.692,0.855) (Fig. 2).

FLAMM score	Total subjects (N = 152)	Successful TOLAC (N = 103)	Failed TOLAC (N = 49)
0 to 2	0	0	0
3	17	3(17.6%)	14 (82.4%)
4	49	26(53.1%)	23(46.9%)
5	63	53 (84.1%)	10(15.9%)
6	19	17(89.5%)	2(10.5%)
>6	4	4(100%)	0

Table 4 Observed versus predicted TOLAC success rate by FLAMM model

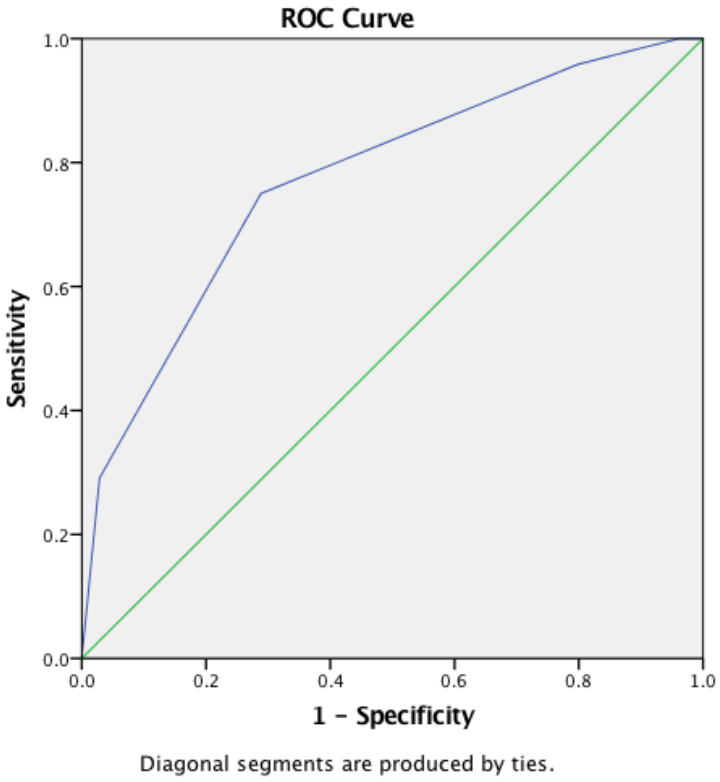

Fig. 2 ROC curve for FLAMM model (AUC.773) (95%CI 0 .692,0.855). At a cut-off score of 5, the sensitivity was 71.84% and specificity was 75.51%

Table 5 shows the successful and failed vaginal delivery rates by the predicted Grobman model. Of the 140 women with a score of >70%, 99 (70.7%) delivered vaginally. Whereas 12 subjects had score of <70%, out of which only 4(33.3%) had successful TOLAC. Using a ROC curve (Fig. 3), the model had an AUC of 0.712, (95% CI, 0.626, 0.798). At cut-off score of 70% the sensitivity was (84.47%) and specificity (46.94%)

MFMU Score	Total subjects (N = 152)	Successful TOLAC (N = 103)	Failed TOLAC (N = 49)
91–100	42	38(90.5%)	4(9.5%)
81-90	71	49(69.1%)	22(30.9%)
71-80	27	12(44.4%)	15(55.6%)
61-70	11	4(36.4%)	7(63.6%)
51-60	1	0	1(100%)

Table 5 Observed versus predicted successful TOLAC rate by Grobman model

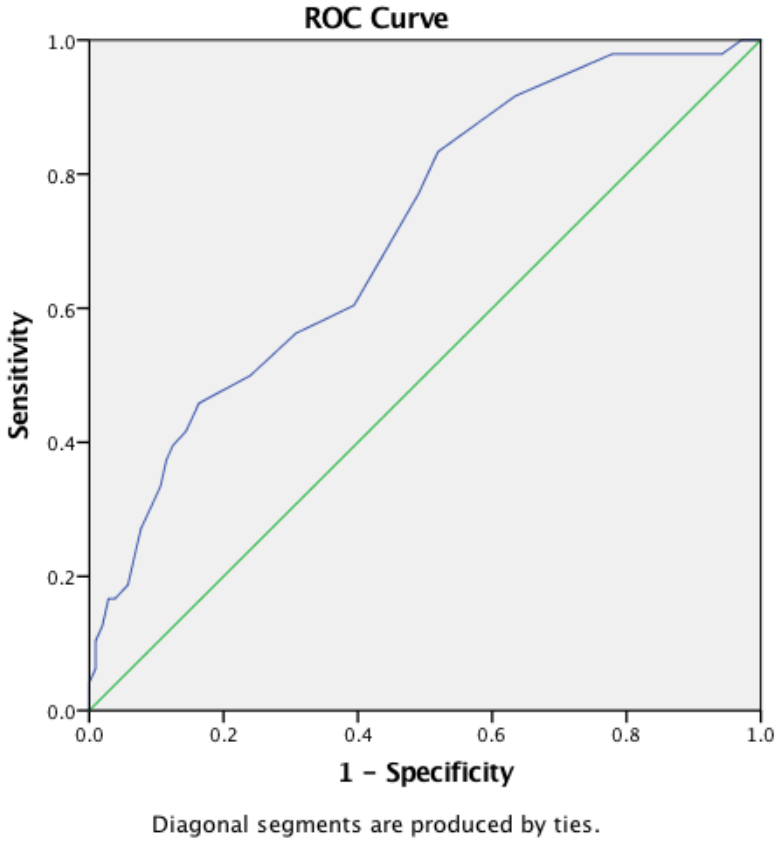

Fig. 3 Receiver operating curves for the MFMU scoring system (AUC.712) (95% CI, 0.626, 0.798). At cut-off score of 70% the sensitivity was (84.47%) and specificity (46.94%)

Table 6 compares the accuracy of the two scoring systems. When the Flamm score was ≤4 the probability of vaginal birth was 43.9% and when the score was >6 the probability was 100%. For a MFMU score of >80%, 87/116 (76.99%) women had a successful vaginal birth and when the score was <70%, 4/12 (33.3%) subjects had successful vaginal birth.

