Diagnostic Accuracy of Flamm and Geiger Scoring System as a Prediction Model for Outcome at the Time of Labour- A single-Centred Study

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Abstract

Objective: To develop a simple scoring system (model) based on the information available at the time of hospitalization to predict the probability of success/failure of vaginal birth after caesarean (VBAC).

Method: A prospective observational study carried out in a tertiary care hospital, from Punjab Province, Pakistan with recruitment of participants over a period of six months. Pregnant women underwent trial of labour after caesarean (TOLAC) with inclusion criteria as follow: Pregnant females with singleton fetus (on USG), of age ⩾ 18 years with prior history of one caesarean section, with vertex presentation of fetus (antenatal examination). Patients with any of the following excluded from study: have uterine surgery, fetal mal-presentation and Cephalo pelvic disproportion. One hundred and sixty (160) pregnant women were under trial for the development the prediction model using variables (maternal age, gestational age, body mass index (BMI),) at the time of admission. The outcomes, such as successful or failure of VBAC, were correlated with the VBAC score results.

Results: Out of 160 cases, 113 (70.6%) cases had successful VBAC while remained 47 (29.4%) had unsuccessful VBAC (p-value=0.0001). The scoring model indicated 33.3%, 68.6% and 80.5% successful VBAC for score 0-2, 3-7 and 8-10 respectively (p-value=0.045).

Conclusion: The present study demonstrates that the suggested VBAC prediction model is an effective tool for predicting the outcome of TOLAC and may be used to counsel females of reproductive age regarding the mode of childbirth in the current pregnancy and subsequent pregnancies.

Keywords: TOLAC, Vaginal birth after caesarean section, prediction model, caesarean section

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Introduction

Obstetricians' practices continue to serve with the best outcome provided to the delivering mother who has prior underwent one caesarean section. Generally, the prevalence of Vaginal birth after caesarean section (VBAC), ranging from 9.6% to 52.2% and is varied globally.[1,2] On the other hand, the prevalence of caesarean sections (CS) has been increased from last three decades.[3] According to Word health organization (WHO), the CS varies world widely but the highest rate had been observed in China.[4] In the past 20 years, caesarean section based deliveries has been increased enormously in many countries, including Pakistan. In most countries including Turkey, Egypt, and Brazil have reported the 50% child deliveries though CS. Similar trends have been observed in South Asian nations, like as Pakistan, where abrupt increased in the caesarean sections from 3.2% to 20% between 1990 to 2018.[5,6] The acceptable caesarean section rate was considered to be between

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10% and 15% by the international medical community from 1985 to 2015. Previous ecological studies' have revealed non-significant decrease in death rate subject to caesarean section frequency higher than 10% while other have shown increased in the risk of mother and fetus mortality when caesarean rate approaches 15%. [7-9]
The most prevalent medical justifications for caesarean deliveries include dystocia, previous caesarean delivery, cephalopelvic disproportion, protracted labour, the size of the infant, and multiple gestations[10] however, studies reported 2 to 4 times increased in mortality rate in women who give birth through caesarean section compared to women that deliver vaginal childbirth.[7,8] Despite the fact that modern surgical procedures' like CS are considered to be a significantly safe invasive procedure[11] but CS patients may have health risks including haemorrhage, blood transfusion, anesthesia-related difficulties, and surgical complications.[12]
Public health experts from all over the world have become concerned about the rapidly increasing rate of caesarean births in recent years. However, the WHO no longer advises countries to achieve a particular rate according on their population level due to the significant incidence in caesarean section frequency.[13] Furthermore, the mother's wishes for a caesarean section can also be considered as a non-medical aspect that has resulted in an increase in the caesarean rate.[14,15] Literature also demonstrates that females may request a caesarean delivery for a variety of cultural or particular reasons, such as past delivery experiences, protracted labour, anxiety about vaginal birth, and the cultural acceptance of caesarean sections.[14]
However, in Pakistan, a doctor's suggestion to perform a caesarean section viewed as the primary factor influencing the pregnant woman's decision. Given that the majority of Pakistani women give birth to their children at home, the increasing caesarean delivery rate in the country is on the rise. However, considering how often caesarean sections are performed inappropriately, it is possible to hypothesize that gynecologist's would do non-medically necessitated caesarean procedures in order to profit financially, save time, and gain surgical expertise.[16]
There are generally two alternatives available to a woman who has had one prior caesarean delivery: VBAC or an elective repeat caesarean procedure (ERCS). Both alternatives have different risks associated with maternal and perinatal morbidity, and rarely mortality. Uterine rupture, haemorrhage, endometritis, transfusion, increased chances of asphyxia or perinatal death of the infants are major risk related with VBAC.[1,17] These VBAC associated risk had found minimally in the patients with successful VBAC but unfortunately, no existing tool is reliable to identify women for successful VBAC. Maternal complication rates are lowest in successful vaginal deliveries, intermediate in planned caesarean deliveries, and greatest in unsuccessful vaginal deliveries. Institutions and the service providers also influence on the success rates of VBAC. Therefore, keeping in view the above facts, there is need of time to developed a reliable and observable algorithm or nomogram that correctly identifies or reliably predicts the success of VBAC. There is scanty data available in Asian ethnicities particularly from Pakistan that might evaluate the antepartum and intrapartum predictors for VBAC success/failure prediction, thus an accurate and reliable prediction model must be developed and validated to predict a successful outcome. The objective of the study was to develop and evaluate the novel approach (model) using preliminary information at the time of hospitalization to find out the probability of success of VBAC.

