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Maternal complications with vaginal birth after cesarean delivery: A multicenter study

George A. Macones, MD, MSCE,[a,b,c,*] Jeffrey Peipert, MD, MPH,[d] Deborah B. Nelson, PhD,[a,b] Anthony Odibo, MD,[a,b] Erika J. Stevens, MA,[a,b] David M. Stamilio, MD, MSCE,[a,b] Emmanuelle Pare, MD,[a,b] Michal Elovitz, MD,[a] Anthony Sciscione, DO,[e] Mary D. Sammel, ScD,[b] Sarah J. Ratcliffe, PhD[b]

Departments of Obstetrics and Gynecology,[a] Biostatistics and Epidemiology,[b] and Leonard Davis Institute for Health Economics,[c] University of Pennsylvania, Philadelphia, PA; Department of Obstetrics and Gynecology, Women and Infants Hospital, Brown Medical School,[d] Providence, RI; Drexel University School of Medicine,[e] Philadelphia, PA

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Vaginal birth after cesarean delivery
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Objective: This study was undertaken to determine incidence and risk factors for uterine rupture in women attempting vaginal birth after cesarean delivery (VBAC) in a wide range of hospital settings.
Study design: We performed a case-control study nested within a cohort of women who have had a prior cesarean to determine the incidence and risk factors for uterine rupture in women attempting VBAC.
Results: The incidence rate of uterine rupture in those who attempt VBAC was 9.8 per 1000. A prior vaginal delivery was associated with a lower risk of uterine rupture (adjusted odds ratio [OR] = 0.40, 95% CI 0.20-0.81). Although prostaglandins alone were not associated with uterine rupture, sequential use of prostaglandin and pitocin was associated with uterine rupture (adjusted OR = 3.07, 95% CI 0.98-9.88).
Conclusion: Women with a prior cesarean should be offered VBAC, and women with a prior cesarean and prior vaginal delivery should be encouraged to VBAC. Although other studies have suggested that prostaglandins should be avoided, we suggest that inductions requiring sequential agents be avoided.

A goal of Healthy People 2010 is to reduce both the primary and repeat cesarean delivery rates.[1] One way to accomplish the latter would be to increase the proportion of women who attempt a vaginal birth after a prior cesarean. Unfortunately, the rate of vaginal birth after cesarean (VBAC) continues to fall in the United States, primarily because of concerns about complications such as uterine rupture.[2-4]

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* Reprint requests: George A. Macones, MD, 2000 Courtyard Building, 3400 Spruce St, Philadelphia. PA 19104.
E-mail: gmacones@mail.obgyn.upenn.edu

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Prior studies outlining the incidence and risk factors for uterine rupture among a cohort of women attempting VBAC have come mainly from university/tertiary care centers with most studies reporting relatively few cases of uterine rupture. Thus, questions remain concerning the adequacy of the sample size and the generalizability of the study results. The goal of this study was to improve upon prior work and to assess the incidence and risk factors of uterine rupture in a cohort of who attempt VBAC, both in community and tertiary care hospital settings. We report the largest series of validated cases of uterine rupture in women who attempt VBAC, and focus on whether there are antepartum or early intrapartum predictors that can help guide patient counseling and clinical management.

Methods

We performed a multicenter, case-control study within a retrospective cohort (1996-2000) to assess maternal outcomes among women with a prior cesarean delivery. There were 17 participating hospitals in this study, 16 of which were in a defined geographic area of Southeastern Pennsylvania; the other was a large teaching hospital in Rhode Island. Given that a major goal of this study was to assess clinical outcomes in a mix of hospitals, we included both tertiary care hospitals and community hospitals (with and without obstetric/gynecology residency programs). Six of the included sites are tertiary, university hospitals and 5 of sites did not have a residency program in obstetrics and gynecology. Institutional Review Board approval was obtained from each hospital before the conduct of this study.

