Original Article

Predictors of Repeat Cesarean Section in Women with One Previous Lower Segment Cesarean Section: A Retrospective Study from Malaysia

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Abstract

Background: The rates of repeat cesarean section (CS) among women with previous CS are increasing worldwide. The predictors of a repeat CS can vary across different populations.

Objective: To determine the predictors of repeat CS among women from Malaysia with one previous lower segment CS (LSCS) who underwent trial of labor (TOLAC).

Materials and Methods: This retrospective cohort study included women with one previous LSCS who followed up and delivered their current pregnancy at Hospital Universiti Sains Malaysia (USM), Kelantan, Malaysia, between January 01, 2016, and December 31, 2017. Women with singleton pregnancies were included while those who had a history of classical CS, current pregnancy with preterm birth, non-cephalic pregnancy, lethal fetal anomalies, uterine rupture, and severe preeclampsia or planned for elective CS were excluded. Logistic regressions were performed.

Results: The study included 388 women who underwent TOLAC and successfully gave childbirth through vaginal birth after cesarean (VBAC) ($n = 194$) or emergency LSCS ($n = 194$). Factors significantly associated with repeat CS were no history of vaginal delivery (adjusted odds ratio (aOR): 2.71; 95% confidence interval (CI): 1.60, 4.60; $P < 0.001$), estimated fetal weight ≥3500 grams (aOR: 4.78; 95% CI: 2.45–9.34; $P < 0.001$), and presence of meconium-stained liquor (aOR: 2.40; 95% CI: 1.33–4.35; $P = 0.004$).

Conclusion: The above-mentioned predictors of a repeat CS among women from Malaysia with one previous LSCS who underwent TOLAC can be useful for clinicians in making an informed decision.

Keywords: Cesarean, Malaysia, obstetric delivery, predictors, previous scar, repeat cesarean section, trial of labor, vaginal birth after cesarean

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INTRODUCTION

Cesarean deliveries, also known as C-section (CS), are increasingly becoming common worldwide, despite not being an encouraged method for child delivery, and thus represent a worldwide concern.[1] The World Health Organization and the United Nations Children's Fund have recommended that CS rates should account for a maximum of 15% of the predicted births.[2] However, in most countries and regions, the CS rates are higher than this recommended rate. For example, in the United States, the rate of CS has risen from 5% in 1970 to 31.9% in 2016.[3,4] Similarly, in Latin America and the Caribbean region, the rates of CS are 42%, in Oceania it is 31%, in Europe 25%, and in Asia 19%. In Africa, the CS rates are the lowest in the world (7%).[5] A recent population-based study from Malaysia that utilized data from the Malaysian National Obstetrics Registry reported that between 2011 and 2015, the rate of CS in Malaysia was 23.2%, and that the rate of CS increased by 3% between this period.[6]

In women who have undergone CS, there is a widespread practice of repeating CS in the subsequent deliveries. However, it is recommended that if the initial CS was a low transverse scar, then such women are candidates for vaginal delivery, and they should be informed of the same. To reduce the rates of CS and in women deemed to have a positive likeliness of vaginal birth after cesarean (VBAC), women can undergo trial of labor after cesarean delivery (TOLAC).[7,8] However, a failed TOLAC is associated with increased maternal and perinatal morbidity when compared with a successful VBAC and an elective repeat CS, and thus adequate assessment of candidacy for TOLAC is essential.[7,9] In the recent past, while the rates of CS have increased worldwide, the rates of TOLAC have decreased.[10] This is despite VBAC having several advantages over an elective repeat CS, when possible.[7]

Several factors are associated with an increased likeliness of CS, including being aged >40 years,[1,11] obesity resulting in obstetric complications such as macrosomia,[12,13] and gestational and pre-gestational diabetes.[1] These predictors of both CS and repeat CS can vary between countries, and thus it is important for clinicians to be aware of these predictors within a population to make an informed decision. However, to the best of the authors' knowledge, from the Malaysian population, there is limited data regarding the predictors of repeat CS in women with previous lower segment CS (LSCS). Therefore, the current study aimed to assess the associated factors of repeat CS among women with one previous LSCS who underwent TOLAC. Women with only one previous LSCS were chosen because in general, those with two or more CS are likely to subsequently deliver only through CS.

MATERIALS AND METHODS

Study design, setting, and population

This retrospective cohort study included women with one previous LSCS who followed up and delivered their current pregnancy at Hospital Universiti Sains Malaysia (USM), Kelantan, Malaysia, between January 01, 2016, and December 31, 2017. Hospital USM is a public tertiary care hospital. The study was approved by the Human Research Ethics Committee of USM, Malaysia, and relevant permissions were obtained from the Director of Hospital USM to review the medical records.

