

Pregnancy Outcome and Mode of Delivery After a Previous Operative Vaginal Delivery

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OBJECTIVE: To assess pregnancy outcome and risk factors for repeat operative vaginal delivery in women with previous operative vaginal delivery.

METHODS: This was a case-control study of all nulliparous women who underwent operative vaginal delivery in a tertiary care medical center from 1993–2006 (n=4,153). The control group included nulliparous women who underwent spontaneous vaginal delivery during the same period in a 2:1 ratio (n=8,306). The women in each group who had a subsequent delivery at our center were identified (n=1,396 and n=2,591, respectively), and the outcome of the subsequent delivery was recorded.

RESULTS: Compared with the women in the spontaneous vaginal delivery group, women who underwent operative vaginal delivery in the index pregnancy had a higher rate of operative vaginal delivery (4.7% compared with 1.2%, $P<.006$) and cesarean delivery (8.5% compared with 4.6%, $P<.001$) in the subsequent pregnancy. The rate of neonatal birth injury (1.5% compared with 0.6%, $P=.005$) and third-degree or fourth-degree lacerations (0.7% compared with 0.2%, $P=.01$) was significantly higher in the group of women with a previous operative vaginal delivery. Risk factors for repeat operative vaginal delivery were as follows: failed vacuum extraction and prolonged second stage as the indication for operative vaginal delivery in the index pregnancy; prolonged interval (more than 3 years) between pregnancies; higher fetal weight, persistent occipitoposterior position, and use of epidural analgesia in the subsequent pregnancy. The presence of epidural analgesia in the index operative vaginal delivery was not associated with a decreased risk of repeat operative vaginal delivery.

CONCLUSION: Nulliparous women undergoing operative vaginal delivery are at increased risk of operative vaginal delivery and cesarean delivery in their subsequent pregnancy. Risk stratification based on the identified risk factors may assist clinicians in predicting the likelihood of repeat operative vaginal delivery and in counseling patients accordingly.

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LEVEL OF EVIDENCE: II

Previous studies have shown that operative vaginal delivery is associated with immediate risks for both mother and neonate.^{1,2} However, data on the effects of operative vaginal delivery on the outcome of a subsequent pregnancy remain scarce.

Given that maternal intrinsic pelvic factor may, in some cases, contribute to dystocia during the second stage of labor and lead to operative vaginal delivery, women with a previous operative vaginal delivery may be at increased risk of operative vaginal delivery in their subsequent pregnancy. This assumption was supported by two previous studies,^{3,4} although these studies were limited by a relatively small sample size and lack of a control group.⁴ Moreover, there are no data regarding the characteristics of women who are prone to repeat operative vaginal delivery in subsequent pregnancy or the effect of an interpregnancy change in known risk factors for operative vaginal delivery (ie, use of epidural analgesia, fetal head position, and fetal weight) on the risk of repeat operative vaginal delivery.

The aim of the present study was to assess pregnancy outcome and risk factors for repeat operative vaginal delivery in women with a previous operative vaginal delivery.

MATERIALS AND METHODS

A comparative case-control design was used. The perinatal database of our tertiary care, university-affiliated medical center was searched for all nullipa-

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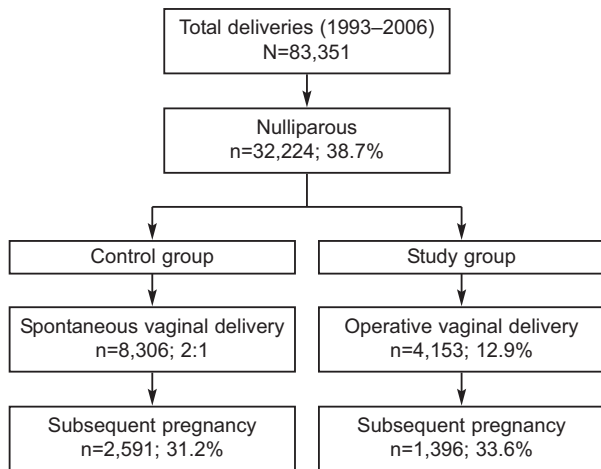


Fig. 1. Definition of the study and control groups. Melamed. *Outcome After a Previous Operative Delivery. Obstet Gynecol* 2009.

rous women who underwent operative vaginal delivery between 1993 and 2006 (operative vaginal delivery group, Fig. 1). This group was matched by maternal age and gestational age at delivery in a 1:2 ratio to a control group of nulliparous women who delivered spontaneously (spontaneous vaginal delivery group, Fig. 1). Women with multiple gestations, nonvertex presentation, or any other contraindications for vaginal delivery were excluded from the study. The study protocol was approved by the Rabin Medical Center institutional review board.

