Results of a Well-Defined Protocol for a Trial of Labor After Prior Cesarean Delivery

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OBJECTIVE: It has been claimed that a trial of labor after cesarean carries higher maternal and fetal risks than planned cesarean delivery. Because the management of such patients in our department differs from that described in some studies, and is perhaps more cautious, we hypothesized that the outcome may be better.

METHODS: We identified women with 1 previous low uterine segment cesarean who had delivered a cephalic singleton infant at gestational age 34 weeks or more from January 2000 through May 2005. Our policy is to encourage such women to undergo a trial of labor unless cesarean delivery is indicated. Unless otherwise indicated, our policy is to wait for spontaneous labor. We do not use prostaglandins, and recommend cesarean delivery if the cervix is unripe.(Bishop score < 6). We compared the outcome between women who underwent a trial of labor and women who underwent planned cesarean delivery.

RESULTS: A trial of labor was attempted by 841 women (80% successful), and 467 underwent planned cesarean delivery. Uterine rupture was observed in 1 woman 18 hours after vaginal delivery. There was no difference in major or minor maternal morbidity. There was no serious neonatal morbidity. Among the planned cesarean patients, hospital stay was longer, and there were more admissions to the neonatal intensive care unit.

CONCLUSION: With our well-defined protocol, a trial of labor after cesarean seems to be as safe for the mother and infant as planned cesarean delivery, and the hospital stay is shorter.

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The overall rate of cesarean delivery in the United States has risen dramatically, from 5% of all deliveries in 1970 to a high of 26% in 2002.[1] A similar pattern has been observed in Israel, with a national rate of cesarean deliveries in 2004 of approximately 20%. A major reason for this increase in the rate of cesarean deliveries is the concomitant dramatic decline in the rate of vaginal birth after cesarean (VBAC). This decline may be attributed to several large reports from the United States showing an increase in the frequency of maternal and perinatal morbidity associated with a trial of labor after cesarean as compared with planned cesarean delivery. In the study by McMahon et al,[2] major maternal complications were almost twice as likely among those whose deliveries were managed with a trial of labor as among those who had undergone an elective cesarean delivery. This was so because the rate of cesarean delivery in the women who attempted a trial of labor was 40%, and major complications were substantially more frequent than for women who had a second cesarean delivery without a trial of labor. Lydon-Rochelle et al,[3] in a population-based, retrospective cohort analysis in Washington State, concluded that for women with 1 prior cesarean delivery, the risk of uterine rupture is higher among those whose labor is induced with either prostaglandins or oxytocin than among those with either spontaneous labor or repeated cesarean delivery without labor. In the study by Landon et al,[4] which reports the results of a prospective cohort study at 19 medical centers belonging to the National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network, the most significant result was that a trial of labor after prior cesarean delivery is associated with greater perinatal risk than is elective repeated cesarean delivery without labor. This was so because the frequency of hypoxic–ischemic encephalopathy was significantly greater among the infants of women who underwent a trial of labor than among women who had elective repeated cesarean delivery.

Because we observed that the management of parturients with previous cesarean delivery in our department differs substantially from that described in the above-mentioned studies, we hypothesized that the maternal and perinatal outcome may also be different, and possibly better, because our approach seems to be more conservative or more cautious. The aim of the present investigation was to assess the risks of maternal and perinatal morbidity associated with a trial of labor as compared with repeated planned cesarean delivery in our institution.

PATIENTS AND METHODS

We performed a retrospective cohort study from January 2000 through May 2005 in our institution, the Bnai Zion Medical Center, a level 3 university hospital mainly serving the urban population of the city of Haifa, Israel. The study was approved by the Institutional Review Board. The annual number of deliveries is approximately 4,500, and the cesarean delivery rate during the study period increased gradually from 17% in the year 2000 to 20.1% in 2004. In our system, the deliveries are conducted by certified midwives, supervised by residents, staff obstetricians, and maternal-fetal medicine specialists. Our service provides full in-house coverage of at least 3 obstetrics and gynecology residents, with staff obstetricians and maternal-fetal medicine specialists either in house or on call. The operating room and neonatal intensive care unit (NICU) are adjacent to the delivery rooms. We also have 24-hour, in-house coverage of a neonatologist, at least 2 anesthesiologists, a blood bank service, and an intensive care unit, as well as readily available consultants from the various departments of the hospital.

