Outcome of Vaginal Birth after Cesarean Section: A Retrospective Comparative Analysis of Spontaneous Versus Induced Labor in Women with One Previous Cesarean Section

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Abstract

Objective: The purpose of this study is to compare the success rate of vaginal birth after cesarean (VBAC) in spontaneous and induced labor. Design: This is an 8-year retrospective comparative study. Setting: University hospital. Population: Five hundred and ninety-four women who had one previous lower segment cesarean delivery. Materials and Methods: This is a retrospective study of all women, who had lower segment cesarean section, admitted for trial of labor between April 2010 and November 2016. Five hundred and sixty-seven women who elected to have trial of labor after one previous cesarean were included in the study, of these 477 (84.13%) had spontaneous onset of labor (control group) and 90 (15.87%) had induction of labor (IOL) (study group). Two hundred and seventy-seven women had no previous vaginal delivery, and 297 had one previous vaginal delivery. Results: We compared the success rates of VBAC in women who had IOL with those who came with spontaneous labor. The rate of vaginal delivery after CS (VBAC) was 50.0% and 66.6% in the study and control groups, respectively. There was a significant increase in the rate of cesarean delivery due to fetal distress in the study group ($P = 0.016$). There were no cases of uterine rupture in the control group and one case in the study group. Patients who had spontaneous labor and at least one previous vaginal delivery have higher success rate of vaginal delivery. Conclusion: Women with one previous CS, who undergo IOL, have lower success rates of vaginal delivery compared with those who presented in spontaneous labor. They also have higher risk of CS delivery due to fetal distress. Previous normal vaginal delivery increases the success rate of VBAC.

Keywords: Induction of labor, previous lower segment cesarean section, prostaglandin, vaginal birth after cesarean section

Introduction

The rate of cesarean section (CS) has increased worldwide leading to higher number of women with previous uterine scar.[1] For instance, a published 10-year review reported a rise in CS rate up to 80%, in Saudi Arabia increasing from 10.6% in 1997 to 19.1% in 2006[2] and in the UK from 9% in 1980 to 25% in 2007.[1] Pregnant women with one previous CS are faced with two delivery options: vaginal birth after cesarean (VBAC) section or elective repeat CS. Rates of successful VBAC vary from one study to another. For instance, a large study in the USA (33,560 women) showed that women attempting a vaginal birth after a prior CS had around 73% of success rate.[3] VBAC section has less complications and faster recovery compared with CS. Conflicting data exist concerning the safety of induction of labor (IOL) in women with previous single lower segment CS (LSCS). The greatest impact of failed trial of VBAC is emergency CS.[4-5] CSs are associated with more blood loss, more risk of bladder and ureteral injuries, postpartum infections, pulmonary embolisms, and more risks of neonatal respiratory complications (if performed before 39 weeks).[3-5] In addition, multiple repeat CSs can lead to increased risk of maternal morbidity and mortality because of abnormal placental adherence and cesarean hysterectomy, which increases with...
each subsequent CS. Studies have shown that women with one previous CS who undergo IOL have lower success rates of vaginal delivery compared with those who presented in spontaneous labor. Women who had a previous successful VBAC have the best chance to deliver vaginally with success rate of 85%–90%. Other prognostic variables include maternal age <40 years, ethnicity, body mass index (BMI) <30, gestational age <40 weeks, infant birth weight <4 kg, and higher admission bishop score. Success rate of VBAC correlates with the indication of the previous CS; CS for fetal malpresentation had higher success rate (84%) compared with CS for either labor dystocia (64%) or fetal distress (73%).

Uterine rupture rarely occurs in unscarred uterus (may occur in neglected prolonged labors). In western societies, rupture of uterus may occur in women undergoing VBAC. A study done in the Netherland showed that the use of PGF2, for induction or augmentation of labor with low bishop score, increased the risk of uterine rupture. One study, including 20,059 women (done in the USA) who had one previous CS, found a rate of uterine rupture of 0.52% for spontaneous labor, 0.77% for induced labor with cervical catheter, and 2.22% for PG induction. Secondary analysis of the study showed that proper selection of women most likely to give birth vaginally and avoiding sequential use of multiple doses of PG and oxytocin are the best ways to avoid uterine rupture. Results from multiple studies done in the USA showed that previous vaginal delivery is independently associated with reduced risk of uterine rupture.