We then identified the women in each group who had a subsequent delivery at our center, and maternal and neonatal outcomes and mode of delivery in the subsequent pregnancy were recorded and compared for the two groups (Fig. 1). With regard to cesarean deliveries for the subsequent pregnancy, we included only those women who underwent intrapartum cesarean delivery or women in whom cesarean delivery was performed on request or because of significant perineal trauma during the index delivery; women who underwent indicated elective cesarean delivery in the subsequent pregnancy (ie, nonvertex presentations, placenta previa, multifetal gestation) were excluded.

The indications for operative vaginal delivery at our center are prolonged second stage, as stipulated in the guidelines of the American College of Obstetricians and Gynecologists,⁵ and nonreassuring fetal heart rate. Briefly, the diagnosis of prolonged second stage in nulliparous women is considered when the second stage exceeds 2 hours (or 3 hours in the presence of regional anesthesia). In multiparous women, the diagnosis is made when the second stage

exceeds 1 hour (or 2 hours in the presence of regional anesthesia). Only low or outlet operative vaginal delivery was performed during the study period.⁶ Vacuum extraction is considered the method of choice in our institution when operative vaginal delivery is indicated. Failed vacuum extraction is defined as two cup detachments or no progression of the fetal head despite appropriate traction.

Data analysis was performed with SPSS 15.0 (SPSS, Inc., Chicago, IL). Student *t*-test was used for comparison of continuous variables between the groups, and χ -square test was used for categorical variables. Multivariable logistic regression analysis was performed to detect independent factors associated with increased risk of repeat operative vaginal delivery. Differences were considered significant at $P < .05$.

RESULTS

Of the 32,224 nulliparous women who gave birth at our center during the study period, 4,153 (12.8%) underwent operative vaginal delivery (operative vaginal delivery group, Fig. 1) and were matched in a 1:2 ratio to a control group of nulliparous women who delivered spontaneously (spontaneous vaginal delivery group, $N = 8,306$).

The characteristics of the operative vaginal delivery and spontaneous vaginal delivery groups at the index pregnancy are presented in Table 1. Overall, there were no clinically significant between-group differences in background parameters. Obstetrically, women in the operative vaginal delivery group were characterized by a significantly higher rate of use of epidural analgesia, persistent occipitoposterior position, third-degree and fourth-degree lacerations, and fetal macrosomia (more than 4,000 g).

Among the women in the operative vaginal delivery group, 33.6% (1,396 of 4,153) underwent a subsequent delivery at our center compared with 31.2% (2,591 of 8,306) of the women in the spontaneous vaginal delivery group ($P = .006$).

The women in the operative vaginal delivery group were older (Table 2) and, similar to the findings in the index pregnancies, had a higher rate of persistent occipitoposterior position and a higher mean birth weight (Table 2).

Figure 2 presents the mode of delivery in the subsequent pregnancy. Compared with the women in the spontaneous vaginal delivery group, women who underwent operative vaginal delivery in the index pregnancy had a higher rate of operative vaginal delivery (4.7% compared with 1.2%, $P < .006$) and cesarean delivery (8.5% compared with 4.6%, $P < .001$) in the subsequent pregnancy. Prolonged second stage was the



Table 1. Demographic and Obstetric Characteristics of the Index Operative and Spontaneous Vaginal Delivery Groups