Women who were aged ≥18 years, had singleton pregnancy, and had previously undergone an LSCS for their last delivery were included. Those with a classical CS (previously or in the current pregnancy), presenting for preterm birth (<37 weeks) in the current pregnancy, non-cephalic pregnancy, lethal fetal anomalies, with uterine rupture, with severe pre-eclampsia, and those who underwent elective CS for any other reason in the current pregnancy were excluded from the study.

Sample size

The sample size was calculated using the Power and Sample Size Calculation software version 3.1.2. The determination of sample size was based on a two-proportion formula with a level of significance of 0.05 and a power of 80%. The selected variables for calculation were considered based on significant results from previous studies. The parameters that were used in sample size determination were: i) level of significance (α): 5%; ii) power: 80%; iii) P_0: proportion of spontaneous vaginal delivery (mode of delivery) in unexposed factors reported in the previous study; iv) P_1: proportion of spontaneous vaginal delivery (mode of delivery) in exposed factors based on expert opinion; and iv) m: ratio of spontaneous vaginal to delivery CS (mode of delivery) reported in a previous study. An additional 10% were added to the sample size to account for missing form, incomplete data (>30%), and the possibility of data error. Accordingly, the final minimum sample size estimated for this study was 388.

A total of 1788 women were eligible for the current study. A simple random sampling was used to get the required sample size. The selection of patients was based on the random number generated by the SPSS software.

Data collection

All required information were extracted from the medical records of the patients and recorded on a data collection

form. The outcome variable for this study was mode of delivery, which was categorized into VBAC and emergency CS. The independent variables were sociodemographic characteristics (such as ethnicity, parity, and history of vaginal birth), maternal characteristics (maternal age at the previous and current pregnancy, type of previous LSCS, indication of previous LSCS, and interpregnancy interval), and neonatal characteristics (estimated fetal weight and presence of meconium-stained liquor).

The estimated fetal weight was the final fetal weight estimated at the last follow-up before delivery. Meconium-stained liquor was defined as the presence of meconium in the amniotic fluid, which changes the color of the liquor from clear to various shades of green, yellow, or brownish color, depending on the degree of the meconium-stained liquor. At our hospital, if significant meconium staining is noted in labor, there is continuous electronic fetal monitoring. The mother is also transferred to obstetric-led care and the delivery is not imminent. If there are signs of fetal distress, emergency delivery is done.

Statistical analysis

Data entry and analyses were done using Stata Special Edition (SE) version 14 (Stata Corp, 2015). Descriptive analysis was used for reporting the sociodemographic, maternal, and neonatal characteristics. Results were presented as frequency (percentage) for categorical variables and mean (standard deviation [SD]) for numerical variables.

Simple and multiple logistic regression analysis were used to identify the clinical variables for predicting CS delivery in women with one previous LSCS. In simple logistic regression, all independent variables (i.e., sociodemographic, maternal, and neonatal characteristics) were analyzed. Independent variables with a P value < 0.25 or those deemed to be clinically important were included for multiple logistic regression. The crude and adjusted odds ratio (OR), regression coefficient, 95% of the confidence interval (CI), and P value were reported. P <0.05 was considered statistically significant.

RESULTS

The study included 388 women who underwent TOLAC and successfully gave childbirth through VBAC (n = 194) or emergency LSCS (n = 194). In the VBAC group, 89.2% of the deliveries were by spontaneous vaginal delivery and the remaining 10.8% were through assisted vaginal delivery.

Socio-demographic characteristics

The sociodemographic characteristics of the patients are shown in Table 1. The majority of the women were Malay (96.6%) and previously primipara (74.7%). In the current child delivery, the majority of the primipara mothers underwent emergency LSCS (54.8%). In the LSCS group, most women did not have a history of vaginal delivery (84.0%).

Maternal and neonatal characteristics

The overall mean maternal age at the time of previous pregnancy was 26.8 years [Table 2]. In the previous pregnancy, 87.9% had undergone emergency LSCS, with the most common indication being fetal complications (60.8%). In the current pregnancy, the overall mean (SD) maternal age was 29.7 (4.8) years, while the mean (SD) gestational age was 39.0 (2.3) weeks. The mean (SD) interval between the two pregnancies was 38.7 (21.5) months. The estimated fetal weight was <3500 grams in most cases (323; 84.6%), and 16.0% had the presence of meconium-stained liquor.

Factors associated with cesarean delivery

Eleven clinically important variables were assessed for association with LSCS in the univariable analysis using simple logistic regression. Parity history of vaginal delivery, previous type of LSCS, indication of previous LSCS, gestational age of present pregnancy, estimated fetal weight, and meconium-stained liquor were found to be significantly associated with LSCS (i.e., $P < 0.25$) [Table 3].