In an attempt to reduce the rising CS rate and its complications, our practice is to counsel women with one CS regarding risk and benefit of VBAC. This current practice also accommodates the large family size in our area.

The aim of the present study was to compare the success rate of VBAC in induced versus spontaneous labor in women who have had one previous CS.

**Materials and Methods**

This is a retrospective study conducted in Imam Abdulrahman Bin Faisal University. It is a tertiary hospital serving as a referral center for the Eastern Province in Saudi Arabia, Al-Khobar. Many high-risk pregnancies are delivered in this unit. The hospital receives booked cases from obstetrics and gynecology clinics of the same hospital, emergency admissions, and referral cases from other hospitals and health-care centers in the area. The approval for accessing patients’ data was obtained from the department of obstetrics and gynecology and the hospital administration.

The data were collected from November 2008 to November 2016 (8-year period). Women with one previous LSCS were recruited for the study. The following data were collected from patients’ case notes: maternal age, gravidity, parity, gestational age, Prostin IOL (including number of doses), indication of IOL, use of syntocinone, type of rupture of membrane (spontaneous vs. artificial), and mode of delivery (spontaneous vaginal delivery, vacuum, CS for failure to progress or fetal distress). These data were coded as numerical values and tabulated in an excel file. Maternal age was defined as completed years at time of delivery; women <18 years old and older than 48 years were excluded. Parity was defined as number of previous births of gestational age more than completed 20 weeks’ gestation or birth weight >500 g at delivery. Estimated gestational age was based on the last menstrual period and/or routine ultrasound examination before completion of 20 gestational weeks.

Cases of uncontrolled diabetes, preeclampsia, eclampsia, preterm labor, multiple pregnancy, more than one CS, and intrauterine growth restriction were excluded from the study and control groups as these cases have high probability for elective repeat CS and low threshold for emergency CS.

During the study period, the method of induction for all cases was with PGE2, and the numbers of doses were included in the study. The decision for induction versus augmentation with oxytocin +/- artificial rupture of membranes (ARMs) depends on bishop score. Emergency CS delivery was defined as that performed after the onset of labor for certain indication as fetal distress or failure to progress.

An individualized assessment of the suitability for success of VBAC was made for each patient based on the bishop score, indication for the previous CS, presence of medical problems, and fetal size.

In this study, 65% (368 women) of the cases were booked in our hospital and they were counseled regarding mode of delivery. The final plan was written in the medical record by the maternity team before the expected date of delivery. Our hospital approach is to offer VBAC to the majority of women with singleton cephalic presentation after 37 weeks’ gestation. There were 27 booked patients admitted to the delivery room. Seven of these patients had multifetal pregnancy and were excluded. The remaining 20 patients were admitted with a plan for elective repeat CS. The remaining 35% (199 women) patients in this study were either admitted through emergency department or referred from other centers/hospitals with plan of delivery documented after admission by a senior obstetrician in consultation with the on-call consultant. In all cases (booked and unbooked), soon after admission, full history and abdominal and vaginal examinations are carried out in order to assess the size of the fetus, position and presentation of the fetus, cervical dilatation, status of the membrane, bishop score, and adequacy of maternal pelvis. Ultrasound examination of the fetus was done to determine the estimated fetal weight, site of the placenta, and amniotic fluid volume.

Admitted patients had continuous external electronic fetal monitoring once they are in active phase of labor. Intermittent monitoring was done in latent phase.
Online Social Science Statistics calculators were used for the statistical calculation. Chi-square $2 \times 2$ contingency tables were used for testing statistical differences between the groups. $P < 0.05$ was considered statistically significant difference.

**RESULTS**

The total number of deliveries during the study period (8 years period) was 19,678 births. Of these, 17,979 patients delivered vaginally and 1699 patients delivered by CS. The average annual number of deliveries in our hospital is approximately 2400. During this period, there were 594 women with one previous CS. Twenty-seven women were excluded from this review due to the various exclusion criteria mentioned above. The remaining 567 women were recruited for this study. All of them were appropriate candidate for VBAC.

