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Vaginal breech delivery of pregnancy before and after the estimated due date—A prospective cohort study

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ABSTRACT

Introduction: 3–4% of pregnant women present with a fetal breech position at term. National societies regard vaginal breech delivery as a safe option, but only for a specific and thoroughly counseled group of patients. To avoid adverse outcome, many practitioners recommend elective cesarean section once their patients go past the estimated due date. Since encompassing evidence is missing, the evaluation on this common clinical practice is needed.
Objective: This study compares the short-term maternal and fetal outcome in intended vaginally breech deliveries before the estimated due date (until 40 0/7 weeks of gestation) to the outcome of deliveries carried out past the estimated due date (later than 40 0/7 weeks of gestation).
Methods: This prospective cohort study includes 827 women who presented for an intended vaginal breech delivery of a singleton at our perinatal center between January 2010 and December 2016.
Results: 447 patients (54%) delivered before or at their estimated due date, 380 (46%) of pregnancies continued after the estimated due date. Comparing both groups, no significant difference in maternal and neonatal short-term mortality and morbidity was found. The rate of caesarian sections was increased in the group of patients, who delivered later than 40 1/7 weeks of gestation. Here, the likelihood for delivery maneuvers was also increased.
Conclusion: This study provides evidence, that an elective cesarean section for breech presentations at term is not obligatory when the estimated due date has passed in singleton pregnancy.

Introduction

At term, 3–4% of mothers expect breech infants and seek counseling regarding the safest delivery mode. For decades, providers would recommend elective cesarean sections based on large multicenter trials. In contrast, various national guidelines and expert statements emphasize the safety of vaginal breech deliveries while stressing the importance of rigorous patient selection and thorough patient counseling [1,2]. Numerous exclusion criteria were implemented for vaginal breech births (e.g. post-term pregnancies and birth induction), which often affect clinical management merely based on low level evidence and individual expert opinion [3–6].

Nearly 40% of pregnancies continue beyond their estimated due date. A "post-term pregnancy" on its own constitutes a risk factor for elective or cesarean section after onset of labor. Birth inductions are usually recommended after a patient reaches her due date; this intervention also increases the risk for a cesarean section [7,8]. Post-term pregnancies, birth by caesarean section, diabetes and a high body mass index (BMI) were associated in many studies. Particularly for breech deliveries, many health care providers recommend elective cesarean sections the day the due date has passed. In the light of the globally increasing caesarean section numbers with almost 30 million in 2015 [9] and the related burden on the healthcare system, this clinical decision-making automatism is not only problematic but also lacking broad evidence. For example, no association between post-term pregnancy and the neonatal morbidity and mortality was shown in the Term Breech Trial [6]. Also, the PREMODA study did not investigate this particular issue; the results documented a low perinatal morbidity when consensus guidelines were followed, which recommend a vaginal breech trial of labor only for patients with a gestational age less than 39 weeks at births [10].

This prospective case-control study was designed to answer the question if a vaginal breech delivery is less likely and associated with a higher rate of adverse outcomes for mother and child after the estimated due date has passed. Hence, this study compares (1) the maternal and fetal outcomes and the (2) mode of delivery in

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patients who intended a singleton vaginal breech delivery at 37 0/7 to 40 0/7 weeks of gestation versus at 40 1/7 to 42 6/7 weeks of gestation. Since labor induction influences cesarean section rates, we also compared (3) perinatal outcome and cesarean section rates of induced deliveries in pregnancies with a baby in breech position and breech deliveries with spontaneous labor.

Materials and methods

Patient cohort

The study included patients of the FRABAT cohort who intended a vaginal breech delivery of a singleton at term (>37 weeks) [11]. The trial was conducted at the Goethe University Hospital Frankfurt in Germany between January 2010 and December 2016. The local ethics committee approved the study protocol (Internal Reference Number: 420/11). The requirement for written patient consent was waived since we did not collect any more data than relevant for routine clinical care.