In the final model for associated factors, no history of vaginal delivery increased the odds of emergency LSCS by 2.71 times (95% CI: 1.60, 4.60; $P < 0.001$) after controlling for fetal weight estimation and meconium-stained liquor. Estimated fetal weight of ≥3500 grams increased the odds of emergency LSCS by 4.78 times (95% CI: 2.45, 9.34; $P < 0.001$) after controlling for history of vaginal delivery and meconium-stained liquor. The presence of meconium-stained liquor increased the odds of emergency LSCS by 2.40 times (95% CI: 1.33, 4.35; $P = 0.004$) after controlling for history of vaginal delivery and fetal weight estimation [Table 4].

Table 1: Sociodemographic characteristics according to the mode of delivery (*N*=388)

Variables	Mode of delivery	
	Vaginal delivery, *n* (%)	Emergency LSCS, *n* (%)
Ethnicity		
Malay	188 (96.9)	187 (96.4)
Non-Malay	6 (3.1)	7 (3.6)
Parity		
Primipara	131 (67.5)	159 (82.0)
Multipara	63 (32.5)	35 (18.0)
History of vaginal delivery		
Yes	60 (30.9)	31 (16.0)
No	134 (69.1)	163 (84.0)

LSCS – Lower segment cesarean section

Table 2: Maternal and neonatal characteristics according to the mode of delivery (*N*=388)

Variables	Mode of delivery	
	Vaginal delivery, *n* (%)	Emergency LSCS, *n* (%)
Maternal characteristic: Previous pregnancy		
Maternal age (years)*	26.70 (4.22)	26.91 (4.25)
Type of LSCS		
Elective	32 (16.5)	15 (7.7)
Emergency	162 (83.5)	179 (92.3)
Indication of LSCS		
Fetal	134 (69.1)	118 (60.8)
Maternal	76 (39.2)	136 (35.1)
Maternal characteristic: Current pregnancy		
Maternal age (years)*	29.56 (4.56)	29.77 (4.95)
Gestational age (weeks)*	38.87 (2.98)	39.21 (1.21)
Interpregnancy interval (months)*	38.18 (19.72)	39.15 (23.18)
Neonatal characteristics		
Estimated fetal weight (g)		
<3500	177 (92.7)	146 (76.4)
≥3500	14 (7.3)	45 (23.6)
Meconium-stained liquor		
No	173 (89.2)	153 (78.9)
Yes	21 (10.8)	41 (21.1)

*Mean (SD). SD – Standard deviation; LSCS – Lower segment cesarean section

Table 3: Factors associated with repeat cesarean section using simple logistic regression (*N*=388)

Variable	Simple logistic regression		
	B	Crude OR (95% CI)	*P*
Parity			
Multipara	0	1	-
Primipara	0.78	2.18 (1.36-3.51)	0.001
History of vaginal delivery			
Yes	0	1	-
No	0.86	2.35 (1.44-3.84)	0.001
Maternal characteristic: Previous pregnancy			
Maternal age (years)	−0.01	0.99 (0.94-1.04)	0.662
Type of LSCS			
Elective	0	1	-
Emergency	0.85	2.36 (1.23-4.51)	0.010
Indication of LSCS			
Maternal	0	1	
Fetal	0.36	1.44 (0.95-2.19)	0.089
Maternal characteristic: Current pregnancy			
Maternal age (years)	−0.01	0.99 (0.95-1.03)	0.662
Gestational age (weeks)	−0.12	0.89 (0.75-1.05)	0.169
Inter pregnancy interval (months)	−0.002	1.00 (0.99-1.01)	0.655
Neonatal characteristics			
Estimated fetal weight (g)			
<3500	0	1	-
≥3500	1.36	3.90 (2.06-7.38)	<0.001
Meconium-stained liquor			
No	0	1	
Yes	0.79	2.21 (1.25-3.90)	0.006

LSCS – Lower segment cesarean section; CI – Confidence interval; OR – Odds ratio

DISCUSSION

The rates of CS in Malaysia have increased in the recent past. According to the data from the National Obstetrics Registry of Malaysia, the overall rate of CS increased by 2.1% between 2010 and 2012.[14] Similarly, between 2011 and 2015, a 3% increase was noted in the number of CS deliveries.[6] For women with one previous LSCS, repeat LSCS delivery increased from 25.1% in 2011 to 26.1% in 2012.[14] However, to the best of the authors' knowledge, the current study is the first from Malaysia to provide the predictors of repeat LSCS in women with one previous LSCS.