The participants included in the retrospective cohort portion of the study were delivered women with a history of a prior cesarean identified by an inclusive International Classification of Disease (ICD) code-based search at each of the participating hospitals. The ICD code search included the term "previous cesarean delivery, delivered" which, necessarily included both women who had an attempt at VBAC as well as those women who underwent an elective repeat cesarean delivery. The sensitivity of this ICD code-based search had been validated in several pilot studies that predated the start of this study. The medical records from this ICD-based search were requested from each of the participating institutions.

A team of trained nurse abstractors reviewed each medical record for this cohort, using standardized, closed-ended data collection forms. Approximately 3% of records requested were never found (despite multiple requests). During this initial review, each medical record was reviewed briefly (approximately 20 minutes) and information concerning the demographic, obstetric/medical history, and clinical outcomes (VBAC attempt/elective repeat cesarean, success/failure, rupture, major complications) for each woman was abstracted. The purpose of this brief review was to identify the subset of women who attempted VBAC, from which cases of uterine rupture and controls would be identified (Figure). We excluded subjects with either an unknown prior cesarean scar as well as women with a prior classical uterine incision. At the start of the study, and at several points during the review period, the abstractors underwent training to further ensure data validity. Using this strategy, we identified cases of uterine rupture among women with a prior cesarean attempting VBAC from each of the 17 participating hospitals. Because uterine rupture, the outcome of interest, can be confused with an asymptomatic dehiscence of the prior scar, we defined uterine rupture a priori as separation of the uterine scar (determined at laparotomy), immediately preceded by either a nonreassuring fetal heart rate pattern (determined by the treating obstetrician) or by signs/symptoms of acute maternal bleeding (SBP <70 mm Hg, DBP <40 mm Hg, HR >120) or by the presence of blood in the maternal abdomen at the time of laparotomy. All possible cases of uterine rupture were reviewed by the principal investigator (G.M.) to be certain that the classification was correct. Controls were randomly selected from the set of women who attempted VBAC but did not experience a uterine rupture. This random selection was accomplished by using a random numbers generated sequence applied to subjects who attempted VBAC but did not meet the case definition.

Among the subset of cases and selected controls, the inpatient records were reabstracted in detail by research nurses trained specifically for this more complex data collection. We were interested in a variety of types of potential predictors for uterine rupture, including patient demographics, obstetric history, medical history, and social history. We were also specifically interested in examining several pregnancy complications as potential risk factors for uterine rupture, including gestational diabetes and preeclampsia. Detailed information on the process of labor was also collected, with specific interest in whether labor occurred spontaneously, was induced, or augmented. We also collected information on medications for cervical ripening and induction/augmentation of labor, such as pitocin, prostaglandins, or Foley bulbs.

The data from the case and control records were then entered into a relational database, with frequent quality assurance procedures implemented to ensure quality data entry. Data analysis was performed in several steps. For descriptive purposes, comparisons of demographic and historical factors between women with a prior cesarean who attempted VBAC and women with a prior cesarean who opted for elective repeat cesarean were performed with standard bivariate techniques. Major and minor complications between these 2 groups were expressed as relative risks (unadjusted and 95%