Our policy is to encourage all women with a prior single, low-segment cesarean delivery and a singleton cephalic gestation to undergo a trial of labor unless repeated cesarean delivery is indicated. Women are counseled regarding the risks and benefits of a trial of labor compared with elective cesarean delivery. We usually quote a VBAC success rate ranging between 60–80%, the higher figure for women with previous VBAC or previous vaginal delivery, the lower figure for women who had dystocia as the indication for the primary cesarean delivery.[5] Breech presentation, estimated fetal weight of more than 4,000 g, (based on clinical and ultrasonic evaluation), unknown uterine scar, low vertical incision, inverted T incision, or any other uterine scar, as well as the patient's request are considered indications for repeat planned cesarean delivery. In the absence of maternal or fetal indication, our policy is to wait for spontaneous labor or until 42 weeks. Whenever delivery is indicated, we consider induction only in the face of a ripe cervix (Bishop Score > 6), and prefer amniotomy to oxytocin. However, we do not use prostaglandins or Foley catheter, and recommend cesarean delivery if the cervix is unripe. We use oxytocin to augment labor when necessary. (Starting at 1.6 mU/min, with increments of 1.6 mU every 30 minutes until regular contractions, 3–4 per 10 minutes, are achieved or a maximal rate of 20 mU/min is reached.) At admission, all patients are evaluated and examined by an obstetrics and gynecology resident, who assesses whether they comply with our requirements for a trial of labor. Upon admission, 1 unit of packed blood cells is prepared at the blood bank, and intravenous infusion is started. Once in active labor, all patients are on continuous fetal monitoring. Epidural analgesia is provided upon the patient's request. We do not perform routine manual exploration of the uterine cavity after successful VBAC.

The study included all women who had had 1 prior low-segment cesarean delivery and with a singleton pregnancy at 34.0 gestational weeks or more. The medical records for each woman were reviewed by 1 of the authors (V.N.). Demographic data, details of the obstetric history, and information about intrapartum and postpartum events were recorded. Neonatal data were collected up to discharge on all infants who were admitted to the NICU. Maternal and perinatal outcomes were compared between women who had a trial of labor and those who underwent planned repeated cesarean delivery.

Uterine rupture was defined as a disruption or tear of the uterine muscle and visceral peritoneum or a separation of the uterine muscle with extension to the bladder or broad ligament. Uterine dehiscence was defined as a disruption of the uterine muscle with intact serosa. Febrile morbidity was defined as a temperature of 38.0°C or more on at least 2 occasions at least 6 hours apart, excluding the first 24 hours after delivery. Major maternal complication was defined as the occurrence of 1 or more of the following: uterine rupture, hysterectomy, re-laparotomy, operative injury (bladder, bowel, extension of uterine excision to the cervix or to the broad ligament), transfusion of 2 or more units of blood. Minor maternal complications were defined as the occurrence of 1 or more of the following: maternal febrile morbidity, wound infection, uterine scar dehiscence, transfusion of 1 unit of blood.

All analyses were performed using the SPSS 11.5 statistical software (SPSS Inc., Chicago, IL). A χ^2 test (Fisher exact test was used when appropriate) was

used to examine differences between groups in categorical variables, and *t* test (Mann–Whitney test when appropriate) was used for continuous variables. Logistic regression was performed to adjust comparison of morbidity rate for potential confounder or modifier variables. A *P* value less than 0.05 was considered significant.

RESULTS

There were 23,705 births during the study period. Among the 1,376 (5.8%) women who had a singleton gestation and a history of 1 cesarean delivery, 68 were less than 34 weeks and were thus excluded. Of the remaining 1,308 women, 841 (64%) underwent a trial of labor, and 467 (36%) had a planned cesarean delivery. Among women undergoing a trial of labor, labor was induced with oxytocin or amniotomy in 60 (7.1%) parturients and augmented with oxytocin in 128 (15.2%). The indications for planned cesarean delivery were: unknown uterine scar in 30 women (6.4%), postmyomectomy in 6 (1.3%), breech presentation in 76 (16.3%), suspected macrosomia in 89 (19.1%), need for induction with unfavorable cervix in 62 (13.3%), various obstetric indications in 19 (4.1%), maternal request in 177 (37.9%), and other indications in 8 (1.7%). The overall success rate for vaginal delivery was 79.7% (670 of 841 women, 95% confidence interval [CI] 76.9–82.4).

The demographic and perinatal characteristics of women and infants in the 2 groups are presented in Table 1. Compared with women who underwent planned repeated cesarean delivery, women who underwent a trial of labor were more likely to be less than 35 years old, to be of higher parity, and to have a history of prior successful vaginal birth after cesarean. Women undergoing planned cesarean delivery were delivered at an earlier gestational age and were more likely to have 1 or more pregnancy complication.