Material and Method

The current study being conducted in Department of Obstetrics & Gynecology, Lady Atchison Hospital, Lahore, and was taken fully approval by the Ethical review board of the institution and was conducted in accordance with the declaration of Helsinki. A sample size of 160 was calculated using 95% confidence interval (CI), 63.6% with sensitivity of Flamm and Geiger score system i.e. 72% with 7.5% margin of error and specificity i.e. 76% with 4% margin of error. Patients with one caesarean section history, Singleton pregnancy, vertex presentation of fetus (antenatal examination) with gestational age ≥ 37 weeks were included while patient with previous classical caesarean section; previous uterine surgery other than caesarean section, fetal mal-presentation (antenatal examination) and Cephalo pelvic disproportion (ultrasonography) being excluded from the investigation protocol.
The following system was used which was already purposed by the model of Flamm and Geiger.[18] In this proposed model, a total five (05) variables namely, maternal age, vaginal birth history, Reason for first cesarean section, cervical effacement on admission and cervical dilatation on admission were included, and named as Flamm and Geiger scoring system. The variable was assigned with score ranged from 0 to 4 based on the scoring system proposed by previous

models reported by Troyer and Parisi et al and Flamm and Geiger.[18,19]

Flamm and Geiger scoring system used in the proposed prediction model:

1. Maternal age (Years): a. <40= 2, b. >40= 0
2. Vaginal birth history:

a. Before and after first caesarean section= 4
b. After first caesarean section= 2
c. Before first caesarean section= 1
d. None= 0

3. Reason for first cesarean section: a. Failure to progress= 0, b. Other reason= 1
4. Cervical effacement on admission: a. >75%=2, b. 25-75%=1, c. <25%=0
5. Cervical dilatation on admission: a. >4cm=1. b. <4cm=0

All variables in the research were analyzed with the help of the statistical analysis tool using Statistical package for the social sciences (SPSS) version 21. (SPSS Inc. Chicago, IL). Descriptive statistics such as mean, standard deviation (SD) employed for maternal age, BMI, and gestational age while frequencies were used for variables in prediction model for success/failure of VBAC. The Chi-square and students-t test were performed for comparison amongst groups with 95%CI and p-value ≤0.05 was taken as statistically significant.

Results

In the current study, 160 pregnant women with mean age 27.62±4.23 were recruited. Majority n=71 (44.4%) of the females were in age group between 25 to 30 years with mean BMI 30.26±3.85 Kg/m^2. The mean gestational age was measured as 39.28± 1.16 weeks. Table 1. represented demographic and clinical information of the studied participants. Out of 160 patients, 113 (70.6%) cases had successful VBAC while remained 47 (29.4%) had unsuccessful VBAC. Table 2 demonstrated the association of the variables with success and failure of VBAC. The common indication of failure in VBAC was failure to progress, >75% Cervical effacement at admission and >4cm Cervical dilatation on admission. As shown in the (figure 1), the frequencies of all variables computed for successful and failed VBAC. The developed score was ranged from 0-10, patients with 0-2, 3-7 and 8-10 score have shown 33.3%, 68.6% and 80.5% successful VBAC respectively.