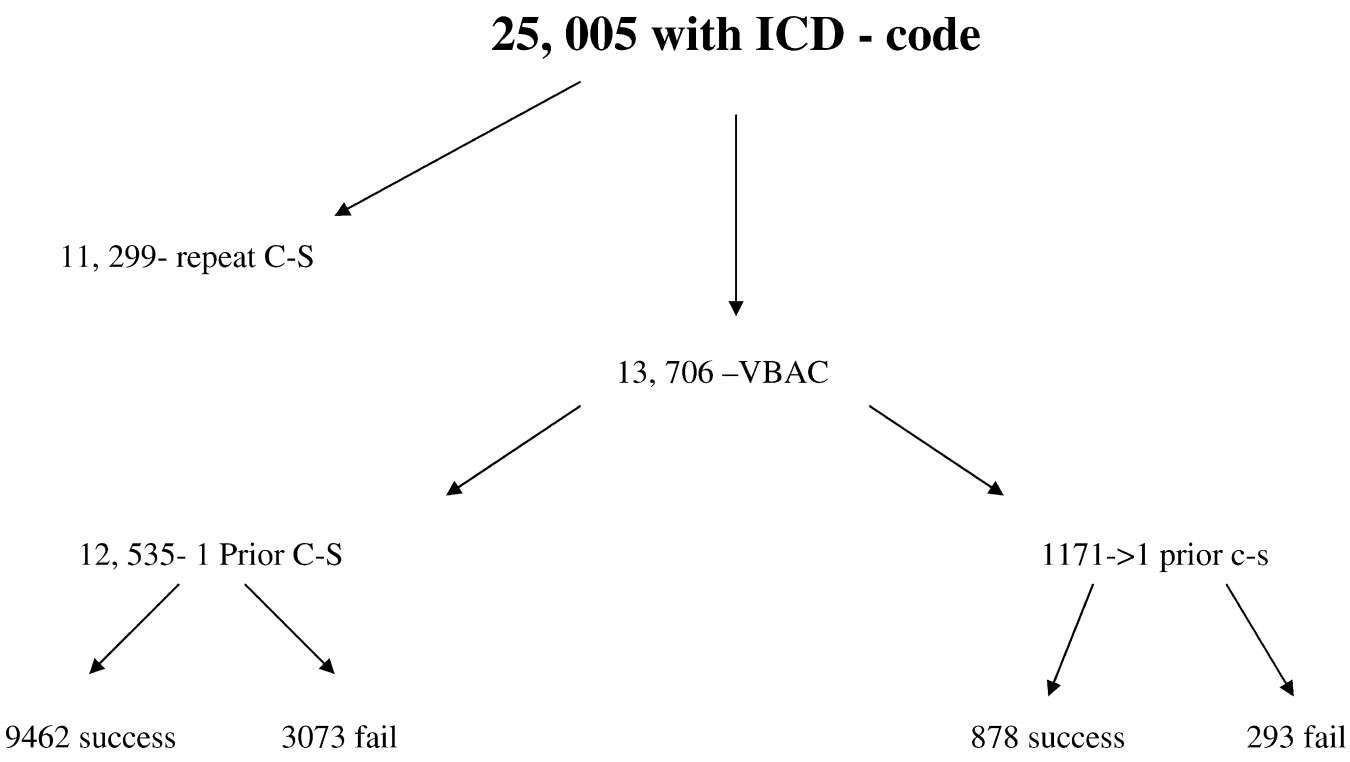

Figure Subjects included in study.

CIs). For this study, the primary analysis was between the group of women with a prior cesarean attempting VBAC with a uterine rupture (cases) and the group of women with a prior cesarean attempting VBAC without a uterine rupture (controls). First, descriptive statistics were conducted to explore the risk factors for uterine rupture. Second, baseline characteristics of cases of uterine rupture and controls were compared, by using unpaired *t* tests (for normally distributed continuous variables), Mann-Whitney *U* tests (for non-normally distributed variables), and χ^2/Fisher exact for categorical variables. The results from these bivariate analyses were used to select variables for our multivariable logistic model for uterine rupture.[5] Backward selection was used to reduce the number of variables, provided that removing the variable did not greatly affect any of the remaining estimates. Potential confounders were included based on their known, or suspected relationship, with uterine rupture. These variables were included regardless of their statistical significance. Indicator variables for the study sites were included in all comparisons.

We had specific interest in induction/augmentation of labor (and specific medications for this purpose) and uterine rupture. Because of the complex relationship between the type of labor and medications used, 3 models were developed. In 1 model, labor was coded as "spontaneous, induced, augmented," which ignores the specific medication used. In the second model, we assessed the specific medication used (none, prostaglandin, pitocin, both prostaglandin and pitocin)—this does not account for whether labor was induced or augmented (ie, some patients may have labor induced with pitocn alone). The third model accounts for both the specific agent and whether labor was induced/augmented/spontaneous.

