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Prior cesarean section—An acceptable risk for vaginal delivery at free-standing midwife-led birth centers? Results of the analysis of vaginal birth after cesarean section (VBAC) in German birth centers

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ABSTRACT

Objectives: Is out-of-hospital vaginal birth at a birth center safe for women with a previous cesarean section? Do their maternal or neonatal outcomes vary significantly from those of a “non-cesarean” control group?

Study design: Retrospective evaluation of prospectively collected data on documented singleton births (cephalic presentation, >34/0 weeks of gestation), all of which were second births, occurring between 2000 and 2004 in 1 of 80 German birth centers. Births that occurred in the birth center or when labor had started in the birth center prior to transfer were included for analysis.

Results: Three hundred and sixty four women (5.3%) had a previous cesarean. The control group included 6448 parae II with no previous cesarean. Significant differences ($p < 0.05$) between these two groups included: the transfer rate of mothers from a birth center to a hospital clinic during labor, the number of emergency transfers, the method of delivery (repeat cesarean), and the Apgar score at 5 min ≤ 7 .

Conclusions: At best, vaginal birth after cesarean (VBAC) is possible at a birth center if good cooperation exists with an emergency birth clinic near the birth center, allowing for a responsible and timely transfer to this hospital. Because serious maternal and neonatal complications are rare, further continuous observational studies with larger sets of data are necessary to determine safety of free-standing birth center care for women having VBAC.

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1. Introduction

More than a quarter of all births end in cesarean section in industrialized countries such as the United States (2004: 27%) and Germany (2003: 25.5%). A significant number of these operations are repeat cesareans. The question of whether a birth following a previous cesarean should also be delivered via cesarean section has been a controversial topic among experts for decades. The tenet “once a cesarean, always a cesarean” has been repeated frequently. However, recently there has been a move towards encouraging VBAC [1]. Considerations of the risks involved in a repeat cesarean and the

low probability of rupture of the uterine scar, as well as heightened awareness of this risk, have contributed to recommendations for VBAC to occur in modern hospitals with sufficient diagnostic and especially therapeutic resources to deal with high-risk pregnancy.

However, some women with previous cesareans have expressed a desire for out-of-hospital birth, for example at a birth center, where the diagnostic and therapeutic resources are limited. For the most part, women requesting out-of-hospital births have been prescreened and classified as low risk thereby excluding women with previous cesarean birth.

Lieberman et al. [2] found that in the U.S. a small, but constant demand exists for out-of-hospital delivery with previous cesarean, although there are no sufficiently strong and relevant data on this topic. The situation in Western Europe, particularly in Germany, is similar.

This study intends to answer the question of whether the maternal or neonatal outcomes for women giving birth after

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previous cesarean vary significantly from those of a “non-cesarean” control group and whether an out-of-hospital birth is safe for women with a previous cesarean. We will also compare our results with those of the *U.S. National Study of Vaginal Birth After Cesarean in Birth Centers* (Lieberman et al. [2]).

2. Materials and methods

The study was based on raw data sets on out-of-hospital births in Germany between the years 2000 and 2004 that were provided by the QUAG e.V. (Society for Quality in Out-of-Hospital Obstetrics) and the ZQ Hannover (Center for Quality and Management in Health Care at the Medical Chamber of Lower Saxony). Since 1999, all midwives practicing out-of-hospital have been required by German law to participate in quality audits. The current database includes more than 60,000 documented births.

The only data sets included in this study were documented singleton births (cephalic presentation >34/0 weeks of gestation), all of which were second births in a select group of women birthing or starting labor, in 1 of 80 German free-standing birth centers during the 5-year period cited above. Around 85% of all free-standing German birth centers gave permission to take part in the study.

The target group of the study included all second births to mothers with a previous cesarean. Women were not accepted for VBAC in the birth centers if they presented with other than a Pfannenstiel scar, a history of preterm birth, an unusual position of placenta, more than one previous c-section, or any other pregnancy complication. The control group included all second births to mothers with no previous cesarean delivery in their medical history.