Perinatal management for patients expecting breech babies is highly standardized in our clinic. The patients were counseled regarding delivery options between 34 and 36 weeks of gestation. In case of intended vaginal delivery and nulliparity, the patient's pelvis (obstetric conjugate or CVO and the intertubarous distance) was assessed by Magnetic Resonance Imaging [12]. Vaginal breech deliveries were mainly conducted in an upright position [13] under the care of a' Maternal-Fetal Medicine' board-certified obstetrician. We included all birth positions in this study. A caesarean section was performed when non-reassuring or ominous fetal heart tone tracing, arrest of labor during first or second stage of delivery or maternal exhaustion was present.

We included participants who met the following criteria: gestational age at 37 0/7 weeks or more, minimum estimated fetal weight of 2500 g, intent for a vaginal delivery, and an adequate pelvis with a minimum CVO of 12 cm as well as a minimum intertubarous distance of 11 cm [12] for nulliparous women. Exclusion criteria included prematurity, fetal weight <2500 g, nulliparous women with an inadequate pelvis, priorly diagnosed lethal congenital malformations, multiples, planned cesarean section and gestational diabetes with insulin treatment.

Variables of interest were collected using the state database 'Perinatalerhebung Hessen'. Further information about maternal and fetal outcomes was gathered from charts and discharge letters. We collected demographic variables of mothers and newborns such as body mass index (BMI), age of the mothers at birth, epidural anesthesia during birth, induction and maternal birth-injury rates, weeks of gestation at delivery as well as the sex, length, head circumference and weight of the infant.

"Maternal and neonatal morbidity" and "neonatal mortality" after breech birth were defined as primary outcomes and represented by the following variables: APGAR scores, neonatal death, admission to the neonatal intensive care unit (NICU) after delivery, birth injuries, intubation. We compared these outcomes in patients at 37 0/7 and 40 0/7 weeks of gestation versus participants at 40 1/7 and 42 6/7 weeks of gestation. The mode of delivery ("spontaneous breech birth" or "assisted spontaneous breech birth with delivery maneuvers" or "birth by cesarean section during labor") as well as maternal morbidity was defined as secondary outcomes.

Statistical analyses

Normal distribution was tested as applied. Group differences were tested using Pearson's test and Fishers exact test. For variables on interval scales means and standard deviations were calculated and *t*-tests were performed. All statistical analyzes were carried out using JMP software (SAS Institute, Cary, USA). When the 95% confidence interval (CI) did not include the number 1. A *p*-value less than 0.05 were considered statistically significant.

Results

827 patients expected a singleton breech infant, intended a vaginal birth and were anonymously included in the analysis. 447 of these patients (54 %) delivered between 39 0/7 and 40 0/7 weeks of gestation (BDD group); 380 patients (46%) delivered after their due date (40 1/7 and 42 6/7 weeks of gestation; PDD group).

For demographic baseline characteristics, the mothers' mean age (32.2 years in BDD versus 32.6 years in PDD), BMIs (22.9 in the BDD and 23 in the PDD) and parity were not significantly different in both groups. The rate of induction (PGI) was significantly higher in the PDD group (21.1%; $p > 0.0001$) than in the BDD group (9.2%).

Also, fetal characteristics were equally distributed between the two groups. For example, head circumference (BDD 35.1 cm versus PDD 36.0 cm), birth length (BDD 51.5 cm versus 53.0 cm) and most common fetal breech position in both groups were equivalently distributed (Frank breech: 274 61.3% in BDD versus 219 57.6% in PDD). The birth weight of the newborn was significantly higher in the PDD group (3197 g in BDD versus 3533 g in PDD; $p < 0.001$).