A priori, we performed a sample size calculation to determine the number of subjects required for the nested case-control portion of the study. We made the following assumptions: 2-sided alpha level (type I error) of .05, a beta level (type II error) of .2 (power of 80%), and a control/case ratio of 5:1. To detect an odds ratio (OR) of 2.0 or greater for risk factors with a prevalence of greater than 15%, 134 cases of uterine rupture will be required.

Results

We reviewed the records of 25,005 women with a prior cesarean section, of which 13,706 (53.7%) underwent a VBAC attempt and 11,299 (44.3%) underwent an elective repeat cesarean (Figure). Fifty-nine percent of subjects were delivered at nonuniversity hospitals and 41% at university hospitals.

Patients with a prior cesarean section who attempt VBAC differ from those who opted for an elective repeat cesarean (Table I). Women who attempt VBAC tended to have fewer prior cesarean sections, fewer prepregnancy

Table I Characteristics of women who attempt VBAC compared with those who undergo elective repeat cesarean section

	VBAC attempt (n = 13,706)	Elective repeat cesarean section (n = 11,299)	*P*
Maternal age (y)	30.2 (5.5)	31.5 (5.1)	<.001
Ethnicity			
White	56.8% (7785)	67.1% (7581)	<.001
Black	30.7% (4208)	22.7% (2565)	
Hispanic	5.5% (754)	4.8% (543)	
Asian	2.3% (315)	1.7% (192)	
Other	4.7% (644)	3.7% (418)	
Delivered at university hospital	55% (7538)	65% (7344)	<.001
Prior spontaneous abortion	27.3% (3742)	29.7% (3356)	<.001
Prior elective abortion	21.2% (2906)	19.6% (2215)	.003
Prior vaginal delivery	36.3% (4975)	13.9% (1570)	<.001
2 or more prior cesarean deliveries	8.5% (1165)	32.3% (3650)	<.001
Chronic hypertension in index pregnancy	2.8% (384)	4.0% (452)	<.001
Gestational diabetes in index pregnancy	4.4% (603)	7.6% (859)	<.001
Preeclampsia in index pregnancy	2.6% (356)	3.1% (350)	.009
Asthma in index pregnancy	8.3% (1138)	8.4% (949)	.76
Preexisting diabetes	1.0% (137)	2.1% (237)	<.001
Self-reported tobacco use	18.7% (2563)	17.1% (1932)	.001
Self-reported cocaine use	3.8% (521)	2.4% (271)	<.001
Birth weight (g)	3334 (SD = 672)	3358 (SD = 706)	.009
Gestational age at delivery (wks)	38.6 (SD = .8)	37.9 (SD = 2.3)	<.001

medical problems, and fewer antepartum complications. There was a statistically significant, but clinically unimportant, difference in the mean gestational age at delivery and mean birth weight between those who attempt VBAC and those who received repeat elective cesareans. Among those women who attempted VBAC (Figure), the vaginal delivery rate was 75.5%, and this was similar among the group of women attempting VBAC with a single prior cesarean (75.5%) and the group of women attempting VBAC with 2 or more prior cesareans (75.0%). These success rates are consistent with prior work.[6,7]

Table II Major and minor morbidities comparing women attempting VBAC and women with an elective cesarean section

	VBAC attempt	Elective repeat cesarean section	RR (95% CI)	*P*
Major morbidity				
Uterine rupture	0.9%	0.004%	21.1 (8.6-51.5)	<.001
Bladder injury	0.4%	0.4%	1.05 (0.71-1.51)	.79
Other major operative injury	0.9%	0.6%	1.52 (1.14-2.02)	.003
Minor morbidity				
Blood transfusion	0.7%	1.2%	0.58 (0.45-0.75)	<.001
Postpartum fever	9.4%	13.0%	0.73 (0.68-0.78)	<.001

