

# A Retrospective Study of the Association of Repeated Attempts at Trial of Labor After Cesarean Birth on Maternal and Neonatal Outcomes

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**Purpose:** To assess the maternal and neonatal outcomes of repeated trials of labor after one previous cesarean section.

**Materials and Methods:** We identified and reviewed the records of all women who had had a trial of labor after cesarean section at a tertiary care center in Saudi Arabia between January 1, 2011, and December 30, 2018. The inclusion criteria were women with singleton vertex pregnancies between 24 and 42 weeks of gestation and a trial of labor after one cesarean section. The exclusion criteria were two or more previous cesarean sections, intrauterine fetal demise, breech presentation, labor induction, estimated fetal weight >4 kg, and classical or low vertical uterine incision. The pregnancy outcomes of these women were compared according to the number of trials of labor after cesarean section.

**Results:** During the study period, 1139 women met the inclusion criteria. The number of women with previous zero, one, two, or three or more trials of labor after cesarean section were 669 (58.7%), 237 (20.8%), 132 (11.6%), and 101 (8.9%), respectively. There were statistically significant trends between the four groups in age, nationality, gravidity, and parity but not in the booking status, BMI, or the hemoglobin level before a trial of labor after cesarean section. The rate of vaginal birth after cesarean section increased significantly ( $p < 0.001$ ) from 72.9% with zero to 93.3% with one, 93.9% with two, and 94.1% with three or more trials of labor after cesarean section.

**Conclusion:** Previously successful vaginal births after cesarean delivery are associated with improved maternal and neonatal outcomes in the subsequent trials of labor after cesarean delivery.

**Keywords:** trial of labor after cesarean, cesarean section

## Introduction

The rate of cesarean delivery has progressively increased across the world. Between 1990 and 2014, the rate of cesarean delivery increased from 22.8% to 42.2% in Latin America and the Caribbean, 4.4% to 19.5% in Asia, 18.5% to 32.6% in Oceania, 11.2% to 25% in Europe, 22.3% to 32.3% in North America, and 2.9% to 7.4% in Africa.<sup>1</sup> The probable reasons behind this rise include medical (increased maternal age, obesity, breech presentation, failed induction of labor, and a history of prior cesarean section) and non-medical indications (preference of the mother or family for cesarean delivery, clinician convenience, financial incentives, and concerns of medico-legal issues).<sup>2-5</sup>

One of the obstetric sequelae after cesarean section is the high probability of repeat cesarean sections. Several attempts have been made to reduce this

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complication, including a trial of labor after cesarean section. It is an appropriate option for many women as recommended by the American College of Obstetricians and Gynecologists.<sup>6</sup> They stated that

most women with one previous cesarean delivery with a low-transverse incision are candidates for and should be counseled about and offered a trial of labor after cesarean section.

Similar conclusions were published by the Society of Obstetricians and Gynecologists of Canada and the Royal College of Obstetricians and Gynecologists.<sup>7,8</sup> A successful trial of labor after cesarean section provides an opportunity to achieve a vaginal birth after cesarean delivery.

In contrast, a failed trial results in an emergency cesarean section with increased maternal morbidity. The rate of maternal morbidity is the lowest in women who have a successful vaginal birth after cesarean delivery (0.2%), higher in women who undergo an elective repeat cesarean section (0.8%), and highest in women who have a failed trial of labor after cesarean section (3.3%).<sup>9</sup> The advantages of vaginal birth after cesarean include safety, elimination of major surgery, acceptability, and shorter recovery time than with the elective cesarean section.<sup>6</sup> In women who desire future pregnancies, successful vaginal birth after cesarean avoids the need for multiple cesarean sections with the known risks of surgery, placenta previa, and placenta accreta spectrum.

While the safety of a trial of labor after one previous cesarean section is well-documented, there is a lack of recently published studies on repeat trials of labor after cesarean section. The present study aimed to assess the maternal and neonatal outcomes of repeat trials of labor after one previous cesarean section.

## Materials and Methods

This retrospective study was conducted at a tertiary care center in Saudi Arabia. The hospital records of all women who were admitted to our hospital between January 1, 2011, and December 30, 2018, who had had a trial of labor after cesarean section were identified and reviewed. The study was approved by the King Abdulaziz University Hospital Institutional Review Board (Number 381-17) and performed in accordance with relevant guidelines and regulations in Saudi Arabia and the Declaration of Helsinki. Because of the type of the study, patient consent to review their medical records was not required by the King Abdulaziz University Hospital IRB.

Saudi and all eligible immigrant pregnant women from different socio-economic backgrounds were routinely followed in the antenatal clinics (booked). Immigrant non-eligible pregnant women who were not booked during pregnancy may present to the emergency department in established labor without any prior antenatal care (unbooked). The hospital's policy is to accept and admit them.

