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Maternal and neonatal outcome after vaginal breech delivery at term after cesarean section – a prospective cohort study of the Frankfurt breech at term cohort (FRABAT)[★]



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ABSTRACT

Objective: To compare the neonatal and maternal outcomes as well as the mode of delivery of intended vaginal breech deliveries in women with a prior cesarean section to primiparous patients.

Study Design: The prospective monocenter cohort study was conducted among 604 women who presented for an intended vaginal singleton breech delivery at term between January 2007 and December 2016.

Results: Out of 37 women with a prior cesarean 19 had a successful vaginal delivery. 344 of 567 primiparous women had a successful vaginal delivery. Neonatal morbidity and mortality as well as maternal outcome were not significantly different in successful vaginal deliveries of women with prior cesarean compared to primiparous patients. The cesarean section rate was not significantly higher in the group of women with a prior cesarean (49%) compared to the group of primipara (39%).

Conclusion: A prior cesarean should not be taken as an exclusion criterion for a planned vaginal delivery out of a breech presentation at term. Large multicenter, case-controlled studies are necessary to implement international guidelines.

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Introduction

Breech presentation occurs in up to 4% of pregnancies at term [1]. Worldwide, a substantial number of expectant mothers seek expert counseling regarding the optimal mode of delivery. In the previous years, many authors underlined the safety of the vaginal breech birth; several trials in high-resource countries reported little difference in neonatal mortality and morbidity comparing vaginal deliveries versus cesarean sections [2–6]. Stringent selection criteria for patients, expertise of obstetricians and an upright birth position were identified as crucial for a successful and safe clinical management [7]. Nevertheless, many providers still do not feel comfortable with a vaginal breech delivery and would always recommend an elective abdominal delivery since they lack profound clinical expertise in this arena.

Cesarean sections cause short- and long-term health effects for women and children, e.g. increased rates of uterine rupture, hemorrhage and abnormal placentation as well as autoimmune disorders [8–13]. Despite these data, the worldwide cesarean section numbers have dramatically increased during the last 30 years. In 2015 alone, nearly 30 million cesarean sections were counted [14]. Considering the individual and societal burden of the associated adverse outcomes, the performance of medically not required cesarean sections has to be limited.

For patients with a fetal breech presentation at term and prior cesarean section, the majority of obstetricians would recommend a planned cesarean section – a clinical decision that is not underpinned by substantial evidence. International guidelines state that a vaginal delivery after a prior cesarean for a cephalic lie is associated with a low complication rate when women are selected carefully [15,16]. Hence, we hypothesize that a vaginal delivery of a breech baby after a prior cesarean section will not create significant morbidity or mortality for the neonate and the mother. Therefore, the aims of this prospective cohort study were to analyze (1) the neonatal short-term complications, (2) the maternal outcome and (3) the mode of delivery of intended vaginal breech births at term in primiparous women compared to patients, who underwent a prior cesarean section.

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Materials and Methods

This prospective cohort study was performed at the Goethe University hospital in Frankfurt, Germany. Between January 2007 and December 2016, 1,425 women expected a singleton in breech presentation at term (> 37 weeks of gestation). 456 patients were excluded due to a planned cesarean section. 365 patients met exclusion criteria such as an estimated fetal weight under 2,500 g or exceeding 4,500 g, intrauterine growth retardation, uterine malformation and multiparity for women without a prior cesarean section. The study sample included 604 women, who intended a vaginal delivery and met our inclusion criteria (e.g. minimum estimated fetal weight of 2,500 g, nulliparity or pregnancy after a cesarean section and an adequate pelvis with an obstetrical conjugate greater than 12 cm and an intertuberous distance greater than 11 cm). The examined patient cohort – the FRABAT cohort – has been previously described by Jennewein et al. [17].

The Goethe University Ethics Committee approved the study (Internal Reference Number: 420/11). No special consent of the patients was needed because the study was embedded in our routine patient care and did not require additional treatment or documentation. We collected all relevant information from the patients' charts or the State Database, the 'Perinatalerhebung Hessen', after the patients were discharged.