Major complications, defined as uterine rupture, bladder injury, or other major operative complications (bowel injury, uterine artery laceration)[8] were more common among the women who attempt VBAC, whereas minor complications (blood transfusion, postpartum fever) were more common among the group of women who underwent elective repeat cesarean (Table II). We identified 134 cases of uterine rupture among the group of women who attempted VBAC, which yields a cumulative incidence of 9.8 per 1000 (95% CI: 8.1-11.4 per 1000). Uterine rupture was more common among women with 2 or more prior cesareans (200/1000) compared with women with only a single prior cesarean (87/1000).

The bivariate analysis of historical factors related to uterine rupture among women attempting VBAC suggested that nonwhite race was protective for uterine rupture (Table III). A prior vaginal delivery was strongly protective, whereas other obstetric historical factors were largely unrelated to uterine rupture among this group. There was a trend toward a positive association between the number of prior cesareans and the risk of uterine rupture. We found no maternal medical factors or social factors (smoking/drug use) associated with uterine rupture among women attempting VBAC. Delivery beyond 37 weeks in the index pregnancy was associated with a small increase in the rate of uterine rupture, though birth weight (categorized as $\leq$4000 g) was not associated with uterine rupture. Compared with the group of patients attempting VBAC who had spontaneous labor, both women who had either induced or augmented labors were more than 3 times more likely to experience a uterine rupture. However, medications used for labor stimulation (pitocin/prostaglandin) were not individually associated with uterine rupture, though when sequential prostaglandin-pitocin was used, there was an increase in risk. Importantly, only PGE-2 prostaglandins were used in subjects in this study.

The bivariate results were used to select variable for inclusion in the multivariable model to explore the independent factors related to uterine rupture among

Table III Bivariate analysis comparing women attempting VBAC with a uterine rupture and women attempting VBAC without a uterine rupture: Results from nested case-control study

Tables risk factor (ref. group)	Case (n = 134) no. (%) or mean (median)	Control (n = 665) no. (%) or mean (median)	Odds of rupture	95% CI	*P* value
Demographics					
Age (y)	31.95 (33)	30.61 (31)	1.05	1.01-1.09	.010
Nonwhite	37 (27.8)	293 (44.0)	0.49	0.32-0.75	<.001
Married	95 (71.9)	445 (69.9)	1.10	0.73-1.67	.647
Private/HMO	50 (37.5)	281 (42.2)	0.80	0.54-1.20	.225
Nonuniversity hospital	90 (67.1)	421 (63.3)	1.19	0.80-1.76	.397
Obstetric history					
2 or more prior cesarean sections	22 (16.4)	79 (11.8)	1.46	0.87-2.44	.151
Prior term pregnancy	123 (92.4)	634 (95.3)	0.60	0.27-1.35	.187
Prior vaginal delivery	25 (18.7)	251 (37.7)	0.38	0.23-0.62	<.001
Prior abortion	49 (36.8)	277 (41.6)	0.82	0.55-1.22	.352
Prior cesarean section term	59 (56.1)	115 (49.3)	1.32	0.83-2.09	.245
Prior cesarean section birth weight ≤4000 g	105 (81.4)	405 (71.9)	1.71	1.06-2.76	.029
Medical history					
Chronic hypertension	5 (3.7)	50 (7.5)	0.48	0.15-1.22	.12
Diabetes	3 (2.2)	36 (5.4)	0.41	0.08-1.31	.13
Autoimmune disease	2 (1.5)	6 (0.9)	1.67	0.16-9.49	.53
Asthma	13 (9.7)	61 (9.1)	1.07	0.52-2.05	.83
Gestational diabetes	5 (3.7)	30 (4.5)	0.82	0.24-2.19	.69
Social Factors					
Smoking	22 (16.5)	140 (21.0)	0.74	0.43-1.23	.24
Cocaine use	2 (0.01)	21 (0.03)	0.47	0.05-1.98	.30
Alcohol use	7 (0.05)	36 (0.05)	0.98	0.36-2.31	.96
Current obstetric data					
Term delivery	61 (45.8)	240 (36.7)	1.46	1.00-2.13	.048
Gestational age at delivery (wks)	39.11 (39)	38.39 (39)	1.14	1.03-1.27	.011
Birth weight >4000 g	21 (17.3)	78 (12.9)	1.41	0.83-2.39	.203
Birth weight (kg)	3.52 (3.51)	3.35 (3.41)	1.46	1.07-1.99	.017
Intrapartum factors					
Labor type					
Spontaneous	22 (16.4)	273 (41.0)	1.0 (reference)		
Induced	69 (51.4)	230 (34.7)	3.68	2.21-6.14	<.0001
Augmented	43 (32.0)	162 (24.4)	3.26	1.88-5.64	<.0001
Labor medications (none)					
None	68 (50.7)	430 (64.6)	1.0 (reference)		
Pitocin only	37 (27.6)	188 (28.2)	1.25	0.81-1.92	.325
Prostaglandin only	3 (2.24)	25 (3.7)	0.76	0.22-2.58	.659
Both pitocin and prostaglandin	26 (19.4)	22 (3.3)	7.47	4.01-13.93	<.0001