The current study found that no history of vaginal delivery, fetal weight ≥3500 g, and presence of meconium-stained liquor were significant predictors of emergency LSCS. Similarly, Vankan *et al*.[15] found that in a Dutch population, history of vaginal delivery was a significant factor positively associated with VBAC. They also found that patients who underwent elective CS did not have a history of prior vaginal delivery. These findings are coherent with the findings of several other studies.[16-18] In the Asian population, a study from Taiwan found that 95.5% of the patients with a prior vaginal delivery had a successful VBAC; in those with a history of VBAC, the success of subsequent VBAC was 100%.[19] Collectively, the findings of our study and those in the literature indicate that no prior vaginal birth is a significant predictor of LSCS.

Fetal weight estimations during pregnancy are an important aspect of prenatal and intrapartum care, and it can influence the decision-making process of clinicians because both low and high birth weights have associated risks. In case of VBAC, similar to our findings, several studies have found that in women with macrosomic fetuses (i.e., birth weight ≥4000 g), the likeliness of successful VBAC decreases.[7,20] In an Asian context, the study from Taiwan found that in women who had a failed TOLAC (i.e., had to

Table 4: The final model of associated factors of repeat cesarean section (*N*=388)

Variable	Multiple logistic regression		
	B	AOR (95% CI)	*P*
History of vaginal delivery			
Yes	0	1	
No	1.00	2.71 (1.60-4.60)	<0.001
Estimated fetal weight (g)			
<3500	0	1	
≥3500	1.56	4.78 (2.45-9.34)	<0.001
Meconium-stained liquor			
No	0	1	
Yes	0.87	2.40 (1.33-4.35)	0.004

All methods of variable selection were performed and gave the same result. Linearity checking was not done as all variables were categorical. There was no multicollinearity and interaction. The overall fitness of the model was checked; Hosmer-Lemeshow (P=0.884), Pearson Chi-square test (P=0.674), classification table (63.1%) and area under the ROC curve (67.4%). Regression diagnostic was performed; estimated logistic probability (P), leverage (h), covariate pattern (n), Hosmer and Lemeshow delta Chi-squared influence statistics ($d\chi^2$), Hosmer and Lemeshow Delta-D influence statistic (dd) and Pregibon Delta-Beta influence statistic (db). Influential outliers were identified by checking percent changes in regression coefficient which set >20%. Three influential covariate patterns were identified but not deleted after assessing the width of 95% CI of variables. *B* – Regression coefficient; AOR – Adjusted odds ratio; CI – Confidence interval; ROC – Receiver operating characteristic

undergo CS), the birth weight was higher than that in the VBAC group (3379 g vs. 3068 g; $P < 0.01$), and this was independent of the fetal gender.[19,21] However, we concur with the arguments of Horng *et al*.[21] that TOLAC should not be discouraged only based on estimated birth weight in otherwise eligible women. A notable point is that the birth weight in the Taiwan study was similar to the fetal cutoff used in our study (i.e., ≥3500 g) rather than the ≥4000 g that is often used in Western studies to define macrosomia. This finding indicates the need for studies to determine if there is a need to re-define macrosomia in context of the Asian population.

Similar to our findings, the presence of meconium-stained liquor has been found to be associated with increased likeliness of cesarean delivery, perinatal morbidity, and mortality.[22] In fact, this is one of the leading causes of the indication of CS, as it can lead to fetal distress, NICU admission rate, low birth weight, and neonatal death.[23] In addition, meconium-stained neonates are more prone to developing respiratory failure.[24] A point to note is that longer duration of labor is associated with meconium-stained amniotic fluid, likely because the prolonged stressful environment may result in increased peristalsis of a fetal gastrointestinal tract and relaxation of the anal sphincter followed by the passage of meconium.[25]

Limitations

This study has a few limitations, including its retrospective study design, due to which causality cannot be proven. In addition, this is a single center study, and thus its findings cannot be generalized to the population in other hospitals and regions of Malaysia. Finally, this study did not determine if fetal gender-based estimated weight was also an associated factor in emergency LSCS.

CONCLUSION

This study adds to the existing knowledge in the literature from a Malaysian context that no history of prior vaginal delivery, estimated fetal weight ≥3500 g, and presence of meconium-stained liquor are significant predictors of emergency LSCS in women undergoing TOLAC after one prior CS. These findings can guide the decision-making process of clinicians. Further multi-center/nationwide studies are warranted to validate the findings of this study.

Ethical consideration

Ethical approval was obtained from the Human Research Ethics Committee of USM, Malaysia (USM/JEPeM/17100534) on January 17, 2018. Permission to review the medical records was obtained from the Director of Hospital USM on October 9, 2017. The study was conducted in accordance with the Declaration of Helsinki, 2013.

Data availability statement

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

Peer review

This article was peer-reviewed by two independent and anonymous reviewers.

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Conflicts of interest

There are no conflicts of interest.

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