Ninety (15.87%) patients of the 567 women received PGE2 for IOL (study group), while 477 (84.13%) had spontaneous labor (control group).

Table 1 shows the indications of IOL. Table 2 shows general characteristics of all participants in the study. Table 3 compares the characteristics of the women who received resin with those who went in spontaneous labor.

The most common cause of IOL was prelabor rupture of membranes (33.3%), followed by postdated pregnancy (26.6%).

The rate of IOL using Prostin was 15.87%. There were no cases of IOL using mechanical cervical dilators. There were no significant differences between the women who received Prostin and those who did not receive it regarding the maternal age ($P = 0.7$) and parity ($P = 0.25$).

Women induced with Prostin were more likely to have ARMs compared with those who were not induced (72.2% and 41.09%, respectively; $P < 0.001$).

There were 45 vaginal deliveries in the induced group, 3 of them were vacuum deliveries, while there were 318 vaginal deliveries in the spontaneous group, one of them was vacuum delivery; the difference was statistically insignificant with $P = 0.14$ [Table 4].

There were 31 (34.4%) emergency CS due to failure to progress in the induced group and 15 (3.1%) in the spontaneous group; the difference between the two groups was statistically significant ($P = 0.0001$).

Women, with one previous CS who had induced labor, have lower success rates of vaginal delivery compared with those who presented in spontaneous labor.

Two hundred and seventy-seven women in the study had at least one previous vaginal delivery and one LSCS, of these 205 delivered vaginally; the success rate of VBAC was 74.0%.

Two hundred and ninety-seven women in the study had no previous vaginal delivery and one LSCS, of these 171 delivered vaginally; the success rate of VBAC was 61.0%. This finding suggests that previous vaginal delivery increases the probability of achieving VBAC. This finding is statistically significant ($P < 0.001$) [Table 5].

**DISCUSSION**

Before the 1970s, in the USA, when a woman was delivered by CS, her future delivery was automatically by CS. In the late 1990s, physicians attempted to reduce CS rate by encouraging the practice of VBAC. The trend of VBAC was increasing from around 0 in the 1970s to 28% in 1995.15

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| Table 1: Indications for induction of labor |
|-------------------------------------------|
| Reason for IOL                           | Number of cases (%) |
|-------------------------------------------|---------------------|
| Gestational age >41                      | 24 (26.6)           |
| Prolabor rupture of membrane              | 30 (33.3)           |
| Term mild PIH                            | 13 (14.4)           |
| Diabetes                                 | 10 (11)             |
| Decrease fetal movement                   | 9 (10)              |
| Mixed indication                         | 4 (4)               |
| Total number of cases                    | 90 (100)            |

PIH=Pregnancy-induced hypertension, IOL=Induction of labor

| Table 2: The general characteristics of respondents (n=567) |
|-------------------------------------------------------------|
| Range/n | Average/percentage |
|-------------------------------------------|---------------------|
| Maternal age | 18-48 | 30.88 |
| Parity | 0-9 | 2.17 |
| Gestational age | 37-44 | 39 |
| Prostin IOL | 90 | 15.87 |
| Use of syntocinon | 279 | 49.2 |
| Artificial rupture of membranes | 262 | 46.2 |
| Normal vaginal delivery | 363 | 64 |
| Cesarean section | 191 | 33.69 |
| Vacuum | 13 | 2.29 |
| Neonatal weight | 789-4750 | 3104.87 |

IOL=Induction of labor

| Table 3: Comparison of the two groups of women, those who received induction of labor versus those in spontaneous labor |
|-------------------------------------------------------------------------------------------------------------|
| Induced labor (%) | Spontaneous (%) | $P$ |
|-------------------|-----------------|-----|
| Total number      | 90              | 477            |     |
| Maternal age      | 30.84           | 31.1           | 0.7 |
| Parity            | 2.2             | 1.98           | 0.25|
| Gestational age   | 39.89           | 37.89          | <0.001|
| Use of syntocinon | 60 (66.67)      | 218 (45.7)     | 0.03|
| for labor         |                 |                |     |
| augmentation      |                 |                |     |
| Artificial rupture of membranes | 65 (72.22) | 196 (41.09) | <0.001|
| Cesarean section  | 41 (45.56)      | 148 (31.03)    | <0.001|
| Vacuum            | 3 (3.33)        | 1 (0.2)        |     |
| Neonatal weight   | 3076.67         | 3254.34        | 0.005|