For study purposes, the demographic variables of mothers and newborns were obtained, e.g. Body Mass Index (BMI), patient age at birth, epidural anesthesia, weeks of gestation at delivery as well as the head circumference and weight of the infant. We defined "neonatal morbidity" and "neonatal mortality" as primary outcomes, which were measured by APGAR scores, neonatal death, intubation and admission to the neonatal intensive care unit (NICU) after delivery. Secondary outcomes were mode of delivery ("spontaneous breech birth" or "birth by cesarean section during labor") as well as maternal morbidity such as birth injuries. We compared all outcomes in intended vaginal breech delivery at term of (1) primiparous patients to (2) patients after prior cesarean section.

Clinical counseling and management of patients intending breech delivery followed a highly standardized protocol. Between 34 to 36 weeks of gestation, all women with a singleton breech baby received counseling about delivery options. A vaginal approach was offered to women with a breech singleton at term with an estimated gestational weight over 2,500 grams. Also, a pelvic MRI was performed in primiparous women and patients after cesarean section and no vaginal birth.

An experienced Maternal-Fetal Medicine board-certified obstetrician was attending all breech births. The preferred birth position was in an upright position since Louwen et al. found a significant better neonatal and maternal outcome in this position [7]. In rare cases, the obstetrician in charge turned the mother on the back to perform assisted delivery maneuvers. All birth positions were included in this study. We performed a cesarean section in the following clinical scenarios: non-reassuring or ominous fetal heart tone tracing, arrest of labor during first or second stage of delivery or maternal exhaustion.

Statistical analysis

All statistical analysis was performed using JMP software (SAS Institute, Cary, USA). In cases of steady value scales (e.g. age, BMI) mean and standard deviation were calculated and the t-test was used to compare both groups. Differences of characteristics between two groups were analyzed using the Pearson χ^2 test and the Fisher's Exact test. Due to the different group sizes an additional analysis was performed with a subgroup of automatically and randomly chosen women from the group of Primipara in order to compare equal sample sizes.

Results

567 primiparous (PP) and 37 patients with a prior cesarean (PC) – a total of 604 women – intended a vaginal breech delivery and were included in this analysis. Demographic baseline characteristics such as week of gestation (39.6 weeks in PP versus 39.5 weeks in PC, $p: 0.7$ as well as BMIs (23.0 in PP versus 23.4 in PC, $p: 0.6$) differed not significantly between both groups. Expectant mothers showed significant differences in age, mean age in the PP group was 32 ± 4 versus 35 ± 6 in the PC group ($p: 0.005$). Also, the characteristics of the neonates were similar in the two groups, e.g. birth weight (3,323 g in PP versus 3,369 g in PC, $p: 0.54$), or neonatal head circumference (35.6 cm in PP versus 35.5 cm in PC, $p: 0.81$). The frank breech was the most frequent breech presentation in both groups (351, 61.2% in PP versus 17, 46.0% in PC) (Table 1).

Primary outcome: neonatal outcomes

Comparing the neonatal outcomes for all successful vaginal deliveries in both groups (Table 2), there were no significant differences regarding the rates of 5minutes APGAR below 4 (PC: 5.3%, PP: 0.87%, $p: 0.19$), fetal birth injuries (PC: 5.3%, PP: 2.0%,

Table 1
Intended vaginal deliveries out of a breech position at term, demographics, women with a prior cesarean vs Primipara.

Characteristics	Prior cesarean (n=37)	Primipara (n=567)	P-Value
Age (mean, Std Dev ¹)	35 (± 6)	32 (± 4)	0.005
BMI ² (mean, Std Dev ¹)	23.4 (± 4.6)	23.0 (± 3.6)	0.6
Parity			
1 (this pregnancy)	0	567 (100 %)	
>1	37 (100%)	0	
Gestational week at birth (mean, Std Dev ¹)	39.5 (± 1.5)	39.6 (± 1.2)	0.7
Birth weight in grams (mean, Std Dev ¹)	3,369 (± 441)	3,323 (± 408)	0.54
Head circumference in cm (mean, Std Dev ¹)	35.5	35.6	0.81
Type of breech			0.36
Frank	17 (46.0%)	351 (61.2%)	
Complete	4 (10.8%)	33 (5.8%)	
Incomplete	6 (16.2%)	55 (9.7%)	
Footling	3 (8.1%)	25 (4.4%)	
Oblique lie	0	2 (0.4%)	
Missing data	7 (18.9%)	101 (17.8%)	

¹standard deviation.