women with a prior cesarean section attempting VBAC. After adjustment for confounding, the only historical factor significantly associated with uterine rupture was a prior vaginal delivery, which reduced the odds of rupture by 60% (Table IV).

Neither induction nor augmentation of labor was associated with uterine rupture, compared to women who labor spontaneously (model 1) (Table V). However, the analysis of labor stimulating agents (models 2 and 3) suggested that the risk of uterine rupture was increased only when both pitocin and prostaglandins were used for labor induction. In addition, we did not find any evidence of effect modification, when considering the relationship between induction/augmentation and uterine rupture, stratified by gestational age. The analysis was also unchanged after restricting the analysis to those cases and controls with only a single prior cesarean section.

Comment

The results of this study support several conclusions. First, women with a prior cesarean section who choose to attempt VBAC differ from those who opt for elective repeat cesarean. In general, women who attempt VBAC

Table IV Multivariate analysis: Historical risk factors for uterine rupture

Risk factors	Adjusted OR	95% CI	*P*
Maternal age (continuous)	1.09	1.03-1.15	.003
Nonwhite race	0.78	0.38-1.57	.48
Nonuniversity hospital	0.71	0.38-1.33	.28
Private/HMO insurance	1.08	0.59-1.99	.80
Prior vaginal delivery	0.40	0.20-0.81	.01
2 or more cesarean sections	1.45	0.64-3.27	.36
Delivery gestational age	1.13	0.97-1.30	.11

Table V Multivariate analysis of labor type/medications and uterine rupture

	Adjusted OR	95% CI	*P*
Model 1			
Spontaneous labor	1.0 (reference)		
Labor induction	1.01	0.43-2.34	.97
Labor augmentation	1.72	0.80-3.64	.32
Model 2			
Spontaneous labor	1.0 (reference)		
Pitocin	0.77	0.32-1.83	.56
Prostaglandin	1.41	0.24-8.23	.70
Prostglandin + pitocin	3.07	0.98-9.88	.05
Model 3			
Spontaneous	1.0 (reference)		
Augmented	1.61	0.76-3.40	.22
Induced without pitocin or prostaglandin	0.85	0.23-3.15	.81
Induced with only pitocin	1.46	0.60-3.57	.41
Induced with only prostaglandin	1.90	0.37-9.65	.44
Induced with pitocin + prostaglandin	4.54	1.66-12.42	.003

tend to have fewer preexisting medical problems and current pregnancy complications. Second, rates of major complications among those women who attempt VBAC are low, though higher than the women who opt for elective repeat cesarean. As reported previously and as confirmed in this larger study, found in this study, minor complications are more common among the group of women who opt for an elective repeat cesarean.[8,9] We report the incidence of uterine rupture among women with a prior cesarean attempting VBAC was less than 1%, which is of importance because some have suggested that the occurrence of uterine rupture is on the rise in the United States. Third, the case-control portion of study aimed to identify predictors of uterine rupture among women with a prior cesarean section attempting VBAC. Unfortunately, this study demonstrated that there are few reliable predictors of this catastrophic event.