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In our hospital, during the study period (2008–2016), there were 604 women who had a singleton gestation at term with a history of one previous cesarean delivery with a lower segment transverse incision; 577 women underwent trial of labor (95.5% of cases) as our hospital protocol encourages VBAC. This is particularly useful in our country where people prefer a large family size. This is in contrast to a study done in the UK during a period from 1999 to 2013. There were 29,661 women who had a singleton gestation at term with a history of one previous cesarean delivery with a transverse or unknown incision. Of these cases, 14,529 (49.0%) underwent trial of labor and 15,132 women (51.0%) had elective repeat CS.\(^\text{[16]}\)

Previous studies have indicated success rates ranging from 60% to 80%. In a large multicenter observational cohort study done in the UK, it was confirmed that nearly three-fourths of women at term undergoing a trial of labor after previous CS will achieve a successful vaginal delivery.\(^\text{[17]}\) Vaginal delivery rate (successful VBAC) was 66.31% in our study, which almost match the result in the success rate of VBAC in the UK. The slightly lower success rate of VBAC in our study could be due to the fact that 95.5% of women with previous CS are offered a trial of labor. We could improve our success rate by carefully selecting who should have a trial of labor. This approach will also eliminate the risks associated with emergency CS when faced with failed VBAC.

Various demographic and clinical characteristics are clearly predictive of VBAC success. Among these factors, we found previous vaginal delivery including successful previous VBAC as the most significant. In a study done in the UK, 7065 of women undergoing VBAC had a history of previous vaginal delivery. These women achieved a high rate of VBAC success (86.6%) compared with only 60.9% in women without a history of previous vaginal delivery.\(^\text{[18]}\) In a study done in Women’s Hospital, Hamad General Hospital, Qatar, between April 2004 and April 2005, the result of the study was different from our study. The study included 702 women with a history of one CS and 62.4% also had a history of vaginal delivery. After a trial of labor, vaginal delivery occurred more often among women with no history of vaginal delivery; the results of the study showed that trial of labor resulted in a vaginal delivery more often in women who were delivered only once and by CS (87.7%) than in women who also had a history of vaginal delivery (79.2%). The study was dealing with nonselected and retrospective data, so it is difficult to consider the accuracy of data from these studies.\(^\text{[19]}\)

We conclude from previously mentioned studies that women who have had a CS should strongly consider vaginal delivery for subsequent pregnancies to avoid the complications of multiple repeat CSs.\(^\text{[20]}\)

Other important prognostic factors predicting successful VBAC include maternal age <40 years, white ethnicity, BMI <30, gestational age <40 weeks, infant birth weight <4 kg, and higher admission bishop score.\(^\text{[11,12]}\) In our study, maternal age, parity, and ethnicity were not significantly different between the two groups. The induced group had significantly higher gestational age which is not surprising as the second most common reason for IOL was postdated pregnancy. Neonatal weight <4 kg is predictive of successful VBAC. Both groups in our study had an average neonatal weight of <4 kg. An interesting finding was that although the gestational age in the induced group was larger, the neonatal weight was significantly lower in the induced group. No clear explanation was found for this finding. Antenatal ultrasound prediction of neonatal weight is notoriously inaccurate. Obstetricians should be aware of this when deciding about the mode of delivery.

An effective strategy to decrease the CS rate is the promotion of VBAC. Safe induction methods that enhance VBAC success rate without increasing mortality and morbidity should be evaluated. Prostaglandin E2 has been used extensively for labor induction in term pregnancies. There are many studies looking at IOL in women with one previous CS, but they collect all methods of induction as one group (PG, cervical catheter, and augmentation with ARMs).\(^\text{[21,22]}\)

Observational studies indicate that there is an increased risk of uterine rupture and adverse fetal outcomes when women with a previous CS delivery are induced, especially when prostaglandins are used. In our study, the rate of uterine rupture after prostaglandin IOL with or without previous CS was 2.5% and 0.033%, respectively.