	Index Pregnancy		P
	Operative Vaginal Delivery (n=4,153)	Spontaneous Vaginal Delivery (n=8,306)	
Maternal age (y)	27.7±4.4	27.6±4.8	.5
Diabetes mellitus	89 (2.1)	173 (2.1)	.8
Gestational age at delivery (wk)	39.5±1.5	39.4±2.0	.4
Induction of labor	428 (10.3)	801 (9.6)	.2
Mode of delivery			
Vacuum	3,003 (72.3)	N/A	
Forceps	635 (15.3)	N/A	
Forceps after failed vacuum	515 (12.4)	N/A	
Indication: prolonged 2nd stage	2,197 (52.9)	N/A	
Epidural analgesia	3,531 (85.0)	4,985 (60.0)	<.001
Persistent occiput-posterior position	330 (7.9)	42 (0.5)	<.001
3rd- or 4th-degree perineal laceration	89 (2.1)	21 (0.2)	<.001
Birth weight (g)	3,231±448	3,154±512	<.001
More than 4,000 g	158 (3.8)	249 (3.0)	.02

N/A, not applicable.

Data are mean±standard deviation or n (%) unless otherwise specified.

indication for 80% of the repeat operative vaginal deliveries in the operative vaginal delivery group, compared with 34.4% of the operative vaginal deliveries in the subsequent pregnancy of the women in the spontaneous vaginal delivery group (Fig. 2). Dystocia was a significantly more common indication for cesarean delivery in the subsequent pregnancy in the operative

vaginal delivery group (5.0% compared with 1.9% Fig. 2) and was attributed to arrest of dilatation or prolonged second stage (28.3% and 71.7%, respectively). The risk of cesarean delivery in the subsequent pregnancy remained significantly higher in the women with a previous operative vaginal delivery, even when cases of elective cesarean delivery (mater-

Table 2. Characteristics and Outcome of Subsequent Pregnancy in Women With a Previous Operative or Spontaneous Vaginal Delivery

	Subsequent Pregnancy		P
	Previous Operative Delivery (n=1,396)	Previous Spontaneous Delivery (n=2,591)	
Maternal age (y)	29.3±4.3	28.5±4.1	<.001
Time from index delivery (y)	2.5±1.3	2.6±1.4	.2
Parity	2.0±0.0	2.0±0.0	N/A
Diabetes mellitus	32 (2.3)	53 (2.0)	.2
Gestational age at delivery (wk)	39.3±1.7	39.3±1.5	.4
Preterm delivery (less than 37 0/7 wk)	68 (4.9)	101 (3.9)	.1
Induction of labor	90 (6.4)	162 (6.3)	.8
Epidural analgesia	777 (55.7)	1,379 (53.2)	.1
Persistent occipitoposterior position	16 (1.1)	14 (0.5)	.03
Episiotomy	432 (30.9)	737 (28.5)	.1
3rd- or 4th-degree perineal laceration	10 (0.7)	5 (0.2)	.01
Postpartum hemorrhage	30 (2.1)	38 (1.5)	.1
Birth weight (g)	3,301±482	3,256±446	.003
More than 4,000 g	77 (5.5)	112 (4.3)	.09
5-min Apgar score less than 7	4 (0.3)	3 (0.1)	.2
Neonatal birth injury*	21 (1.5)	16 (0.6)	.005
Prolonged maternal hospital stay†	14 (1.0)	23 (0.9)	.7

N/A, not applicable.

Data are mean±standard deviation or n (%) unless otherwise specified.

* Includes cephalohematoma, skull fracture, subdural/cerebral hematoma, intraventricular hemorrhage, and facial-nerve injury.

† Discharge from hospital after more than 4 or 7 days after vaginal delivery or cesarean delivery, respectively.



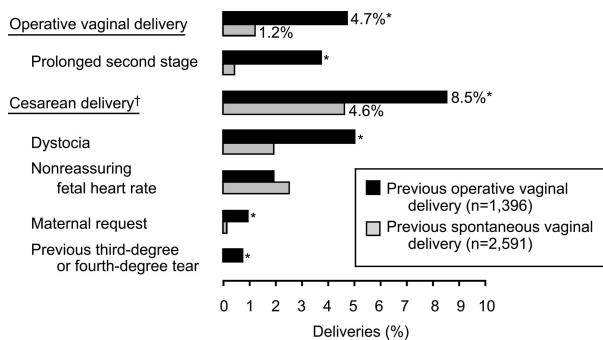


Fig. 2. Mode of delivery at subsequent pregnancy in women with a previous operative vaginal delivery or spontaneous vaginal delivery. * $P < .001$. †Includes intrapartum cesarean deliveries as well as elective cesarean deliveries performed on maternal request. Women who underwent indicated elective cesarean deliveries (ie, nonvertex presentations, placenta previa, multifetal gestation) were excluded. Melamed. *Outcome After a Previous Operative Delivery*. *Obstet Gynecol* 2009.