A small number of data sets (<0.5%) lacked data or had faulty data on individual variables. These sets were not excluded from the overall evaluation, but the variables in question were invalidated. All data sets used were verified for validity and reliability at the ZQ Hannover. The following obstetrical parameters were analyzed and compared between the two groups: age of the mothers at delivery, number of women transferred to hospital either during or after delivery, reasons for the transfer, number of so-called emergency transfers to hospital, time lapsed between admission to the hospital and delivery, method of delivery, indications for cesarean deliveries, weight and size of the newborn, Apgar scores, number of newborns transferred to a NICU, and the corresponding reasons for the transfer, infant and maternal mortality, number of uterine ruptures.

Table 1

Parameters without significant difference ($p \geq 0.05$).

	S. p. cesarean	History without cesarean	p-Value
Maternal age (median)	33 years	32 years	0.843
Previous pregnancies			
1	71.2%	73%	0.947
2	19.2	18.6	
≥3	9.6	8.4	
Neonatal length (median)	52 cm	52 cm	0.946
Neonatal weight (median)	3,600 g	3,600 g	0.632
Maternal mortality	0	0	0.812
Neonatal mortality	0	0.2%	0.410
Neonatal transfer to NICU	1.9%	1.7%	0.722
Total transfer rate mothers post-partum	4.1%	2.5%	0.058
Apgar score 5 min p.n. 0–7	1.7%	1.0%	0.277
Apgar score 10 min p.n. 0–7	0.8%	0.4%	0.213
Gestation at birth 34 to			
<37	0.8%	0.8%	0.202
37–42	97.0	98.0	
>42	2.2	1.1	

2.1. Statistics

The evaluation was conducted as a 2-group comparison between the two groups. The SPSS 11.5 software package was used for evaluating the data. We used Fisher's exact test to calculate probabilities of error in 2×2 contingency tables and the chi-squared test for larger contingency tables. The Mann–Whitney rank sum test was used to compare ranking variables from two independent groups; the Kruskal–Wallis test was used for comparing more than two groups. Computed p -values were reported. We considered a p -value of <0.05 as being significant. A stepwise logistical regression was conducted to assess the risk of cesarean delivery.

3. Results

A total of 6812 deliveries were able to be included in the retrospective evaluation; of these, 364 (5.3%) parae II had undergone a previous cesarean section. As a result, the control group included the remaining 6448 women with no previous cesarean section in their case history.

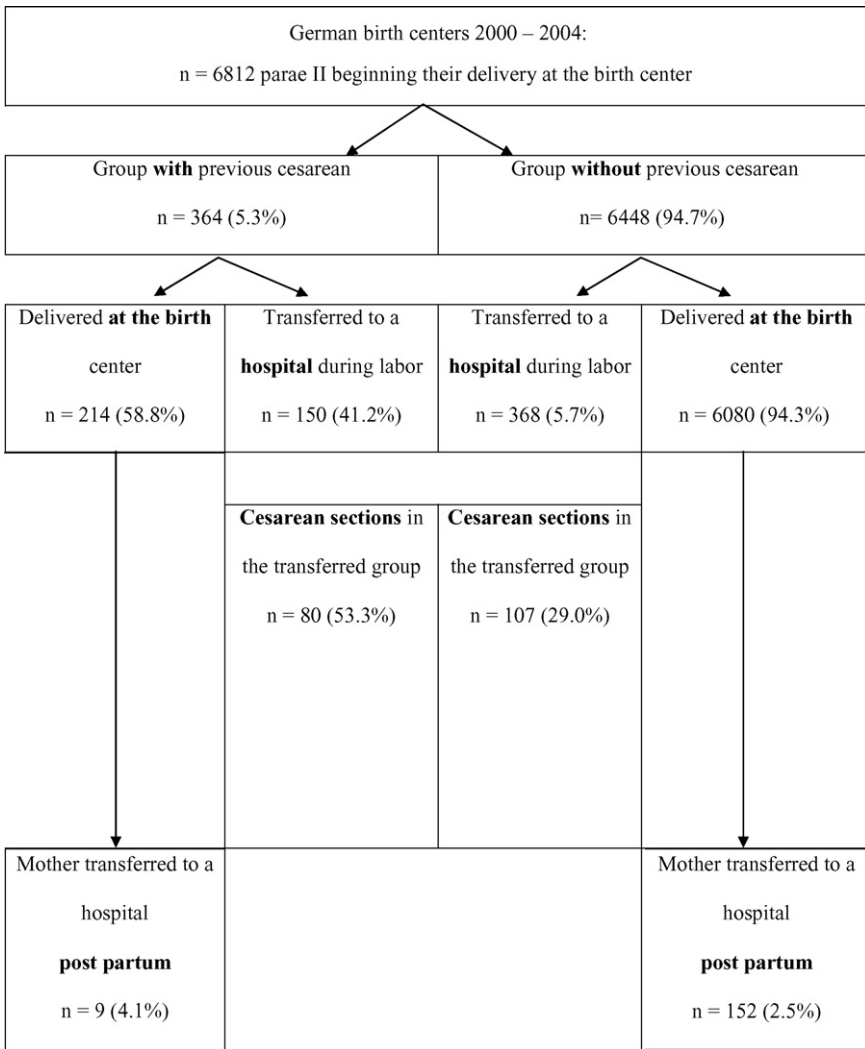
At the preset significance level ($p < 0.05$) the basic data, such as age of the mother, number of previous pregnancies, gestation at delivery, size and weight of the newborn at birth, were not statistically different. Likewise, the values for maternal mortality (0 in both groups), infant mortality (cesarean vs. control group: 0% vs. 0.2%), the total transfer rate for infants to a NICU, and the post-partum transfer rate for mothers from the birth center to a hospital showed no significant differences.