In a prior cohort study that used the Washington State Birth Events Database, Lydon-Rochelle et al[10] found that induction of labor with prostaglandins increased the risk of uterine rupture more than 15-fold (RR [relative risk] = 15.6, 95% CI 8.1-30.0). There was no information on type of prostaglandin used in that study, and uterine rupture was identified from hospital discharge codes (as was prostaglandin use). Both of these are prone to misclassification. A recent American College of Obstetricians and Gynecologists Committee Opinion and Practice Bulletin discourages the use of prostaglandins based largely on these data.[11,12] Our study, in which all subjects received intravaginal prostaglandin (not misoprostol), does not support the strong association between these agents and uterine rupture as suggested reported by Lydon-Rochelle et al.[10] In fact, only the sequential use of prostaglandin and pitocin was associated with an increased odds of uterine rupture. Even with prostaglandins and pitocin, the odds of rupture was increased only 3-fold compared with those who labor spontaneously. Although somewhat limited by the possibility of a type II error (and a small number of cases of rupture in those induced with prostaglandins alone), our data suggest that, inductions requiring sequential prostaglandin-pitocin may be associated with an increase in risk. Thus, the previously reported association between the use of prostaglandins and uterine rupture may be a by-product of confounding by indication rather than a true relationship.

Consistent with other work, a vaginal delivery preceding a VBAC attempt protected against uterine rupture.[13-15] We found a prior vaginal delivery was associated with a 60% reduction in the odds of rupture. Thus, it would seem reasonable to encourage women with a prior vaginal delivery to consider a VBAC attempt. Unfortunately, no other obstetric or historical factors were accurate predictors of uterine rupture.

Prior work on VBAC safety has come from mainly tertiary care institutions.[14,16-20] An advantage of our study is that we have included tertiary and community hospitals, and those with and without obstetrics/gynecology residency programs, making our results more generalizable to a wider spectrum of obstetric patients. Another advantage of our analysis, compared with others on VBAC safety, is that all inpatient medical records were reviewed, rather than relying on ICD codes or birth certificates for both exposure and outcome information. Lastly, our study represents the largest series to date on uterine rupture, in which both exposure and outcome information were validated from records. Still, despite these strengths, our study has several limitations. First, given that all information was obtained from the inpatient record, some data are subject to misclassification. For example, information on substance abuse is based solely on patient report. We believe that such misclassification is likely to be nondifferential, and would likely bias the results toward the null. Second, although we report 1 of the largest studies on VBAC safety, we still have limited power to assess

possible risk factors of low prevalence. Third, our analysis focuses on maternal outcomes after VBAC, and does not consider neonatal outcomes.[21] This is of relevance, because there is a recent report that suggests that the rate of hypoxic ischemic encephalopathy is increased in the newborn infants of women who underwent an elective cesarean compared with VBAC (although the absolute risk is quite small).[22]

In this large, generalizable, observational study of maternal VBAC safety, we found that the overall incidence of uterine rupture in those attempting VBAC is quite low. Based on our data, we believe that women with a prior cesarean should be offered VBAC, and women with a prior cesarean and prior vaginal delivery should be encouraged to VBAC.