²body mass index.

Table 2
Intended vaginal deliveries out of a breech position at term, fetal outcome, women with a prior cesarean vs Primipara.

Fetal Outcome	Prior cesarean (n=19)	Vaginal delivery (Primipara, n=344)	P-Value	Odds Ratio
APGAR 5 ^c			0.18	
<4	1 (5.3%)	3 (0.87%)		
4 < 7	0	4 (1.2%)		
NICU ¹	4 (21.1%)	10 (2.9%)	0.002	
>4 days	1 (5.3%)	3 (0.9%)		
up to 4 days	3 (15.8%)	7 (2.0%)		
Intubation > 24h	0	1 (1.2%)	1.0	
Short time problems with breathing, bradycardia	3 (15.8%)	16 (4.7%)	0.1	
Neurologic deficits	0	4 (1.2%)	1.0	
Perinatal asphyxia	1 (5.3%)	8 (2.3%)	0.39	
Birth defects	1 (5.3%)	7 (2.0%)	0.35	
Chorioamnionitis	1 (5.3%)	14 (4.1%)	0.35	
Premoda	2 (10.5%) ^b	17 (4.9%) ^c	0.26	2.26
Premoda related to delivery mode ^a	1 (5.3%)	9 (2.6%)	0.42	2.07

¹neonatal intensive care unit.^aExcluded because morbidity criteria applied but the causes were not potentially related to delivery mode: 13 cases of amniochorionitis, 1 case of extensive hyperbilirubinemia, 1 case of spontaneous pneumothorax after birth, 1 case of G6DPH deficiency, 2 cases of hypoglycemia; all children were discharged in good general health condition.^b1 case of perinatal asphyxia; all children were discharged in good general health condition.^c6 cases of perinatal asphyxia, 11 cases of problems adapting after birth, 1 case of clavícula fracture after assisted delivery of arms, 2 cases of plexus paralysis after assisted delivery of arms, 2 cases of spontaneous pneumothorax after birth, 1 case of reanimation after emergency cesarean; all children were discharged in good general health condition.**Table 3**
Reasons for cesarean during labor, women with a prior cesarean vs Primipara.

Reasons for cesarean during labour	Prior cesarean	Primipara	P-Value
Cesarean delivery	18 (49%)	223 (39%)	0.30
Maternal wish	2 (11%)	13 (5.8%)	0.31
Delay in stage 1	6 (33%)	79 (37%)	1.0
Delay in stage 2	4 (22%)	66 (30%)	0.6
Abnormal electronic fetal monitoring	8 (44%)	81 (37%)	0.61
Placental reason	1 (5%)	1 (1.4%)	0.27
Cord prolapse	1 (5%)	5 (2.3%)	0.38
Uterine rupture	0	0	1.0
Maternal reason	0	3 (1.4%)	1.0
Other perceived cephalopelvic disproportion	2 (11%)	7 (3.2%)	0.14
Chorioamnionitis	0	8 (3.6%)	1.0
Other fetal reason	1 (5.6%)	1 (0.5%)	0.15

Table 4
Vaginal deliveries out of a breech position at term, maternal outcome, women with a prior cesarean vs Primipara.

Maternal Outcome	Prior cesarean (n=19)	Primipara (n=344)	P-Value	Odds Ratio
Perineal Injury I ^o	7 (36.8%)	104 (30%)	0.61	1.35
Perineal Injury II ^o	3 (15.8%)	70 (20.4%)	0.78	0.73
Perineal Injury III ^o /IV ^o	0	8 (2.3%)	1.0	0
Episiotomy	0	13 (3.8%)	1.0	0
Other injuries	5 (26.3%)	138 (40.2%)	0.34	0.53
No birth injury	6 (31.6%)	61 (17.8%)	0.14	2.13

$p=0.35$) and perinatal asphyxia (PC: 5.3%, PP: 2.3%, $p=0.39$). Moreover, there was no significant difference for neurological abnormalities (PC: 0, PP: 1.2%, $p=1.0$) or short time breathing problems or bradycardia (PC: 15.8%, PP: 4.7%, $p=0.1$). Regarding neonatal intensive care unit (NICU) admission, we found a significant difference. 5.3% of the babies delivered by PC mothers versus 0.87% of PP mothers ($p=0.002$) stayed on our NICU more than 4 days. No neonatal death was documented.