In terms of our primary outcome, we noted no significant difference in terms of neonatal short-term mortality and morbidity comparing both groups. No differences were seen regarding the following exemplary variables: 5 min APGAR below 4 (BDD 0.7%, PDD 0.5%, $p = 0.921$), the stay on a neonatal intensive care unit over 4 days (BDD 2.0%, PDD 3.2%, $p = 0.278$), perinatal asphyxia (BDD 0.7%, PDD 0.5%, $p = 0.260$), neurologic deficits (BDD 0.7%, PDD 0.5%, $p = 0.788$) or maternal birth injuries (BDD 0.5%, PDD 0.8%, $p = 0.528$).

We used a modified PREMODA score [10] to refine our analysis of neonatal adverse outcomes. Here, neonatal morbidity or mortality was defined as the presence of one or more of the following criteria: death within 28 days after delivery, intubation period over 24 h, 5 'APGAR under 4, stay on a NICU over 4 days, seizure under 24 h after birth and delivery associated trauma (excluding hematoma). Flagged single cases were further looked up in detail and cases were excluded where the delivery mode was not associated with the neonatal outcome (e.g. fetal malformations or neonatal infections). When the modified PREMODA score was applied, also no significant difference in neonatal morbidity was detected between study groups (Table 2).

When we analyzed the rate of cesarian sections after the onset of labor as our secondary outcome, we found a significant increase in the PDD group ($n = 137$, 36.1%) versus the BDD group ($n = 117$, 26.2%; $p = 0.0021$). Clinical indications for performing a cesarean after the onset of labor did not differ between both groups (Table 1). Furthermore, 35.5% of patients needed manual assistance during vaginal breech birth in the BDD group compared to 43.6% In the PDD group ($p = 0.048$); hence, the odds ratio for manual assistance was 1.41 when the due date has passed (95% CI 1.00−1.98).

In the BDD group we found 57.6% maternal birth injuries versus 72.8% in the PDD group after due date ($p = 0.024$). We also showed a significant higher rate of perineal injuries in deliveries after the expected due date (54.7%) than before term (44.9%; $p = 0.019$; Table 4).

We also performed a sub-analysis of all successful vaginal deliveries. Here, 330 (73.8%) women had a vaginal delivery before their estimated due date and 243 (63.9%) after their due date. The maternal and fetal characteristics were similar in both groups. We also detected no significant difference between both groups regarding the neonatal and maternal morbidity (Table 3). For example, stays on the NICU over 4 days, adaption problems or intubation of the newborn were not significantly different between

Table 1
Vaginal intended deliveries out of breech presentation, epidemiologicals and maternal characteristics, Pre due date vs. post due date.

Characteristic vaginal intended deliveries	Pre due date (n = 447)	Post due date (n = 380)	p value
Induction	41 (9.2%)	80 (21.1%)	<0.0001
Age (mean, st.dev.)	32.2	32.6	0.378
BMI (mean, st.dev.)	22.9	23.0	0.088
Birthweight (mean, st.dev.)	3197	3533	
Head circumference (mean, st.dev.)	35.1	36.0	
Parity (n, %)			0.006
1	236 (52.8%)	242 (63.7%)	
2	123 (27.5%)	84 (22.1%)	
>2	88 (19.7%)	54 (14.2%)	
Gestational diabetes			
Insulin	13 (2.9%)	5 (1.3%)	0.109
Diet	10 (2.2%)	11 (3.0%)	0.549
Internal preconditions (hypertension, hypothyroidism, dermatologic diseases etc.)	72 (16.1%)	61 (16.0%)	0.983
Hemostasis disorder	7 (1.6%)	7 (1.8%)	0.759
Type of breech (n, %)			0.220
Frank	274 (61.3%)	219 (57.6%)	
Complete	37 (8.3%)	22 (5.8%)	
Incomplete	45 (10.1%)	36 (9.5%)	
Footling	12 (2.7%)	18 (4.7%)	
Oblique Lie	1 (0.2%)	1 (0.3%)	
Missing data	78 (17.5%)	84 (22.1%)	
Cesarean	117 (26.2%)	137 (36.1%)	0.0021
Reason for cesarean (n, %)			
Mothers whish	12 (10.26%)	6 (4.4%)	0.068
Delay in stage 1	34 (29.1%)	59 (43.1%)	0.020
Delay in stage 2	29 (24.8%)	39(28.5%)	0.508
Abnormal fetal heart tone tracing or Doppler	52 (44.4%)	50 (36.5%)	0.198
Uterine scar or pathology	6 (5.2%)	1 (0.7%)	0.027
Placental reason	5 (4.2%)	(0%)	0.005
Cord prolapsed	3 (2.6%)	3 (2.1%)	0.845
Bleeding or premature birth indicators	1 (0.8%)	3 (2.2%)	0.377
Maternal reason	1 (0.9%)	2 (1.5%)	0.652
Cephalopelvic disproportion	3 (2.6%)	6 (4.4%)	0.430
Chorioamnionitis	6 (5.1%)	4 (2.9%)	0.367
Other fetal reason	1 (0.9%)	(0%)	0.213