Table 1: *Demographic & Clinical information of studied subjects*

Demographic Characteristics	(n=160)	Successful VBAC n (%)	Failed VBAC n (%)	p-value
Maternal Age mean±SD(Years)	27.62±4.23			
<25	43 (26.9%)	32 (28.3%)	11(23.4%)	0.727
25-30	71 (44.4%)	48 (42.5)	23(48.9%)	
>30	46 (28.8%)	33 (29.2%)	13(27.7%)	
BMI (Kg/m^2)	30.26±3.85			
25-30	82 (51.3%)	60 (53.1%)	22(46.9%)	0.291
>30	78 (48.7%)	53 (46.9%)	25(53.1%)	
Gestational Age: mean±SD(Weeks)	39.28±1.16			
<39	38 (23.8%)	27 (23.9%)	11(23.4%)	0.519
39-40	86 (53.8%)	58 (51.3%)	28(59.6%)	
>40	36 (22.5%)	28 (24.8%)	8 (17%)	
Number of women underwent VBAC	n=160	113(70.6%)	47 (29.3)	**0.0001**

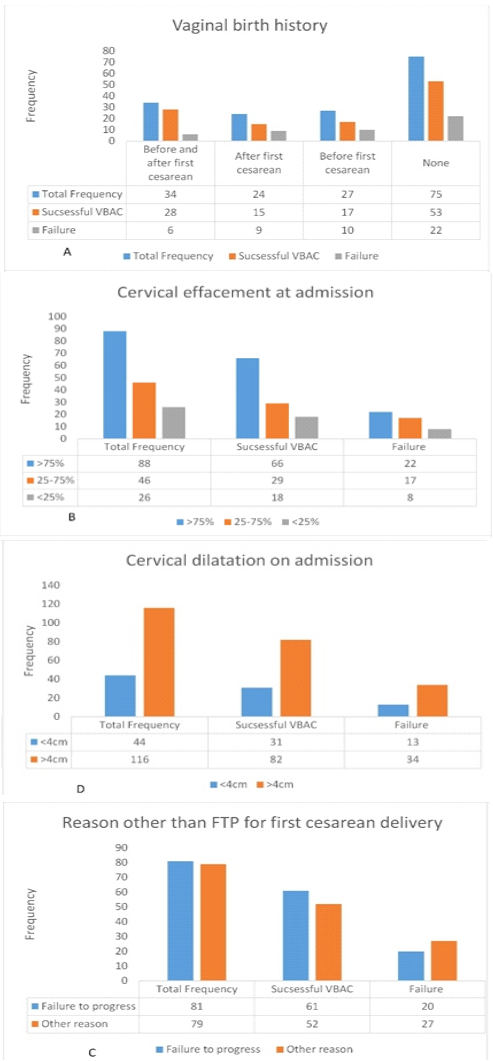

Fig-1. *Bar chart represented frequency of Successful and failure VBAC with; Vaginal Birth History (A),*

Table 2: . *Represented the frequencies of variables in (Predicted model) for Success/Failure of VBAC.*

Characteristic	Frequency	Successful VBAC n (%)	Failure VBAC n (%)	p-value
Age under 40	**n=160**	**113 (70.6%)**	**47 (29.4%)**	**0.001**
Vaginal birth history				0.286
Before and after first cesarean	34 (21.25%)	28 (24.78%)	06 (12.8%)	
After first cesarean	24 (15%)	15 (13.27%)	09 (19.14%)	
Before first cesarean	27 (16.9%)	17 (15.04%)	10 (21.27%)	
None	75 (46.8%)	53 (46.90%)	22 (46.8%)	
Reason other than FTP for first cesarean delivery	81 (50.62%)	61 (53.9%)	20 (42.6%)	0.188
Failure to progress	79 (49.38%)	52 (46.1%)	27 (57.4%)	
Other reason				
Cervical effacement at admission				0.348
>75%	88 (55%)	66 (58.4%)	22 (46.8%)	
25-75%	46 (28.75%)	29 (25.7%)	17 (36.1%)	
<25%	26 (16.25%)	18 (15.9%)	08 (17.1%)	
Cervical dilatation on admission				0.561
<4cm	44 (27.5%)	31 (27.4%)	13 (27.6%)	
>4cm	116 (72.5%)	82 (72.6%)	34 (72.4%)	
Score				**0.045**
0-2	03 (1.8%)	01 (33.3%)	02 (66.7%)	
3-7	121 (75.6%)	83 (68.6%)	38 (31.4%)	
8-10	36 (22.6%)	29 (80.5%)	07 (19.5%)	