We included only women with singleton vertex pregnancies between 24–42 weeks of gestation who had one previous cesarean delivery and had undergone a trial of labor after cesarean section.

Women with previous two or more cesarean sections, antenatal intrauterine fetal demise, breech presentation, induction of labor, estimated fetal weight >4 kg, and classical or low vertical uterine incision were excluded.

The women were divided into four groups based on the number of trials of labor after cesarean section. Group 1 comprised those women with no previous history of the trial. Groups 2, 3, and 4 include those with the previous histories of one, two, three, or more than three trials of labor after cesarean section, respectively. Data extracted included maternal demographics, clinical characteristics, and labor and delivery outcomes (vaginal birth after cesarean success, uterine rupture, uterine dehiscence, need for blood transfusion (packed red blood cells), post-partum fever, APGAR scores, birth weight of the newborn, and neonatal intensive care unit admission). Uterine rupture was defined as a tear of the uterine muscle, and visceral peritoneum or a uterine muscle separation with extension to adjacent structures, and uterine dehiscence was defined as a disruption of the uterine muscle with intact serosa. The outcomes were compared according to the number of trials of labor after cesarean section.

Statistical analysis was conducted with SAS 9.4 (SAS Institute, Cary, NC). Mean, and standard deviation for continuous variables and frequency and proportions were calculated by the number of trials of labor after cesarean section. Trends of each variable with the trial of labor after cesarean section were tested. For a categorical variable, the Cochran-Armitage trend test was used if it had two levels, or the Mantel-Haenszel test was used if it had more than two levels. The normality test was performed for each of the continuous variables since all the variables are not normally distributed ( $p < 0.05$ ); the Jonckheere-Terpstra test was used to test trends. A two-tailed  $p$ -value of  $p < 0.05$  was considered statistically significant.

**Table 1** Demographic and Clinical Characteristics According to the Number of the Trial of Labor After Cesarean Section

Demographic and Clinical Characteristics		TOLAC, Number (Percentage)				P-value
		Group 1 (n=669)	Group 2 (n=237)	Group 3 (n=132)	Group 4 (n=101)	
Age (Mean $\pm$ SD)		29.4 $\pm$ 5.4	30.6 $\pm$ 5.5	32.6 $\pm$ 4.9	35.4 $\pm$ 4.8	<0.0001 <sup>†</sup>
Nationality	Saudi	585 (87.4)	193 (81.4)	93 (70.4)	23 (22.7)	<0.0001*
	Non-Saudi	84 (12.5)	44 (18.6)	39 (29.6)	78 (77.2)	
Booking Status	Booked	519 (78.0)	175 (74.2)	99 (75.6)	78 (78.0)	0.6155*
	Non-booked	146 (21.9)	61 (25.9)	32 (24.4)	22 (22.0)	
Gravidity (Mean $\pm$ SD)		3.2 $\pm$ 1.9	4.1 $\pm$ 1.7	5.1 $\pm$ 1.4	7.0 $\pm$ 1.8	<0.0001 <sup>†</sup>
Parity (Mean $\pm$ SD)		1.8 $\pm$ 1.5	2.6 $\pm$ 1.2	3.4 $\pm$ 0.9	5.1 $\pm$ 1.4	<0.0001 <sup>†</sup>
BMI (Mean $\pm$ SD)		30.8 $\pm$ 6.5	30.4 $\pm$ 5.9	30.9 $\pm$ 5.7	31.5 $\pm$ 6.1	0.7497 <sup>†</sup>
Hemoglobin before (Mean $\pm$ SD)		11.1 $\pm$ 1.3	11.3 $\pm$ 1.3	11.3 $\pm$ 1.3	10.9 $\pm$ 1.3	0.6097 <sup>†</sup>

**Notes:** Data are mean  $\pm$  standard deviation or n (%). \*P-values from Mantel-Haenszel test for trend or Cochran-Armitage Trend Test. <sup>†</sup>p-value from Jonckheere-Terpstra Test.

## Results

During the study period, 1139 women met the study criteria and were included in the analysis. The number of women with zero, one, two, and three or more trials of labor after cesarean section were 669 (58.7%), 237 (20.8%), 132 (11.6%), and 101 (8.9%), respectively. The demographics and clinical characteristics were presented in Table 1. There were statistically significant trends between the four groups in age, nationality, gravidity, and parity but not in the booking status, BMI, and the hemoglobin level before a trial of labor after cesarean section. Mean age, gravidity, and parity significantly increased with the trial of labor after cesarean section. Simultaneously, the proportion of Saudi women

decreased with the trial of labor after cesarean section from 87.4% after zero trial of labor after cesarean section to 22.8% after three trials of labor after cesarean section.