Table 2
Vaginal intended deliveries out of breech presentation, fetal outcome, Pre due date vs. post due date.

Characteristic vaginal intended deliveries	Pre due date N = 447	Post due date N = 380	p value	Odds ratio (5–95% confidence)
APGAR 5 '(n, %)			0.921	
<4	3 (0.7%)	2 (0.5%)		
4 < 7	7 (1.6%)	5 (1.3%)		
NICU			0.278	
>4 days	9 (2.0%)	12 (3.2%)		
Up to 4 days	16 (3.6%)	20 (5.3%)		
Intubation > 24 h	3 (0.7%)	1 (0.3%)	0.386	
pH arterial blood <7.0	0 (0%)	2 (0.53%)	0.077	
Short time problems with breathing, bradycardia	14 (3.1%)	16 (4.2%)	0.409	
Birth injury	2 (0.5%)	3 (0.8%)	0.528	
Neurologic deficits	3 (0.7%)	2 (0.5%)	0.788	
Perinatal asphyxia	9 (2.0%)	4 (1.1%)	0.260	
Deaths	0 (0%)	0 (0%)	0.000	
Amniochorionitis	7 (1.6%)	17 (4.5%)	0.012	
Umbilical cord complication	25 (5.6%)	24 (5.3%)	0.661	
Death or severe perinatal morbidity (PREMODA)	18 (4%)	23 (6.0%)	0.181	1.54 (0.82–2.89)
Death or severe perinatal morbidity potentially related to delivery mode	9 (2.0%)[a]	8 (2.1%)[b]	0.926	1.05 (0.40–2.74)

Excluded cases because of absent correlation to delivery mode: 14 cases of newborn infection, one case of postpartum ischemia, one case of spontaneous pneumothorax, one case of brain cysts of unknown origin, one case of fetal arrhythmia due to TRAK antibodies, one case of fetal congenital cyst-adenomatoid malformation, one case of pulmonal stenosis, one case of postpartum hypoglycemia, one case of glucose-6-phosphate-dehydrogenase deficiency, one case of congenital hypothyroidism an one case of benign sleeping myoclonism.

a) one case of asphyxia and newborn infection, one case of asphyxia in a forceps delivery, one case of mild asphyxia, one case of respiratory adaption problems of a baby with a pulmonal hypertension and a "wet lung", one case of a mild asphyxia and e plexus paresis, one case of mild asphyxia, one case of a mild asphyxia of a newborn with a forceps delivery, one case of a mild asphyxia of a baby with a meconium aspiration, one case of an asphyxia in a newborn with a forceps delivery, a clavicular fracture and an intracranial bleeding, one case of respiratory adaption problems combined with postpartum hypoglycemia.

b) two cases of respiratory adaption problems, one case of a newborn with respiratory adaption problems and a spontaneous pneumothorax, one case pf asphyxia combined with a pneumothorax and a renal bleeding, two cases of isolated plexus paresis, one case of a newborn with a plexus paresis and a perinatal asphyxia, one case of a newborn with adaption problems where a forceps delivery was necessary.