The American College of Obstetricians and Gynecology state that IOL, for maternal and fetal indications, remains an option for women undergoing VBAC. They state that the use

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**Table 4: The outcome of labor in the induced and spontaneous groups**

| Outcome of labor | Induced labor (%) | Spontaneous (%) | \(P\) |
|-----------------|------------------|----------------|------|
| VBAC            | 45 (50.0)        | 318 (66.6)     | 0.0002 |
| CS due to fetal distress | 10 (11.1)       | 134 (28.0)     | 0.0005 |
| CS due to failure to progress | 31 (34.4)       | 15 (3.1)       | 0.0001 |
| Instrumental delivery | 3 (3.33)        | 1 (0.20)       | 0.014  |
| Ruptured uterus  | 1 (1.11)         | 0 (0.0)        | 0.19   |
| Total number of cases | 90              | 477            |       |

VBAC=Vaginal birth after cesarean, CS=Cesarean section

**Table 5: The effect of previous vaginal delivery on success of vaginal birth after cesarean**

|                      | VBAC | Emergency CS | Total |
|----------------------|------|--------------|-------|
| Women with previous vaginal delivery | 205  | 73           | 277   |
| No previous vaginal delivery | 171  | 126          | 297   |
| Total                | 376  | 199          | 574   |

\(P<0.001.\) VBAC=Vaginal birth after cesarean, CS=Cesarean section
of oxytocin for augmentation of contraction during VBAC is not precluded and should be used with direct supervision by senior obstetricians.\textsuperscript{[23]}

Women with one previous CS who undergo IOL have lower success rates of vaginal delivery compared to those who presented in spontaneous labor.\textsuperscript{[24]} In our study, just about a half of women in the induced group achieved a vaginal delivery compared to up to two-thirds in the women with spontaneous onset of labor. These results are similar to a study done in the King Khalid University Hospital, King Saud University, Riyadh, Saudi Arabia. The study showed that women, with one previous CS who undergo IOL, have lower success rates of vaginal delivery compared to those who presented in spontaneous labor. The incidence of successful VBAC in spontaneous labor was 72%; however, when induced, the incidence of successful VBAC was 63.5%.\textsuperscript{[24]}

We further found that CS rate was also higher in the induced group compared to the spontaneous onset group. Further analysis revealed that the IOL group had a significantly higher proportion of emergency CS due to fetal distress compared with spontaneous labor group. This could be attributed to uterine hyper stimulation and continuous CTG monitoring during the time of IOL. These findings might help clinicians and patients in the decision-making for the method of delivery when it comes to pregnancy with a previous scar.

Son \textit{et al.} reported that in the setting of a trial of labor after cesarean delivery in the second stage with a fetal station of at least +2, attempted operative vaginal delivery resulted in a VBAC delivery in most women and was not associated with increased adverse maternal and neonatal outcomes but was associated with a reduced frequency of endometritis compared with repeat cesarean delivery without operative vaginal delivery attempt.\textsuperscript{[25]}

Regarding uterine rupture in our hospital during the study period, there were no cases of ruptured uterus in women who had spontaneous labor, while there was one case of rupture uterus for the IOL group. In a retrospective study, which was done in our hospital during a period of 1992–2010, it was found that in women with one previous CS, IOL with prostaglandin led to comparable rate of vaginal delivery similar to those without prior CS but with relatively high risk of uterine rupture. The rate of uterine rupture was 30 times higher in the study group (2.5% vs. 0.033%).\textsuperscript{[26]}

\textbf{Conclusion}

Decision to deliver women with previous CS is a complicated process that involves the physician’s knowledge of the available evidence, experience, and fear of litigation as well as the previous maternal experience and knowledge. Any decision made will affect the outcome of the present pregnancy as well as the future obstetric performance and fertility of the patient.

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\textbf{Conflicts of interest}

There are no conflicts of interest.

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