Significantly more women delivered vaginally ( $p < 0.001$ ) with each attempted trial of labor after cesarean section, increasing from 488 women (72.9%) with zero trial of labor after cesarean section to 221 women (93.3%) with one trial of labor after cesarean section, 124 women (93.9%) with two trials of labor after cesarean section, and 95 women (94.1%) with three or more trials of labor after cesarean section (Table 2).

The uterine rupture occurred in one woman during the first trial of labor after cesarean section and in one woman

**Table 2** Pregnancy Outcomes According to the Number of Trials of Labor After Cesarean Section

Pregnancy Outcomes	TOLAC, Number (Percentage)				P-value
	Group 1 (n=669)	Group 2 (n=237)	Group 3 (n=132)	Group 4 (n=101)	
VBAC Success	488 (72.9)	221 (93.2)	124 (93.9)	95 (94.0)	<0.0001*
Uterine Rupture	1 (0.1)	0	0	1 (0.9)	0.2541*
Dehiscence	4 (0.6)	0	0	0	0.1513*
Transfusion	16 (2.3)	1 (0.4)	1 (0.7)	1 (0.9)	0.0819*
Pyrexia	10 (1.4)	1 (0.4)	2 (1.5)	0	0.2372*
No of hospital stays (Mean $\pm$ SD)	2.4 $\pm$ 1.7	1.9 $\pm$ 2.1	1.8 $\pm$ 1.3	2.0 $\pm$ 2.0	<0.0001 <sup>†</sup>
Birth weight (kg), (Mean $\pm$ SD)	3.1 $\pm$ 0.5	3.0 $\pm$ 0.5	3.2 $\pm$ 0.5	3.3 $\pm$ 0.5	0.0035 <sup>†</sup>
1-minute Apgar <5	20 (2.9)	1 (0.1)	2 (1.5)	1 (0.9)	0.0759*
5-minute Apgar <5	1 (0.1)	237 (100.0)	0	0	0.4737*
Neonatal resuscitation	4 (0.6)	1 (0.4)	0	1 (0.9)	0.9222*
ICU admission	10 (1.4)	0	1 (0.8)	1 (0.9)	0.3168*

**Notes:** Data are mean  $\pm$  standard deviation or n (%). \*P-values from Mantel-Haenszel test for trend or Cochran-Armitage Trend Test. <sup>†</sup>p-value from Jonckheere-Terpstra Test.

with three or more trials of labor after cesarean section. Uterine dehiscence occurred only in four women (0.6%) with no trial of labor after cesarean section. There were statistically significant differences in birth weights ( $p = 0.0035$ ) and the duration of hospital stay ( $p < 0.0001$ ) between the groups, while other parameters, such as APGAR scores, neonatal resuscitation, and ICU admission, showed no significant differences between the groups (Table 2).

Mean birth weight increased with the number of trials of labor after cesarean section while the duration of hospital stays was longer when a trial of labor after the cesarean section was zero and shorter when a trial of labor after the cesarean section was more than zero (2.49 days vs  $< 2.0$  days).

## Discussion

The safety of a trial of labor after one previous cesarean is well-documented. However, there are limited published reports on repeated trials of labor after the cesarean section as the national data is lacking and only a few old studies are available.

The main concern regarding repeat trials of labor after cesarean section had been the potential increase in maternal and neonatal morbidity. This concern was based on the theoretical risk that repeated trials of labor after cesarean section may produce additive strain on the uterine scar. The main finding of our study was that repeated trials of labor after cesarean section are safe for the mothers and the children. The number of successful vaginal deliveries increases with the number of attempted deliveries after the cesarean section from 72.9% with no previous trials of labor after cesarean section to 94% with three or more previous trials of labor after cesarean section.

Our study showed that a higher amount of attempted vaginal deliveries was not associated with an increased risk of uterine rupture. This result is consistent with the findings of Gyamfi et al<sup>10</sup> and Mercer et al.<sup>11</sup> The vaginal birth rate after cesarean was 94% (318/336) in women with a history of one or more previous vaginal births after cesarean delivery as compared to 70.5% (620/880) in women without a history of vaginal birth after cesarean delivery ( $P < 0.001$ ). There was no significant difference in the uterine rupture rate in the previous vaginal birth after the cesarean delivery group compared with those without this history, 0.60% versus 1.93%, respectively ( $P = 0.093$ ).<sup>10</sup> Mercer et al, in 2008, published a secondary analysis of a 4-year observational study in 19 academic medical centers in the United States between 1999 and 2002.<sup>11</sup> The study included 13,532