In comparing infant conditions, as characterized by the Apgar score, there were no significant differences between 5-min and 10-min Apgar scores ≤ 7 (Table 1).

Within the previous cesarean group there were no uterine ruptures, laparotomies due to birth complications, or peripartum hysterectomies. In one case, the threat of a uterine rupture was recorded as the reason for transfer to hospital and indication for cesarean procedure; however, vaginal delivery was achieved by vacuum extraction.

In both groups, the three most common reasons for transferring the mother from a birth center to hospital were (with the possibility of more than one reason being named): (1) labor arrest in the dilatation or expulsion period, (2) high-fetal station, (3) pathological cardiotocography or auscultatory abnormal fetal heart rate. Intrapartum monitoring in the birth centers consists of regular auscultation with the combined use of Pinard and

Table 2
Group composition—percentage of transfers.



Doptone in over 98%. Fetal cardiotocogram is frequently used at least as an admission test. Table 2 gives an overview of the number of transferred mothers and cesarean deliveries in both groups. Table 3 shows the nine parameters with significant differences between both groups. These include the maternal transfer rate, the delivery mode, and the postnatal condition of the newborn. The clinical relevance of this result will be discussed below.

Women transferred in labor by ambulance (as a possible indication of an emergency situation) from a birth center to

hospital are considered to be an especially high-risk group. The number of cesarean deliveries was not significantly different among these two groups (previous cesarean versus no previous cesarean) (Table 4). Practically all birth centers are collaborating with a hospital maternity unit not further away than 10 km. Usually, the receiving hospital will be notified by phone of the imminent arrival of a laboring woman.

For a woman in the target group, who delivered her first child by cesarean, the stepwise logistical regression resulted in an 8-fold

Table 3
Significant results ($p < 0.05$) in the evaluation of birth center data, 2000–2004.

Parameters	Group with previous cesarean (%) [n = 364]	Control group (all other parae II) (%) [n = 6448]	p-Value
Maternal transfer rate to a hospital during labor	41.2 [150]	5.7 [366]	0.000
Maternal transfer rate to a hospital post-partum due to birth injuries	2.5 [9]	0.5 [34]	0.000
Emergency maternal transfer to a hospital during labor	2.7 [10]	0.9 [55]	0.002
Delivery within 1 h of arrival at hospital following transfer	9.3 [10]	20.1 [57]	0.007
Delivery mode: (repeat) cesarean, both groups	22.3 [80]	1.7 [106]	0.000
Delivery mode: spontaneous delivery, both groups	73.5 [264]	97.9 [6285]	0.000
Delivery mode: cesarean, women transferred to a hospital	53.3 [80]	29.0 [106]	0.000
Delivery mode: spontaneous delivery, women transferred to a hospital	36.7 [55]	63.4 [232]	0.000
Apgar score, 1 min p.n. <7	8.1 [29]	5.1 [326]	0.020

Table 4

Mode of delivery in relation to arrival of the mother at the hospital.