nal request or previous third-degree or fourth-degree lacerations) were excluded ($n=97$, 6.9% compared with 4.4%, $P=.001$). Women in the operative vaginal delivery group were at increased risk of maternal perineal trauma and neonatal birth injury in the subsequent pregnancy compared with women with a previous spontaneous vaginal delivery (Table 2).

To assess whether differences in the characteristics of the groups were responsible for the higher rate of operative vaginal delivery and cesarean delivery in the women with a previous operative vaginal delivery, the data were fitted to a multivariable logistic regression model. Even after adjustment for potential confounders (maternal age, diabetes, labor induction,

epidural analgesia, persistent occipitoposterior position, fetal sex, and neonatal birth weight), the risk of repeat operative vaginal delivery and of cesarean delivery remained significantly higher in the women with a previous operative vaginal delivery than in those in the spontaneous vaginal delivery group (odds ratio 3.9, 95% confidence interval 2.5–5.9 for repeat operative vaginal delivery; odds ratio 1.9, 95% confidence interval 1.5–2.5 for cesarean delivery in the subsequent pregnancy).

Multivariable logistic regression analysis yielded several independent predictors of repeat operative vaginal delivery (Table 3). Factors related to the index operative vaginal delivery that conferred an increased risk of operative vaginal delivery in the subsequent pregnancy (Table 3) were failed vacuum extraction and prolonged second stage as the indication for operative vaginal delivery. In contrast, persistent occipitoposterior position in the index pregnancy was associated with a lower risk of operative vaginal delivery in the subsequent pregnancy. Factors related to the subsequent pregnancy that conferred an increased risk of repeat operative vaginal delivery (Table 3) were prolonged interval (more than 3 years) between the pregnancies (independent of maternal age), higher fetal weight than in the index pregnancy, persistent occipitoposterior position, and use of epidural analgesia. Of the five women who had at least six of the risk factors (fetal head position other than persistent occipitoposterior and prolonged second stage on the index delivery; epidural block, persistent occipitoposterior position, and higher fetal weight on the subsequent delivery; and time from index deliv-

Table 3. Risk Factors for Repeat Operative Vaginal Delivery for Women With a Previous Operative Vaginal Delivery

	Rate of Repeat OVD With Factor Present	Rate of Repeat OVD With Factor Absent	OR (95% CI)*
Factors relating to index delivery			
Forceps after failed vacuum	11 (9.3)	54 (4.2)	2.8 (1.4–5.8)
Prolonged 2nd stage	42 (6.1)	23 (3.2)	2.1 (1.2–3.6)
Persistent occipitoposterior position	1 (0.7)	64 (5.1)	0.1 (0.02–0.9)
Factors relating to subsequent delivery			
Time from index delivery more than 3 y	4 (9.8)	61 (4.5)	3.8 (1.2–12.5)
Fetal weight higher than in index pregnancy	47 (5.9)	18 (3.0)	2.1 (1.2–3.3)
Persistent occipitoposterior position	6 (37.5)	59 (4.3)	13.8 (4.8–21.2)
Epidural analgesia	47 (6.0)	18 (2.9)	1.8 (1.1–3.3)

OVD, operative vaginal delivery; OR, odds ratio; CI, confidence interval.

Data are n (%) unless otherwise specified.

Maternal age at index or subsequent delivery, labor induction at index or subsequent delivery, nonreassuring fetal heart rate as the indication for operative vaginal delivery at index delivery, epidural analgesia at index delivery, and macrosomia at index delivery (more than 4,000 g) were not significantly associated with increased risk of operative vaginal delivery in subsequent pregnancy.

* Values reflect the results of multivariable logistic regression analysis and are expressed as OR (95% CI) for operative vaginal delivery compared with spontaneous vaginal delivery.