Maternal complications are presented in Table 2. There was only 1 case of uterine rupture among 841 women who attempted vaginal delivery after cesarean, a rate of 1.2 (95% CI 0–6.6) per 1,000. The rupture was diagnosed 18 hours after successful vaginal delivery. This patient had a normal postdelivery course for approximately 16 hours when she became hypotensive. Hematologic studies showed a fall in hematocrit and ultrasound examination revealed a large hematoma within the left broad ligament in addition to moderate amount of free fluid in the peritoneal cavity. At the laparotomy, a 4-cm-long rupture of the left uterine wall was diagnosed. The uterus was sutured and the patient had an uneventful postoperative course. One patient underwent hysterectomy after planned cesarean delivery due to placenta accreta. Relaparotomy was necessary in 1 woman after planned cesarean delivery and in 2 women after a failed trial of labor. In all 3 cases, the indication for laparotomy was postpartum hemorrhage intractable to conservative management Overall, the rate of major complications was 1.3% (95% CI

Table 1. Demographic and Perinatal Characteristics of Women Undergoing a Trial of Labor or Planned Cesarean Delivery After Prior Cesarean Delivery

Characteristic	Trial of Labor (n = 841)	Planned Repeated Cesarean Delivery (n = 467)	*P*
Maternal age at delivery (y)			.002
< 35	655 (78)	328 (70.2)	
≥ 35	185 (22.0)	139 (29.8)	
Parity			.001
1	486 (57.8)	331 (70.9)	
2	202 (24.0)	79 (16.9)	
≥ 3	153 (18.2)	57 (12.2)	
Gestational age at delivery (wk)			.001
< 37	33 (3.9)	31 (6.6)	
37–41	652 (77.5)	389 (83.3)	
> 41	156 (18.2)	47 (10.1)	
Prior vaginal delivery	355 (42.2)	136 (29.1)	.001
Maternal disease*	51 (6.1)	40 (8.6)	.09
Pregnancy complication†	84 (10.0)	98 (21)	.001
Mean birth weight (g)	3,318 (±416)	3,417 (±590)	.005

Values are n (%) or mean (± standard deviation).

* Maternal disease includes asthma, diabetes, chronic hypertension, thyroid disease, connective tissue disease, renal disease, and seizure disorders.

† Pregnancy complication includes intrauterine growth restriction, oligohydramnios, pregnancy-related hypertensive disorders, gestational diabetes, placenta previa, placental abruption, and cord prolapse.

Table 2. Maternal Complications

Complication	Trial of Labor (n = 841)	Planned Repeated Cesarean Delivery (n = 467)	*P*
Major complication*	15 (1.8)	6 (1.3)	.50
Hysterectomy	0	1	
Relaparotomy	2	1	
Uterine rupture	1	0	
Operative injury†	11	3	
≥ 2 unit blood transfusion	3	2	
Minor complication	45 (5.4)	17 (3.6)	.17
Febrile morbidity	16	11	
Abdominal wound infection	3	3	
1 unit blood transfusion	2	2	
Uterine scar dehiscence	12	5	
Median maternal hospital stay (range)	2 (2–28)	4 (5–25)	<.001
Neonatal ICU admissions	20 (2.4)	20 (4.3)	.06

ICU, intensive care unit.
Values are n or n (%) unless otherwise specified.
* Women with multiple major complications or both minor and major complications were counted only once, as having major complication; those with multiple minor complications were counted only once, as having minor complication.
† Operative injury includes extension of uterine incision to the cervix or broad ligament and bladder and bowel injury.

0.3–2.31) among women undergoing planned cesarean delivery compared with 1.8% (95% CI 0.9–2.7) among women attempting vaginal delivery after cesarean ($P = .50$). In the latter group, all but 2 of the major complications (uterine rupture and transfusion of > 2 units of blood), were associated with failed VBAC. Consequently, all of the operative injuries were diagnosed and treated during the operation. Likewise, the rate of minor complications was similar in the 2 groups. The only significant difference between the 2 groups was shorter hospital stay among women undergoing a trial of labor after cesarean. Nevertheless, for minor complications, logistic regression analysis revealed significant interaction between the group and previous vaginal delivery.($P = .045$) Therefore, we analyzed for each subgroup separately. Only among women without a previous vaginal delivery, a trial of labor after a cesarean was associated with a significantly higher rate of minor complications, compared with planned repeated cesarean delivery, 7.2% compared with 3.6% ($P = .03$, odds ratio 2, 95% CI 1.05–4.04).

There were no neonatal deaths, and none of the infants suffered from hypoxic-ischemic encephalopathy. Admission to the NICU was slightly higher, but with borderline significance, among infants delivered by planned cesarean delivery (4.3% compared with 2.4%, $P = .055$).

Demographic and perinatal characteristics of women who had a successful or failed VBAC are presented in Table 3. Women who had a successful VBAC were of higher parity, were more likely to have had prior vaginal delivery and prior successful VBAC, were more likely to be admitted in active labor, and were less likely to need induction.