Scoring system/score	Predictability
Flamm and Geiger (1997)	
>6	100% vaginal delivery
≤4	43.9% vaginal delivery
Grobman et al. (2009)	
>80%	76.99% vaginal delivery
<70%	33.3% vaginal delivery

Table 6 Comparison of scoring systems in predicting vaginal delivery

There were two events of uterine scar dehiscence in the failed TOLAC group and patients were taken for emergency LSCS, intra-operatively urinary bladder injury was also found, for which general surgery opinion was taken. Also, in the elective

repeat LSCS group, intra-operatively 3 subjects were found to have dense adhesions between uterus and urinary bladder, for which general surgery opinion was taken and managed accordingly.

1. DISCUSSION

This was a hospital based prospective cohort study, in which 200 study subjects with previous one cesarean section were enrolled and two calculators (FLAMM and MFMU) were evaluated in the successful prediction of vaginal birth after cesarean section. The MFMU calculator predicts the chance of VBAC based on patient demographic and clinical information available at the time of admission for delivery. In addition to factors such as maternal age, BMI at admission, race/ethnicity, other factors included are gestational age, cervical examination (effacement, dilation, station), pre-eclampsia (yes/no), and induction (yes/no). Inclusion of these additional factors slightly improved the performance of the calculator. The FLAMM calculator uses maternal age, history of vaginal birth, a reason other than failure to progress for first cesarean delivery, cervical effacement at admission, cervical dilation ≥4 cm at admission. Points are assigned to each of the predictors, the higher the score, more the chances of successful trial of labor [6].

In the present study, the rate of successful TOLAC was 67.76%. A meta-analysis [8] (n = 103 188 VBAC labors) reported a pooled VBAC labor success rate of 74%. In an Australian cohort trial, of the 2345 women enrolled, 1108 (47.2%) were in the planned Elective Repeat Cesarean and 1237 (52.8%) in the planned VBAC group. In the planned VBAC group, 535 (43.2%) women had a vaginal birth and 702 (56.8%) had a cesarean section; 334 (27.0%) as an elective and 368 (29.7%) as an emergency procedure [9]. Spontaneous labor without augmentation was associated with a vaginal delivery rate of 80%, compared to a 74% success rate with oxytocin augmentation, and a 67% success rate with induction.

In the present study 72.8% had spontaneous labor, whereas induction of labor was required in 27.2% subjects. Among the subjects with failed TOLAC the most common reason for emergency LSCS was Failed induction of labor (46.9%), followed by Fetal distress (28.6%), Non progressive labor (20.4%) and uterine scar dehiscence (4.1%).

Knight HE et al. [5] in a study set in the English National Health service, the largest cohort study to analyse the association between primary caesarean section and subsequent mode of delivery, found that younger women and women of white ethnicity had higher success rates. Black women had a particularly low success rate. In the present study when the FLAMM score was ≤4, the probability of vaginal birth was 43.9% and when the score >6 the probability was 100%. At a cut-off score of 5, the sensitivity was 71.84% and specificity was 75.51%. In their original study, using a cut-off score of 5, Flamm et al. [6] found that the sensitivity and specificity for successful trial of labor were 69 and 65%, respectively. Rates of successful VBAC ranged from 49% in the score group of 0–2 to 95% in women scoring 8–10. Increasing score was linearly associated with increasing probability of vaginal birth. For the Grobman calculator, at a cut-off of 70%, the sensitivity was 84.47% and specificity was 46.94%. In their observations, Grobman recommended a threshold of >70% to counsel for successful VBAC outcome with no difference in maternal and neonatal morbidities between groups. The Grobman model has been externally validated in different populations by various researchers and there was a high positive correlation between actual and predicted success rates across these studies.

In the present study 2 (1.3%) patients in the TOLAC group had uterine scar dehiscence and associated urinary bladder injury, for which General Surgery opinion was taken and managed accordingly. The study by Soni et al. [10] found that 2 (0.4%) women had scar rupture, and 4 (0.8%) had scar dehiscence. Grobman et al. in 2008 [11] reported that of the 11,855 women analysed, 83 (0.7%) had a uterine rupture. So, we can say that success of vaginal birth after previous caesarean can be predicted successfully using various calculators, based on maternal demographic and clinical characteristics. And hence the mode of index delivery after previous one caesarean can be individualized after proper counselling.

2. CONCLUSION

Chances of vaginal delivery after previous cesarean section can be predicted successfully using various prediction models. Both prediction models, the FLAMM and the ‘‘close-to delivery’’ nomogram recommended by Grobman et al., are easy to use and could successfully estimate the chances of vaginal birth in previous cesarean, in the present study. At a cut-off score of 5 for the FLAMM model, the sensitivity was 71.84% and specificity was 75.51%. For the Grobman model sensitivity (84.47%) and specificity (46.94%) was seen at a cut-off score of 70%. The decision for women opting for TOLAC can be individualized and patient specific chances of success can be predicted by the use of these prediction models.

Conflict of interest: The authors declare that they have no conflict of interest.

Human and Animal Rights: All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki declaration of 1975 as revised in 2008.

Informed Consent: Informed consent was obtained from all patents for being included in the study.

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