women with singleton pregnancies who had previously undergone at least one cesarean delivery by a low transverse uterine incision and who attempted a trial of labor after cesarean section. After a cesarean delivery, women with no prior vaginal birth had a 63.3% vaginal delivery rate; women with one prior vaginal birth after cesarean had a rate of 87.6%, and those with two or more vaginal births after cesarean had a rate of 90.9%. The rate of uterine rupture decreased after the first successful vaginal birth after cesarean and remained similarly low as the vaginal birth after cesarean number increased from two to four or more. After cesarean delivery, women with no previous vaginal birth had a uterine rupture risk of 0.87%, while women with one previous vaginal birth after cesarean had a rupture risk of 0.45%. Women with two or more vaginal births after cesarean had a uterine rupture risk of 0.43%. Mercer et al's published study is the most extensive study demonstrating that the vaginal birth after cesarean success rate improved with repeat trials of labor after cesarean section.<sup>11</sup> Vaginal births after cesarean were associated with a lower risk of uterine rupture and perinatal complications.

The success rate of trial of labor after cesarean section is high ranging from 60–80% with low rates of complications.<sup>12</sup> Serious complications like rupture uterus occur in 0.4–0.7%. Uterine rupture is increased in the classical and the low vertical uterine incision, induction of labor with prostaglandins, and augmentation with oxytocin. Successful trial of labor after the cesarean section has several benefits over the elective cesarean section in the index and future pregnancies. However, these complications are highest when a trial of labor after cesarean section fails and the emergency cesarean section is performed. This, among other reasons, has led to a decrease in the trial of labor after cesarean section rate despite the existing recommendations of the major professional medical organizations supporting and encouraging women to have a trial of labor after cesarean section. Interestingly, there are significant variations in the trial of labor after cesarean section rates between countries. The rate of trial of labor after cesarean section in Japan is 5%, 12–14% in the United States and Australia, 29–36% in Ireland, Italy, Germany, and 45–55% in Finland, Sweden, and the Netherlands.<sup>13–16</sup> A recent study from a center in Israel reported a rate of 75.6%.<sup>17</sup> Cultural differences may provide some explanation for the varying trial of labor after cesarean section rates.<sup>18</sup>

In the present study, we have compared the success rate and the safety of repeat trials of labor after cesarean section in women with only one previous cesarean section, and we have excluded women with labor induction, whereas, other previous studies have included women with more than one previous cesarean section and labor induction. We found a statistically significant association between increasing maternal age and the number of prior trials of labor after cesarean section. Similar findings concerning maternal age were obtained by Mercer et al having a mean age of 28 years, 29.2 years, and 30.6 years for those with a history of no, one, and two or more vaginal births after cesarean section respectively ( $p < 0.001$ ).<sup>11</sup>

In our study, the mode of delivery was significantly associated with the number of prior successful trials of labor after cesarean section. After a cesarean section, women who had a previous history of vaginal birth were more likely to repeat labor trials after cesarean section successfully. The rate of uterine rupture decreased from 0.15% to 0%, with an increase in the number of vaginal births after cesarean, but after three or more vaginal births after cesarean, the uterine rupture tends to increase to 0.99%.

Uterine dehiscence rate decreased from 0.6% for those with zero trial of labor after cesarean section to 0% for those with one, two, three, or more trials of labor after cesarean section. The small numbers of uterine rupture and dehiscence in our study preclude any meaningful comparisons. We found that the need for transfusion decreased during subsequent trials of labor after cesarean section, but this was not statistically significant. Mercer et al found a statistically significant association between the need for transfusion and the number of prior vaginal births after cesarean ( $p = 0.002$ ).<sup>11</sup> The need for blood transfusion decreases from 1.89 (no prior vaginal birth after cesarean) to 1.24 (one prior vaginal birth after cesarean) and 0.99 (two or more prior vaginal births after cesarean). In our study, there was no statistically significant increase between repeat trials of labor after cesarean section and neonatal morbidity.

There are some limitations to our study. Firstly, our study is of retrospective nature and depends solely on the medical records of the hospital. Secondly, we did not have data on women who were eligible for a trial of labor after cesarean section but who declined and elected to proceed with an elective repeat cesarean delivery.

## Conclusion

Previously successful vaginal births after cesarean delivery are associated with improved maternal and neonatal

outcomes, decrease in rupture rates and the hospital stay of the mother in a subsequent trial of labor after cesarean section. Hence, we recommend that women with previous vaginal birth after one cesarean section should be offered repeat trials of labor.

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## Disclosure

The authors report no conflicts of interest in this work.

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