

## Maternal Outcomes in Pregnant Women of Vaginal Birth after a Cesarean (Vbac) Vs Elective Repeat Cesarean Section (Eras): A Systematic Review and Meta Analysis

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**Abstract:** To systematically review the rate of maternal outcomes in pregnant women undergoing vaginal birth after a cesarean section (VBAC) compared to elective repeat cesarean section (ERCS). **Methods:** Articles were pooled using Pub Med, Medline and Retrospective cohort study analysis from (2000 Jan - 2015 Feb) Inclusion criteria: women with a history of prior cesarean, single ton pregnancies, Uterine rupture, postpartum hemorrhage, mode of delivery and blood transfusion, maternal morbidity, hysterectomy has been considered. Pooled odds ratio with 95 % confidence interval (OR, 95 % CI) were calculated. **Results:** VBAC was successful in 17,598 of 23,649 patients (72%). Maternal morbidity, hysterectomy has been similar in women planning VBAC or ERCS (OR 1.54 95 % CI 0.32–1.21) whereas uterine rupture was different (OR 1.52; 95 % CI 1.12–2.41). Post partum hemorrhage and blood transfusion has more common in VBAC (OR 1.57; 95 % CI 1.20–2.04%) or ERCS (OR 1.52; 95 % CI 1.26–1.83). Outcomes were more favorable in VBAC than ERCS. **Conclusion:** This review shows that VBAC is associated with a success rate of 72%, and show the risk of uterine rupture in women planning VBAC. The study also provides important information to help pregnant women in their decision-making process.

**Key Words:** Uterine rupture, Vaginal birth after cesarean (VBAC), Elective repeat cesarean section (ERCS), Maternal outcomes, Risk factors.

### I. Introduction

In recent years, the indications for a cesarean section have become more prominent due to social circumstances, and the rate of cesarean section continued to increase all over the world. The majority of present studies have focused on high rates of vaginal delivery and the relative safety of "VBAC". The likelihood of vaginal delivery with trial of labor has generally been between 60 to 80% in these studies. In the 1980s, the dictum "once a cesarean, always a cesarean," espoused by Craigin, was revised in many countries, and a trial of labor in women with history of cesarean section was proposed as an attempt to reduce cesarean section rates. However, renewed controversy about the relative safety of VBAC has resulted in a rapid decline in the number of women who experience VBAC, falling from 28.3 per 100 women in 2000 to 16.4 per 100 in 2012, 42% [2]. The risk of uterine rupture during labor following low transverse cesarean is approximately ten times lower than that during labor following a classical cesarean. During the 1960s and 1970s several studies concluded that VBAC was relatively safe. In the 1980s larger studies confirmed this conclusion. The VBAC rate (vaginal delivery rate among pregnant women with prior caesareans) shows increase from 3.5% in 1990 to almost 25% by 2010 [3, 6]. This implies that almost half of all pregnant women with a prior caesarean delivery were opting for trial of labor by 2000, above all uterine rupture will occur in approximately 1% of trials of labor and there is no evidence that this rate can be significantly lowered. A large study on uterine rupture found that no mothers had significant maternal morbidity when delivered successful vaginal birth. Many obstetricians were surprised by the results of a large study that compared trial of labor to elective repeat cesarean and found hospital length of stay, incidence of postpartum hemorrhage, and incidence of postpartum transfusion to be higher in the elective repeat cesarean group. This strange finding was the result of the fact that 72% of patients in the VBAC group delivered vaginally [9]. Hysterectomy is required in approximately 10% of uterine rupture cases. Maternal death is extremely rare with either elective repeat cesarean or VBAC. In the two largest multicentre studies on VBAC, only one rupture-related maternal death occurred in more than 20 000 deliveries. Maternal deaths due to uterine rupture have been reported during attempted home births in areas where in-hospital VBAC was not readily available. This is a powerful argument for continuing to offer VBAC in a safe hospital setting for those women who strongly desire the option. Although the overall estimated rate of uterine rupture is less than 1%, the incidence varies significantly depending on the presence of specific risk factors. Concerns related to uterine rupture have prompted the American College of Obstetricians and Gynecologists (ACOG) to recommend that a physician be "immediately available throughout active labor, capable of monitoring labor and performing an emergency cesarean delivery" when women undergo VBAC. Pregnant women and her health care provider must