Table 4. Risk Stratification for Repeat Operative Delivery by Risk Factor in the Index and Subsequent Deliveries

Risk Factors	Absent at Both Deliveries	Present Only at Index Delivery	<i>P</i>	Present Only at Subsequent Delivery	Present at Both Deliveries	<i>P</i>
Epidural analgesia	5 (2.8)	13 (3.0)	0.9	5 (6.0)	42 (6.1)	0.9
Persistent occipitoposterior position	58 (4.7)	1 (0.7)	0.01	6 (37.5)	—*	—*
Birth weight more than 4,000 g	63 (5.1)	0 (0.0)	0.04	2 (3.1)	0 (0.0)	0.5

Values reflect rate of operative vaginal delivery and are presented as n (%).

* There were no women with fetal head in the persistent occipitoposterior position at both the index and subsequent deliveries.

ery more than 3 years), the rate of repeat operative vaginal delivery was 60% (three out of five).

We further analyzed the effect of an interpregnancy change in the known risk factors for operative vaginal delivery (ie, epidural analgesia, persistent occipitoposterior position, and fetal macrosomia) on the risk of repeat operative vaginal delivery (Table 4).

The increased risk of repeat operative vaginal delivery associated with the use of epidural analgesia at the subsequent delivery was unrelated to whether or not epidural analgesia was present at the index delivery (6.0% compared with 6.1%, $P=.9$). Similarly, avoidance of epidural analgesia at the subsequent delivery in women who had used epidural analgesia at the index delivery did not lower the risk of repeat operative vaginal delivery compared with women who did not use epidural analgesia at the index delivery (3.0% compared with 2.8%, $P=.9$, Table 4).

Women with persistent occipitoposterior position or fetal macrosomia at the index delivery had a significantly lower rate of repeat operative vaginal delivery compared with those who did not have these risk factors at the index delivery, provided that these risk factors were absent in the subsequent pregnancy (0.7% compared with 4.7%, $P=.01$, and 0% compared with 5.1%, $P=.04$, respectively). In contrast, the presence of persistent occipitoposterior position at the subsequent delivery significantly increased the risk of repeat operative vaginal delivery (37.5%) irrespective of whether or not this risk factor was present at the index delivery (0.7% and 4.7%, respectively, Table 4). With regard to fetal macrosomia, its presence at the subsequent delivery was associated with a higher risk of repeat operative vaginal delivery only if this factor was absent at the index delivery, although differences did not reach statistical significance (3.1% compared with 0%, Table 4).

DISCUSSION

In the present study, we sought to assess outcome and mode of delivery in the second pregnancy of women with a previous operative vaginal delivery. Our main

findings were as follows: 1) Women with a previous operative vaginal delivery are at increased risk of both operative vaginal delivery and cesarean delivery in their subsequent pregnancy and, consequently, a higher rate of perineal and neonatal birth injury. 2) Risk factors for repeat operative vaginal delivery include failed vacuum extraction, prolonged second stage, and fetal head position other than persistent occipitoposterior at the index delivery; prolonged interval between the pregnancies; and higher fetal weight (compared with the index pregnancy), persistent occipitoposterior position, and epidural analgesia at the subsequent delivery. 3) The decrease in the risk of repeat operative vaginal delivery associated with refraining from epidural analgesia in the subsequent pregnancy is unrelated to whether or not epidural analgesia was present at the index delivery.

Our finding that women with a previous operative vaginal delivery are at increased risk of repeat operative vaginal delivery in the subsequent pregnancy is not surprising given that at least some cases of dystocia during the second stage of labor and operative vaginal delivery are associated with maternal intrinsic pelvic factor. However, data supporting this hypothesis are limited. In a previous case-control study, Kadar and Romero³ compared mode of subsequent delivery between primiparous women with previous operative vaginal delivery ($n=149$) and those with spontaneous vaginal delivery ($n=1,258$). The women with a previous operative vaginal delivery were at approximately a sixfold higher risk of operative vaginal delivery owing to dystocia during the second stage of labor at their subsequent delivery (11.2% compared with 2%, $P<.005$).³ More recently, Bahl et al⁴ conducted a prospective cohort study to assess mode of delivery in subsequent pregnancies in women who underwent either operative vaginal delivery ($n=184$) or cesarean delivery ($n=209$) during the second stage of labor in their previous pregnancy. The rate of repeat operative vaginal delivery and cesarean delivery among women with a previous operative vaginal delivery was 7% and 10.6%, respec-



tively. Although this study did not include a control group of women with a previous spontaneous delivery, this rate of repeat operative vaginal delivery is considerably higher than the rate of operative vaginal delivery in our control group of women with a previous spontaneous vaginal delivery (1.2%).