Transfer via emergency ambulance	Previous cesarean	Vaginal delivery (n/%)	Cesarean delivery (n/%)
Yes	Yes	5/17.9	5/13.5
	No	23/82.1	32/86.5
No	Yes	75/47.5	65/22.2
	No	83/52.5	228/77.8

higher risk of delivering her second child by cesarean when compared to a woman with no previous cesarean. Likewise, an 8-fold higher risk was associated with labor arrest during the dilatation or expulsion period of labor; in cases of cephalo-pelvic disproportion, the probability of delivery by cesarean or repeat cesarean increased by 34-fold; in cases of high-fetal station it increased by 55-fold.

4. Discussion

The aim of our study is to collect and analyze the data on the birth outcomes for those women with a previous cesarean, who chose vaginal birth in a birth center in consultation with their midwife. The only study that addresses this same issue, though with different methods (prospective, no control group), is a U.S. study by Lieberman et al. [2]; it tracked 1453 births to women who sought a *midwife-supported vaginal birth after cesarean* (VBAC) at an American birth center. Albers [3] had a critical look at the design and the results of this study.

In our study the transfer rate for women from a birth center to a hospital clinic during labor was 6-fold higher for the previous cesarean group than for the control group of women with no previous cesarean. Out of 1453 women in the American group from Lieberman et al. [2], 347 were transferred during labor, corresponding to a rate of 24%, or an order of magnitude similar to that of our German group. The higher transfer rate may be due to extra vigilance by midwives who are unaccustomed to caring for women having VBAC in a free-standing birth center. In the case of women with previous cesareans, the midwives apparently paid special attention to any signs of pathological developments during labor. This would also certainly explain the 3-fold higher rate of so-called emergency transfers to a birth clinic.

The overall low number of emergency transfers from a birth center to a hospital reflects a broad risk-selection. That these transfers are not necessarily obstetric emergencies requiring immediate action is demonstrated by the fact that only half of the women requiring transfer in the previous cesarean group were delivered within 1 h of their arrival at the hospital compared to the control group.

Overall, the main reasons for transfer to the hospital clinic in Lieberman et al. [2] were: labor arrest and abnormal fetal heart rate (suspicious cardiotocography, auscultation); these indications were ranked 1 and 3 in the list of indications for the group under investigation in this study. Among our previous cesarean group there was only one emergency transfer due to suspected imminent uterine rupture, though in the end, no uterine rupture actually occurred. According to Lieberman et al. [2] the probability of this type of event is 0.4%, while Fang und Zelop [4] found a probability of 0.62% in their review and Gonen et al. [5] cited rupture rates of 0.35 and 0.11%. The rate of 1.5% uterine ruptures mentioned in the prospective Dutch study by Kwee et al. [6] is possibly high due to the use of prostaglandins and oxytocin for the induction of labor. Neither drug was used in the German birth centers before or during the birth phases in this

study population. The number of deliveries that we evaluated was too small to establish probability of a rupture event; in other words, the suspected uterine rupture in the woman with a previous cesarean was simply a rare event that clearly falls within a range far below 1%.

While the rate of cesarean in our birth center group of women with previous cesarean was 13 times higher than in our group of parae II with no previous cesarean (22.3% vs. 1.7%), the overall percentage of spontaneous births was still 73.5%. Other studies had similar results: according to the same study by Lieberman et al. [2] cited above, the overall vaginal birth rate was 87%. In their review, Fang and Zelop [4] report a success rate for vaginal births with previous cesarean of 60–80%. This is further supported by other retrospective (Neuhaus et al., 86%) [7] as well as prospective studies (Gonen et al., 80%) [5]. This demonstrates that the attempt at a spontaneous birth even with a previous cesarean is worthwhile and safe. On the question of how best to decide the method of delivery for women with previous cesarean, Paré et al. [8] have recently published the results of an interesting mathematical model. A distinction was made between women who plan only one future pregnancy or multiple future pregnancies. The corresponding success rates for vaginal deliveries with previous cesarean, as well as the risks of uterine rupture, placenta disorders, and hysterectomy, were taken from the available literature. It was shown that for women wishing to continue having children following an initial cesarean section, vaginal birth after previous cesarean should play a role in the consultation and decision-making process, because it results in a lower cumulative hysterectomy rate compared to women undergoing elective repeat cesareans [8].