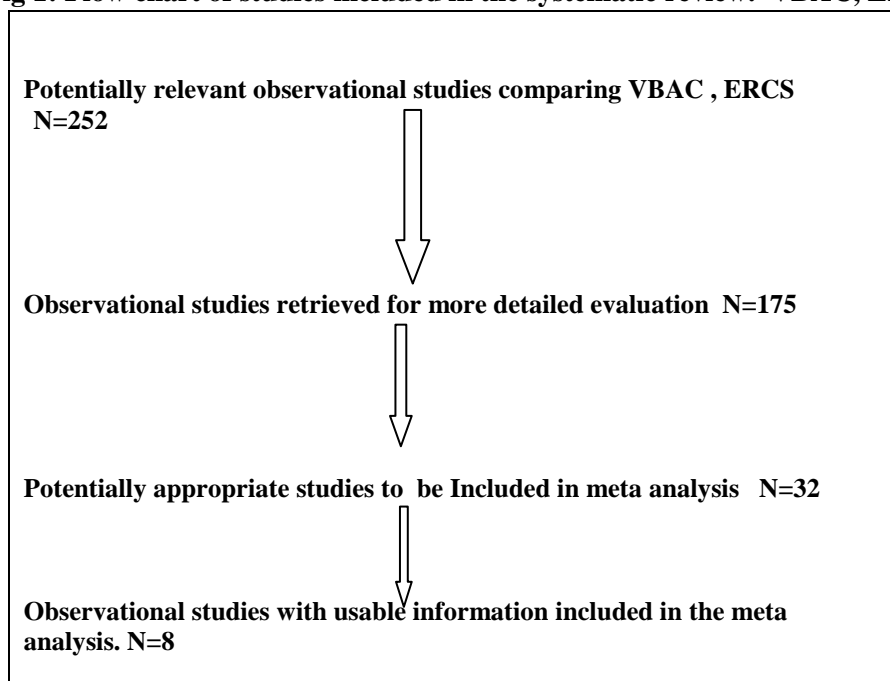
evaluate the following: 1) risk of maternal complications associated with VBAC versus repeat elective cesarean birth, 2) capabilities of the birth facility, 3) personal choice, and 4) the probable success rate of VBAC. This article addresses uterine rupture as the major complication that can occur during VBAC [12,15]. The aim of this study was to review publications available in literature from the period of Jan 2000 through feb2015, which compared maternal outcomes of vaginal birth after a cesarean VBAC versus elective repeat cesarean delivery ERCS and also assessed risk factors for uterine rupture.

**Table1 Results comparing maternal outcome measures:**

Maternal outcomes	VBAC(GROUP 1)		ERCS (GROUP 2)		Odds ratio(95%CI)	P%V
	N= 252		N=187			
	N	%	N	%	(95 % CI)	
Mode of delivery(Forceps)	13	3.86%	3	2.5%	1.54(5.51- 0.43)	0.77
Maternal morbidity	152	4.6%	105	2.60%	2.60(0.32-1.21)	0.12
Uterine rupture	120	1.3%	60	0.4%	1.52(1.12-2.41)	0.01
Postpartum hemorrhage	38	2.3%	20	3.1%	1.57(1.20-2.04)	0.21
Blood transfusion	62	1.2%	40	0.8%	1.52(1.26-1.83)	0.10
Hysterectomy	52	1.67%	48	0.3%	1.18(0.32-1.28)	0.12
Cord PH<7.15	10	10	21	6.23%	0.62 (0.3-1.3)	0.22
Maternal ICU	2	1.67%	0	0	0.07(0.003-0.15)	0.07

Indicate significance difference between groups.

**Fig 1: Flow chart of studies included in the systematic review. VBAC, ERC**



## II. Materials And Methods

A literature search in Pub Med was performed in the period 2000 jan-2015feb to find relevant articles that compared maternal outcomes in pregnant women who had given birth vaginal after cesarean (VBAC) compared to women undergoing elective repeat cesarean section (ERCS). A Boolean search operator was used throughout (AND), and the search was performed in “all fields” mode. Only articles published in English are considered and additional studies were identified under related articles. The studies presented are not exhaustive, but they represent those that have the greatest significance for clinical practice. Key words