DISCUSSION

Our data indicate that with proper patient selection and a well-defined management protocol, a trial of labor after a single low transverse cesarean delivery is associated with a very low rate of major complications and seems as safe for the mother and newborn as planned cesarean delivery. Moreover, it is associated with a shorter maternal hospital stay and possibly fewer admissions to the NICU. The main concern regarding a trial of labor after cesarean is related to the risk of uterine rupture and its consequences for the mother and infant.[6] In the study by Landon et al[4] the rate of uterine rupture was 0.72%. Seven of the 12 cases of neonatal hypoxic-ischemic encephalopathy followed uterine rupture, a rate of 0.46 per 1,000 trials of labor. It is therefore obvious that to decrease the risk of a trial of labor after cesarean, measures must be taken to reduce the risk of uterine rupture. Several studies have shown that the risk of uterine rupture is increased with the induction of labor.[3,4] Likewise, it has been well established that the risk of uterine rupture increases with increasing number of previous cesarean deliveries.[7–9] Yet, in the large multicenter study by Landon et al,[4] 26% of the women undergoing a trial of labor after cesarean were induced with prostaglandins or oxytocin or both, and an additional 33.6% had labor augmented with oxytocin. Moreover, 5.4% of the women undergoing a trial of labor had more than 1 previous cesarean delivery.

In the present study, there was only 1 case of

Table 3. Demographic and Perinatal Characteristics of Women Who Had a Successful or Failed Vaginal Birth After Cesarean

Characteristic	Failed VBAC (n = 171*)	Successful VBAC (n = 670†)	*P*
Maternal age at delivery (y)			.90
< 35	134 (78.4)	521 (77.9)	
≥ 35	37 (21.6)	148 (22.1)	
Parity			.001
1	138 (80.7)	348 (51.9)	
2	19 (11.1)	183 (27.3)	
≥ 3	14 (8.2)	139 (20.7)	
Prior vaginal delivery	33 (19.3)	322 (48.1)	.001
Prior successful VBAC	16 (9.4)	234 (35.7)	.001
Status on admission			.001
Latent phase	78 (48.1)	165 (24.7)	
Active phase	50 (30.9)	389 (58.2)	
Rupture of membranes	15 (9.3)	73 (10.9)	
Induction	19 (11.7)	41 (6.1)	

VBAC, vaginal birth after cesarean.
Values are n (%).
* Data missing for 9 women.
† Data missing for 2 women.

uterine rupture among 841 women who attempted vaginal delivery after cesarean, a rate of 1.2 per 1,000, significantly lower than in Landon's study ($P < .04$).[4] There were no neonatal consequences associated with this rupture and hysterectomy was not necessary. Overall, the rates of major and minor complications were low, and no statistically or clinically significant differences were observed between the 2 groups.

The results of our study demonstrate that by limiting a trial of labor after cesarean to women with a singleton cephalic, nonmacrosomic fetus and a previous single, lower segment uterine incision, and by avoiding induction of labor in women with unfavorable cervix, the risk for uterine rupture can be markedly reduced, rendering the option of a trial of labor after cesarean to be a safe option, for both mother and infant. By waiting for the spontaneous onset of labor, not only is the risk for uterine rupture decreased but also the rate of successful VBAC is increased (Table 3). For women who wish to have larger families, the advantage of a trial of labor may be even more apparent, because multiple cesarean deliveries are associated with a higher rate of complications compared with a second cesarean delivery.[10–11] Moreover, we have shown that a trial of labor after cesarean is associated with a significant reduction in maternal hospital stay. Indeed, our stringent patient selection reduces the number of women eligible for a trial of labor after cesarean; nevertheless, when the legitimacy of a trial of labor after cesarean is at stake, a limited number of trials of labor in a selected population seems to be preferable to utterly banning a trial of labor after cesarean to all.

We recognize that our study has 2 limitations: first, because it is a retrospective study, it is nonrandomized. Second, the number of patients is relatively small. However, with power of about 80%, the sample size was able to detect 3- and 2-fold increase in the rate of major and minor complications, corresponding with differences of only 2.5% and 3.6%, respectively. Nevertheless, we believe that our results are relevant, because they describe the outcome associated with the implementation of a well-defined, strict management protocol in a single institution, with almost no deviation from that protocol.

In conclusion, we have shown that with our well-defined protocol, a trial of labor after cesarean seems to be as safe for the mother and infant as planned cesarean delivery and is associated with a shorter hospital stay. We encourage others to evaluate our approach further and hope that if larger studies do corroborate our results, the dictum "once a cesarean always a cesarean" will continue to be a thing of the past.

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