The 5-min Apgar score plays a special role in the clinical characterization of the post-natal condition of newborns. In our previous cesarean group the percentage of these values between 0 and 7 (and including 7) was 1.7% and thus not significantly different than the percentage for our control group with no previous cesarean (1%). Lieberman et al. [2] cite a frequency of 1% for 5-min Apgar scores <7. It is interesting to note that the percentage of newborns transferred to NICU was higher in the control group with no previous cesarean in their case history than in the group with previous cesarean.

Following delivery at the birth center a significantly higher percentage of women with previous cesarean were transferred to hospital for treatment of birth canal injuries compared to women with no previous cesarean (2.5% vs. 0.5%). Lieberman et al. [2] cite a post-partum maternal total transfer rate of 3.8%; in our group of parae II with previous cesarean this rate was 4.1%.

In general, midwives tend to advice women with previous cesarean to seek medical advice, since this seems to be the only way to explain the overall very low percentage (5.3%) of second births with previous cesarean in the birth center group with a cesarean rate in Germany of 19% (1998) and 25% (2003) (www.gb-bund.de). The available data do not reveal whether midwives make a selection at the introductory meeting during a pregnancy or the women decide to go to the hospital first according to the doctor's recommendation.

Following the U.S. results, Lieberman et al. [2] have recommended that the birth center should refer all women with previous cesarean to a hospital. On the basis of the available data on German birth centers, we cannot support Lieberman's conclusion or soundly refute it. We also refer to the notes by Albers [3] to the American VBAC study. This will require further observational studies with considerably larger data sets.

It is, however, certain that the rare but present risks of uterine rupture during labor and complications associated with separation of the placenta can only be adequately addressed if a clinical setting is in place that allows for a sufficiently rapid reaction to reduce the risk of injury to the mother or child. From our point of view, safe delivery at a birth center is only possible in principle if a close working relationship and good cooperation exists with a hospital near the birth center that is equipped to handle birth emergencies; this allows for a responsible and timely transfer to the hospital without placing the mother and child at risk of residual complications, such as uterine rupture or complications associated with separation of the placenta.

References

- [1] Mercer BM, Gilbert S, Landon MB, et al. Labor outcomes with increasing number of prior vaginal births after cesarean delivery. *Obstet Gynecol* 2008;111:285–91.
- [2] Lieberman E, Ernst EK, Rooks JP, Stapleton S, Flamm B. Results of the national study of vaginal birth after cesarean in birth centers. *Obstet Gynecol* 2004;104:933–42.
- [3] Albers LL. Safety of VBACs in birth centers: choices and risks. *Birth* 2005;32:229–30.
- [4] Fang YMV, Zelop CM. Assessing maternal and perinatal risks—contemporary management. *Clin Obstet Gynecol* 2006;49:147–53.
- [5] Gonen R, Nisenblat V, Barak S, Tamir A, Gonen O. Results of a well-defined protocol for trial of labor after prior cesarean delivery. *Obstet Gynecol* 2006;107:240–5.
- [6] Kwee A, Bots ML, Visser GHA, Bruinse HW. Obstetric management and outcome of pregnancy in women with a history of cesarean section in the Netherlands. *Eur J Obst Gynecol Reprod Biol* 2007;132:171–6.
- [7] Neuhaus W, Bauerschmitz G, Göhring U, Schmidt T, Bolte A. Das Risiko der Uterusruptur nach vorausgegangenem Kaiserschnitt—eine Analyse von 1086 Geburten [The risk of uterus rupture after previous cesarean—an analysis of 1086 births]. *Zentralbl Gynakol* 2001;123:148–52.
- [8] Paré E, Quinones JN, Macones GA. Vaginal birth after cesarean section versus elective repeat cesarean section: assessment of maternal downstream health outcomes. *Br J Obstet Gynaecol* 2006;113:75–85.