include Uterine rupture, Vaginal birth after cesarean (VBAC), Elective repeat cesarean section (ERCS), Maternal outcomes, maternal morbidity, postpartum hemorrhage, blood transfusion, risk factors of uterine rupture. Articles were included in review and meta analysis if they met the following inclusion criteria: women with a history of prior cesarean, single ton pregnancies, the rate of women attempting to give birth vaginally are compared to women undergoing elective repeat cesarean section that are reported in tables and text .Exposure groups were planned VBAC and ERCS. Women who had a history of cesarean section and underwent elective cesarean section during their current pregnancy were included in the ERCS group. Women who had a previous cesarean section but planned vaginal delivery during the current pregnancy were included in the planned VBAC group irrespective of whether they actually had a vaginal delivery. The study population was divided into 2 groups: patients who planned VBAC and patients who planned ERCS. The following comparisons were performed with regard to any type of maternal morbidity, uterine rupture, postpartum hemorrhage and emergency hysterectomy, blood transfusion and maternal ICU and cord PH<7.15(Table1). The primary outcome measure was incidence of VBAC. The secondary outcome measures were maternal satisfaction with decision and VBAC experience, knowledge about birth choices, maternal anxiety levels, compliance with the intervention, maternal rate of VBAC conflict, mode of delivery (spontaneous vaginal birth, forceps delivery, and emergency CS), maternal morbidity, postpartum hemorrhage, uterine rupture and blood transfusion. In a second step, risk factors of uterine rupture were reviewed. For each of the maternal outcomes for which a data set was available, we used the total reported cases. The data sets were from eight different studies; thus, the data included were from different time periods corresponding to the data collection period for each study. Among the cases, women without a previous history of cesarean section were excluded. We also exclude women with placenta praevia/accreta/percreta diagnosed before delivery to exclude known confounding due to these conditions, which would be regarded as an absolute indication for ERCS. The final sample of cases that remained were women with any previous cesarean sections, and these were further divided into the planned VBAC and ERCS groups on the basis of the planned mode of delivery. We calculated the incidence of each of the outcomes of interest with 95% CIs for the two exposure groups, VBAC and ERCS, using the denominators: total expected VBAC and ERCS maternities. Inter studies heterogeneity, defined according to Higgins et al as the percentage of total variation across studies because of heterogeneity rather than chance (I<sup>2</sup>) was tested with  $\chi^2$  or heterogeneity at a significant level of  $P = .10$  and a random-effect model was generated whenever the I<sup>2</sup> statistics were greater than 25%. Categorical variables were examined with calculation of pooled odds ratios (ORs) with 95% confidence interval (CI). Intergroup comparison was considered statistically significant at an alpha level of 2-tailed  $P=.05$  if CIs did not encompass 1.0. Meta analysis was performed with Rev Man (Revision Manager, version 4.2for Windows, The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen Denmark, 2003).

### III. Results

Flow chart for study selection is reported in Fig1. Articles were sub grouped in studies that assessed maternal incidence in women undergoing VBAC versus women opting for ERCS and studies that investigated the risk factors for uterine rupture<sup>[4,6,9,10]</sup>. Maternal outcome rate in pregnant women was compared between planned VBAC and planned ERCS in six studies. The articles were pooled for meta analysis and provided 23,649 (56%) women who planned VBAC and 17,598 (43%) who planned ERCS. The overall successful rate of vaginal delivery in patients who attempted a VBAC after previous cesarean section was 72% (range 60% to 80%). The incidence of maternal morbidity, uterine rupture, blood transfusion, postpartum hemorrhage, maternal ICU and hysterectomy in each study group is represented in Table 1. Two articles<sup>[5,7]</sup> were concordant in finding similar rates of operative vaginal delivery between the two groups. Considered as a whole, there was 252/2,435 (5.6 %) cases of operative vaginal delivery in the VBAC group and 187/1,434 (6.7 %) in ERCS group (OR: 0.98; 95 % CI: 0.49–1.97). Maternal morbidity, emergency hysterectomy has been similar in women planning VBAC or ERCS (OR 2.60 95 % CI 0.32–1.21) whereas uterine rupture/Dehiscence was different (OR 1.52; 95 % CI 1.12–2.41). Post partum hemorrhage and blood transfusion were more common after a successful VBAC (OR 1.57; 95 % CI 1.20–2.04%) or ERCS (OR 1.52; 95 % CI 1.26–1.83). Postpartum hemorrhage was reported in three studies<sup>[8,9,11]</sup>, Hysterectomy was reported in 2 studies<sup>[9-13]</sup> of which in only 1 the procedure was not necessary in any group,<sup>13</sup> and in the other four articles, no differences were noted between women planning VBAC and women undergoing ERCS. Considered as a whole, hysterectomy was performed in 52 of 23,649 (0.2%) cases of planned VBAC and 48 of 17,827 (0.3%) cases of ERCS without a significant difference ( $Z = 1.00$ ;  $P = .32$ ). Four studies assessed blood transfusion in successful VBAC. The pooled analysis showed that women with successful VBAC (162 of 14,766; 1.1%) required blood transfusion less frequently than women with ERCS (154 of 5364; 3%;  $Z = 9.35$ ;  $P = .001$ , 95% CI 0.28 to 0.4).