We also found that the risk of repeat operative vaginal delivery increased with respect to the time elapsed from the index pregnancy, independent of maternal age. The reason for this association is not clear. A long interpregnancy interval has been linked to an increased risk of preeclampsia⁷ and adverse perinatal outcome,⁸ but there are no data on its effect on the mode of subsequent delivery. It is possible that women who undergo a more traumatic instrumental delivery, which may be more likely to be associated with maternal pelvic factor and thus a higher risk of repeat operative vaginal delivery, tend to delay future childbirth to a greater extent than do women who have had a less traumatic operative vaginal delivery.

It is reasonable that the likelihood of a subsequent operative vaginal delivery would be decreased when the index operative vaginal delivery was performed in the presence of known, delivery-specific risk factors for operative vaginal delivery, such as epidural analgesia,^{9–11} persistent occipitoposterior position,¹² and macrosomia.¹³ Conversely, the risk of a subsequent operative vaginal delivery is expected to be higher if the index operative vaginal delivery was performed in the absence of these factors, especially if any of them is present at the subsequent delivery. Our findings supported this assumption for persistent occipitoposterior position and fetal macrosomia but not for epidural analgesia. We hypothesized that, in a women who received epidural analgesia at the index delivery, the reason for the operative vaginal delivery might have been insufficient power because of impairment of maternal expulsion efforts¹⁴ rather than intrinsic pelvic factor. Thus, in these cases, operative vaginal delivery would be less likely to recur in the subsequent delivery. Yet, we observed no difference in the rate of subsequent operative vaginal delivery among women who did or did not receive epidural analgesia at the index operative vaginal delivery. It is possible that the relatively small number of women in our cohort who did not use epidural analgesia during the index or subsequent deliveries precluded the detection of such an effect. Another potential explanation is that the relative contribution of epidural analgesia to the risk of dystocia and operative vaginal delivery in the nulliparous women in our study was of small magnitude, as suggested by previous studies.^{15,16}

We have found that the presence of persistent occipitoposterior position at the index delivery (as a delivery-specific risk factor for operative vaginal delivery) is associated with a decreased risk for repeat operative vaginal delivery in the subsequent pregnancy. However, theoretically, this observation may be counterbalanced by the fact that persistent occipitoposterior position in a previous pregnancy is also a risk factor for persistent occipitoposterior position in subsequent pregnancies,¹⁷ which we have shown to be a major risk factor for repeat operative vaginal delivery. Our ability to assess these opposing effects is limited by the fact that, in the current study, there were no women who were diagnosed with persistent occipitoposterior position in both the index and subsequent deliveries. Thus, we conclude that persistent occipitoposterior position in the index pregnancy should be regarded as a protective factor only if this risk factor is absent in the subsequent pregnancy.

In conclusion, the present study indicates that operative vaginal delivery in the first pregnancy is associated with an increased risk of operative vaginal delivery, cesarean delivery, perineal trauma, and neonatal birth injury in the subsequent pregnancy, most likely owing to maternal intrinsic pelvic factors. It should be emphasized, however, that the absolute increase in this risk is relatively small and that most of the women with a previous operative vaginal delivery are likely to undergo a spontaneous, uncomplicated vaginal delivery in the subsequent pregnancy. Nevertheless, several studies of the long-term emotional consequences of instrumental deliveries reported that about half the women who had an operative vaginal delivery in the primary pregnancy expressed fear of undergoing another childbirth,⁴ and this effect persisted for up to 5 years.¹⁸ Considering this emotional effect, risk stratification based on the factors identified in the present study and the change in the status of known risk factors of operative vaginal delivery between the index and subsequent pregnancies may assist clinicians in predicting the likelihood of an operative vaginal delivery in the subsequent pregnancy and in counseling patients accordingly.

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