To further refine our mortality and morbidity analysis, a modified PREMOMA Score applied [3]. Neonates who met at least one of the following criteria were defined as cases with perinatal morbidity and mortality: death within one year after delivery, intubation > 24h, 5APGAR < 4, stay at a neonatal intensive care unit (NICU) > 4 days, seizure < 24h after birth or perinatal injury (e.g. arm fracture, excluding hematoma). Here, there were no

significant overall differences between our examined groups (PC: 10.5%, PP: 4.9%, $p=0.26$). Additionally, we excluded all cases with morbidity not related to the delivery mode (e.g. cases of chorioamnionitis, neonatal infections): This analysis also showed no significant differences regarding the neonatal mortality and morbidity comparing both groups.

Due to the different group sizes, we compared a subgroup of randomly chosen participants of the PP group to a sample of an equal size of PC group. Here, morbidity of all infants was the same with no significant differences in 5minutes APGAR values below 4 (PC: 5.3%, PP: 0, $p=1.0$), birth injuries (PC: 5.3%, PP: 5.3, $p=1.0$) and perinatal asphyxia (PC: 5.3%, PP: 0, $p=1.0$). Moreover there were no significant differences for the overall stay on a neonatal intensive care unit for over 4 days (PC: 5.3%, PP: 5.3%, $p=0.19$), cases of neurologic deficits (PC: 0, PP: 0) or short time problems with

Table 5

Vaginal deliveries out of a breech position at term, help with body and head delivery, women with a prior cesarean vs Primipara.

Delivery maneuvers	Prior cesarean	Primipara	P-Value	Odds Ratio
Help with body delivery	4 (21.1%)	94 (27.5%)	0.79	0.71
Help with head delivery	7 (38.9%)	138 (40.5%)	0.96	0.86

breathing or bradycardia (PC: 15.8%, PP: 5.3%, $p=0.6$). Applying the PREMODA Score as well as excluding all cases with morbidity not related to the delivery, there were also no significant differences regarding the neonatal mortality and morbidity (Table 2).

Secondary outcome: mode of delivery

Out of the 604 women for whom a vaginal delivery was planned, 241 patients underwent a cesarean section after onset of labor (40.0%) and 363 (60.0%) had a successful vaginal delivery (Table 3). The vaginal birth group included 344 primiparous patients (PP, 60.1%) and 19 women with a prior cesarean (PC, 51.4%). The likelihood of manual assistance during vaginal birth was not significantly different between both groups, e.g. head delivery was assisted in 40.5% PPS versus 38.9% PCs ($p=0.96$) (Table 5).

Overall, the cesarean section rate was not significantly higher in the group of women with a prior cesarean (49%) compared to the group of primiparous women (39%) ($p=0.3$). Analyzing the reasons for a cesarean section (Table 3), we found no significant differences, e.g. delay in stage 1 (PC: 33%, PP: 37%, $p=1.0$), delay in stage 2 (PC: 22%, PP: 30%, $p=0.6$), abnormal electronic fetal monitoring (PC: 44%, PP: 37%, $p=0.61$). In both groups, none uterine rupture was experienced. We want to mention that more than one criterion was possible as a reason for a cesarean (Table 3).

Secondary outcome: maternal outcomes

Analyzing all vaginal deliveries, we detected no significant differences between both groups for any maternal outcomes, e.g. regarding perineal injury I° (PC: 36.8%, PP: 30%, $p=0.61$), perineal injury II° (PC: 15.8%, PP: 20.4%, $p=0.78$), perineal injury III°/IV° (PC: 0, PP: 2.3%, $p=1.0$), other injuries (PC: 26.3%, PP: 40.2%, $p=0.34$). No maternal death was documented (Table 4).