The exposure groups, ERCS and planned VBAC, for each of the outcomes were not significantly different in terms of maternal age, body mass index (BMI), parity, history of previous pregnancy problems and socioeconomic status. The calculated incidence rates of the maternal complications were low and were not found to be significantly different between the two groups (table 1). The relative risk of the severe maternal

morbidities was not different between the VBAC and ERCS groups (table 1). Sensitivity analysis for cases with missing information showed that although the rates changed slightly in the planned VBAC and ERCS groups for cord PH<7.15 and maternal ICU, it did not result in a significant difference in the risk of the adverse outcome between the two exposure groups in either scenario. However the rate in the VBAC group was found to be significantly higher than the rate in the ERCS group (p value for  $\chi^2$  test=0.002).

#### IV. Risk Factors Of Uterine Rupture

Several factors complicate the evaluation of risk factors for uterine rupture during VBAC. First, uterine rupture is a relatively rare event, requiring large sample sizes to identify significant statistical associations between various risk factors and uterine rupture. The majority of studies are observational series that used a case-control or cohort study design. The most studies define uterine rupture as a defect that involves entire uterine wall that is symptomatic and requires surgical intervention, whereas uterine dehiscence is defined as asymptomatic scar separation or thinning that does not require intervention. A prior classical uterine incision extending into the uterine fundus is associated with a 12% risk of uterine rupture<sup>[2]</sup>. However, the definition of uterine rupture varies slightly from study to study. Although the overall rate of uterine rupture in women attempting VBAC is quoted to be less than 1% at present, women who elect a repeat cesarean birth without labor still have a uterine rupture risk of 0.03% to 0.2%<sup>[9-12]</sup>. Among those women attempting VBAC, rates of uterine rupture vary significantly, depending on associated risk factors (Table 2). On the basis of these findings, the authors concluded that women with a prior low vertical uterine incision are not at increased risk for uterine rupture during labor compared with women who had a prior low transverse uterine incision.

**Table 2 Major Risk Factors For Uterine Rupture During VBAC**

Classical uterine incision
Single-layer uterine closure
Prior cesarean births -2
Inter delivery interval -24 months
Maternal age -30 year
Maternal fever -38°C following cesarean
Prostaglandin E2 or misoprostol use
Body mass index BMI differences

#### V. Discussion

This study, which used the data and a nested retrospective cohort design, did not find any significant difference in the incidence and relative risk of adverse maternal outcomes between the VBAC and ERCS groups. However, the incidence rates of the maternal outcomes were more favorable in VBAC than ERCS.

#### VI. Conclusion

This review shows that VBAC after previous cesarean section is associated with a successful rate of 72%. Uterine injury occurs in 1.3% and 0.4% of women undergoing VBAC and ERCS, respectively, and the risk of uterine rupture is approximately 1% in patients planning VBAC, compared with those undergoing ERCS. Additional interventions, in particular blood transfusion and hysterectomy, are performed with the same frequency in the 2 groups. Our findings are similar to the results presented in meta analysis by A. Cristina Rossi; Vincenzo D'Addario<sup>[5]</sup> although the incidence of uterine rupture was higher than the incidence reported in our analysis.

We also determined that women who experienced failure of VBAC present an increased risk of maternal adverse outcomes, compared with VBAC and ERCS. Therefore, the absence of randomized, controlled studies in current literature does not allow driving definitive conclusion about VBAC safety. Literature also lacks of studies investigating the long-term complications, such as incontinence of urine and feces and pelvic organ prolapse in women with previously scarred uterus and vaginal delivery in their next pregnancy. However, meta analysis has the advantage to get a large sample size, which is necessary when variables under examinations are infrequent, as the case of uterine rupture. Although several studies demonstrated an association between clinical factors, maternal characteristics, and unsuccessful vaginal delivery after cesarean section, there is actually no evidence that such factors can be useful to predict outcomes in women attempting to deliver vaginally after a previous cesarean surgery.

Large epidemiological studies with a longer time period for data collection are required to assess whether the incidence of these rare outcomes would significantly differ between the VBAC and ERCS groups if a larger number of cases were to be examined. In the interim, this study contributes additional information to the

process of individual decision making about the mode of delivery by women who have had a previous delivery by caesarean section, as recommended in current guidance.

### Details of ethics approval

As this review was based on data from published literature, ethical approval was not required.

### Authors 'contributions

All authors have made substantial contributions to all of the following: (1)the conception and design of the study ,or acquisition of data, or analysis and interpretation of data ,(2) drafting the article or revising it critically for important intellectual content, (3) final approval of the version submitted.

### Acknowledgements

This project was supported by a grant from the Health and Medical Research Council and the support from SUBEI RENMIN Hospital is greatly appreciated.

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