Cervical effacement at admission (B), Reason other than FTP for first cesarean delivery (C), Cervical dilatation on admission (D)

Discussion

Models to predict VBAC success have been developed to determine which patients would be more likely to have successful VBAC. In our study, the success rate of VBAC was 70.6%, which is in similar direction (60-80%) reported by the American College of Obstetricians and Gynecologists (ACOG) 2010.[20] The mean age of the cases in our study was 27.62±4.23. The insignificant difference in age was found between successful and failure VBAC which is also observed in the study of Metz et al. in which insignificant difference in age was observed (27.9±4.3 and 27.5±4.6; p=0.20).[21] In the predicted model developed by Grobman et al. maternal information's including ethnicity, age, pre-pregnancy body mass index (kg/m^2), prior VBAC and indication of CS at the time of first antenatal visit were collected for developing the predicted model.[22] Development of such model, accurately predicts the successful VBAC. It had been evaluated whether using ultrasound to assess the thickness of a previous uterine scar area might help predict the probability of rupture and a failure VBAC. The meta-analysis performed by Uddin et al. (2013) in 21 studies revealed the significant role of uterine rupture risk in predicting successful VBAC.[23]

An important model in California in 1997 was developed by the Flamm and colleague. 5022 pregnant TOLAC were under trial using four variables that were noted at the time of hospitalization. These variables (maternal age, vaginal delivery before and after the cesarean section, a non-recurring indication of primary caesarean, cervical dilatation and cervical effacement) were used for scoring i.e. (0 to10). There were found significant difference in VBAC success rate amongst groups having score; 0-2 corresponded to 49.1%, 3-7 corresponded to 59.9%, 66.7%, 77%, 88.65%, and 92.65%, and the success of 8-10 was 94.9%.[18] In our study, the success of VBAC was observed for score 0-2 corresponded to 33.3%, 3-7 corresponded to 68.6% and 8-10 corresponded to 80.6% respectively. Our results were also strengthened by the results reported in Flamm model where high success of VBAC was observed in women having scoring range between 8-10. Another study from Gujrat (India) by Patel et al. in 2016 in 150 pregnant women having single caesarian section history were evaluated using Flamm model. The observed results indicated the successful VBAC (95%CI: 3.9 to 6.7) in women having mean score of 5.35 compared to the women having failure VBAC (95% CI: 27 to 4.57) with mean score 3.62 and they concluded that the chances of successful VBAC

increases with the increased in the score. 24 Two more significant variables, spontaneous onset of labour and parity, may be included in the current model for further strengthening of these findings. As there are limited models/studies in multiple variables are available that accurately predict the success of VBAC so other variables including gestational diabetes, preeclampsia, weight gain in pregnancy, race (reported in other models) may be evaluated to developed the VBAC prediction with greater accuracy. Therefore, predicting the success of TOLAC more accurately, keep in view of findings of our research and other similar models with numerous permutations for the development of standard prediction model.

The small sample size and single center is only the limitation of this study. Moreover, the current study was fully approved from ethical review board of the institute in accordance with the Helsinki declaration (1975), revised in 2000.

Conclusion

In conclusion, the present study revealed the significance of the scoring system for predicting the success of the VB AC and can be implemented in counseling the pregnant women regarding the mode of delivery in current and later on pregnancies. Patient age, vaginal delivery before and after the cesarean section, a non-recurring indication of primary caesarean, cervical dilatation and cervical effacement were significantly associated with success of VBAC. Further studies must been conducted with a relatively larger sample size with comparison of the existing model with other predicting models for strengthening of our findings in a given population.

Conflict of Interest *None*

Funding Source *None*

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Authors Contribution

SI: Conceptualization of Project
AAU: Data Collection
AT: Literature Search
MS: Statistical Analysis
FI: Drafting, Revision
SI, AAQ: Writing of Manuscript