Discussion

We performed this prospective cohort study with 604 women intending vaginal breech delivery at term to evaluate the neonatal and maternal outcomes as well as modes of delivery in primiparous patients versus women who intend a vaginal birth after cesarean (VBAC). The neonatal morbidity and mortality was not significantly different in both studied groups, which confirms our initial hypothesis. Also, the cesarean section rate was not significantly higher in the group of women with a prior cesarean (49%) compared to the group of primipara (39%).

A similar cesarean section rate in both groups was surprising since an increased rate of cesarean sections after the onset of labor during a VBAC attempt is well described in the literature [18,19]. In VBAC cases, the increased cesarean section rate compared to women without a prior cesarean section is often explained by a) a remaining reason that has caused the cesarean section in the past and b) the caution of obstetricians trying to prevent imminent uterine rupture [11,13]. We hypothesize that our analysis might reach significance with a bigger sample size in the group of women with a prior cesarean section. However, current studies indicate that a cesarean section after the onset of labor has an advantage for the neonatal outcome compared to a planned cesarean [20].

Therefore, it is not in the interest of the mother and the unborn child to recommend a planned cesarean section *a priori* when a pregnant women with a prior cesarean section seeks counseling regarding the delivery of a breech singleton.

The discussion about the best clinical practice regarding the mode of breech delivery is still ongoing. After numerous trials provided encouraging data in the previous years, the overall approval of vaginal breech deliveries has risen in the obstetric community. However, most providers recommend a cesarean section as preferred delivery mode for women with a prior cesarean section and a breech fetus – despite missing empirical evidence and clear international guidelines for an increased safety of this elective procedure compared to the vaginal approach. In our study, the infant and maternal morbidity was not increased for patients, who underwent a vaginal breech birth after a previous cesarean section. This is a very important fact these mothers who intend a vaginal delivery should be counseled on and indicates that a prior cesarean section is not an exclusion criterion for a vaginal delivery approach of a breech baby at term. To our knowledge this is the first study to evaluate the neonatal and maternal outcome for women attempting a VBAC with a term breech fetus, which constitutes a clear strength of this study. By contrast, we consider the small number of participants in the group of patients with a prior cesarean as the main limitation, which reduces the power of the study. This study was designed as a prospective cohort study at one center in Frankfurt, Germany including all eligible women admitted to the hospital between 2007 and 2016. Large multicenter studies with a larger patient cohort will be further necessary to collect data and support international guidelines regarding VBAC for mothers expecting breech babies.

Numerous international societies such as the Canadian and French Societies of Obstetricians and Gynecologists generally recommend a VBAC for women with a prior cesarean and *cephalic* lie of the fetus [15]. Given the low complication rates of VBAC deliveries and vertex presentation, the preference of an abdominal delivery for *breech* fetuses seems overly cautious and might create a substantial number of unnecessary cesarean sections in breech deliveries. Cesarean section numbers are rising worldwide and pose a tremendous burden to affected individuals and the healthcare system [8–13], so this development has to be seen critical. Hence, the decision of providers and mothers for a cesarean section for breech delivery at term should be made with care. With our data, we want to challenge this common clinical management. Our results should encourage to consider VBAC as a possibility for the management of breech births – given that the patients are selected carefully and the birth is supervised by an experienced obstetrician.

We want to stress that counseling about all options related to breech birth – including the maternal risks of a cesarean section, the success and complication rates of external cephalic versions, and the option of a vaginal breech delivery using strict selection criteria – is of utmost importance and could reduce the number of unnecessary elective cesarean sections without increasing risks for the fetus. In the light of our data and the well-documented risks of an intended VBAC in general, it does not seem plausible that a risk of a prior cesarean section and a fetal breech presentation would add up to an unjustifiable risk for the mother and her child. Since our data underline the safety for both during breech VBAC, a prior cesarean should not be taken as an exclusion criterion for an intended vaginal delivery of a breech infant at term.

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