References

1. Healthy People 2010. Washington (DC): US Dept of Health and Human Services; 2000.
2. Scott J. Mandatory trial of labor after cesarean delivery: an alternative viewpoint. Obstet Gynecol 1991;77:811-4.
3. Greene M. Vaginal delivery after cesarean section—is the risk acceptable? N Engl J Med 2001;345:54-5.
4. Martin J, Harris B, Huddleston J. Vaginal delivery following previous cesarean birth. Am J Obstet Gynecol 1983;146:255-62.
5. Hosmer D, Lemeshow S. Applied logistic regression. New York: John Wiley; 2002.
6. Troyer L, Parisi V. Obstetric parameters affecting success in a trial of labor: designation of a scoring system. Am J Obstet Gynecol 1992;167:1099-104.
7. Macones G, Hausman N, Edelstein R, Stamilio DM, Marder SJ. Predicting outcomes of trials of labor in women attempting vaginal birth after cesarean delivery: a comparison of multivariable methods and neural networks. Am J Obstet Gynecol 2001;184: 409-13.
8. McMahon M, Luther ER, Bowes WA Jr, Olshan AF. Comparison of a trial of labor with an elective second cesarean section. N Engl J Med 1996;335:689-95.
9. Rosen M, Dickinson J, Westhoff C. Vaginal birth after cesarean: a meta-analysis of morbidity and mortality. Obstet Gynecol 1991;77:465-70.
10. Lydon-Rochelle M, Holt VL, Easterling TR, Martin DP. Risk of uterine rupture during labor among women with a prior cesarean delivery. N Engl J Med 2001;345:3-8.
11. American College of Obstetricians and Gynecologists. Induction of labor for vaginal birth after cesarean delivery. Washington (DC): The College; 2002. ACOG Committee Opinion 271.
12. American College of Obstetricians and Gynecologists. Vaginal birth after previous cesarean delivery. Washington (DC): The College; 2004. ACOG Practice Bulletin 54.
13. Caughey A, Shipp TD, Repke JT, Zelop C, Cohen A, Lieherman E. Trial of labor after cesarean delivery: the effect of previous vaginal delivery. Am J Obstet Gynecol 1998;179:938-41.
14. Caughey A, Shipp TD, Repke JT, Zelop CM, Cohen A, Lieberman E. Rate of uterine rupture during a trial of labor in women with one or two prior cesarean deliveries. Am J Obstet Gynecol 1999;181:872-6.
15. Zelop C, Shipp TD, Repke JT, Cohen A, Lieberman E. Effects of previous vaginal delivery on the risk of uterine rupture during a subsequent trial of labor. Am J Obstet Gynecol 2000;183:1184-6.
16. Miller D, Diaz F, Paul R. Vaginal birth after cesarean: a 10 year experience. Obstet Gynecol 1994;84:255-8.
17. Flamm B, Geiger A. Vaginal birth after cesarean delivery: an admission scoring system. Obstet Gynecol 1997;90:907-10.
18. Flamm B, Goings JR, Fuelberth NJ, Fischermann E, Jones C, Hersh E. Oxytocin during labor after previous cesarean section: results of a multicenter study. Obstet Gynecol 1987;70:709-12.
19. Flamm B, Goings JR, Liu Y, Wolde-Tsadik G. Elective repeat cesarean delivery versus trial of labor: a prospective multicenter study. Obstet Gynecol 1994;83:927-32.
20. Flamm B, Newman LA, Thomas SJ, Fallon D, Yoshida MM. Vaginal birth after cesarean delivery: results of a 5-year multicenter collaborative study. Obstet Gynecol 1990;76:750-4.
21. Smith GC, Pell JP, Cameron AD, Dobbie R. Risk of perinatal death associated with labor after previous cesarean delivery in uncomplicated term deliveries. JAMA 2002;287:2684-90.
22. Landon M, Hauth JC, Leveno KJ, Spong CY, Leindecker S, Varner MW, et al. Maternal and perinatal outcomes associated with a trial of labor after prior cesarean delivery. N Engl J Med 2004;351:2581-9.