All newborns were dismissed from the hospital in good general condition.

Table 3
Fetal outcome : Vaginal delivery out of breech presentation, (pre due date vs. post due date).

Characteristic vaginal birth	Pre due date ($n = 330$)	Post due date ($n = 243$)	p value	Odds ratio
Induction	26 (7.9%)	39 (16.1%)	0.003	
Birth weight > 3800 g	14 (4.2%)	59 (24.3%)	<0.001	
Birth position			0.529	
Dorsal position	43 (13.0%)	31(12.8%)	0.923	
Hands and knees/upright	283 (85.8%)	207 (85.2%)	0.848	
Maneuvers necessary				
Assisted arm delivery	66 (20.0%)	62 (25.5%)	0.117	
Assisted head delivery	98 (29.7%)	90 (37.0%)	0.064	1.39 (0.98–1.98)
Assisted body delivery	117 (35.5%)	106 (43.6%)	0.048	1.41 (1.00–1.98)
APGAR at 5 minutes '(n, %)			0.757	
<4	3 (1.0%)	6 (1.8%)		
4 < 7	1 (0.4%)	4 (1.7%)		
NICU			0.483	
>4 days	6 (1.8%)	5 (2.1%)		
Up to 4 days	11 (3.3%)	13 (5.4%)		
Intubation < 24 h	3(0.9%)	1 (0.4%)	0.4661	
pH arterial blood < 7.0	0(0%)	1 (0.4%)	0.199	
Problems with adaptation	11 (3.3%)	10 (4.12%)	0.624	
Birth injury	2 (0.6%)	3(1.2%)	0.428	
Neurologic deficits	3 (0.9%)	1 (0.4%)	0.466	
Perinatal asphyxia	9 (2.7%)	3 (1.2%)	0.204	
Deaths	0 (0%)	0 (0%)	0.0	
Chorioamnionitis	4 (1.2%)	10 (4.1%)	0.026	
Umbilical cord complication	17 (5.2%)	14 (5.8%)	0.750	
Death and severe morbidity (PREMODA)	13 (3.5%)	15 (6.2%)	0.224	1.60 (0.75–3.23)
Death and severe morbidity (PREMODA) potentially related to delivery mode	8 (2.4%)	6 (2.5%)	0.973	1.02 (0.35–2.98)

both groups ($p = 0.973$). All statistical analyzes were additionally performed with equal sample sizes. When we compared 243 randomly chosen women in both groups, all our prior results could be confirmed.

An overdue pregnancy is the most common reason for birth induction [14,15]. Because rates of birth induction were remarkably higher after the estimated due date, we wanted to elucidate the effect of "labor inductions" on our primary and secondary outcomes. The neonatal morbidity and mortality based on the PREMODA criteria showed no significant difference ($p = 0.728$) between the induced ($n = 121$) and non-induced ($n = 706$) patient group at 37 0/7 to 42 6/7 weeks of gestation (OR of 0.77 (95% CI 0.17–3.4)). Further, the rate of cesarean sections was significantly higher in breech deliveries after induction (51.3% versus 32.0% without induction; $p = 0.0014$, Table 5).

When only the vaginal deliveries were analyzed, we found no significant influence of inductions on neonatal outcomes ($p = 0.734$), rate of perineal injuries ($p = 0.767$) or requested epidural anesthesia ($p = 0.097$, Table 6). Sub-dividing the vaginally intended deliveries without inductions into a BDD ($n = 406$) and PDD group ($n = 300$), we found similar rates of cesarean sections in both groups (25.1% in BDD versus 32.0% in PDD; $p = 0.0512$). Overall, cesarean section rates were higher in the patient group after the due date and after birth induction (Table 7). We analyzed the intended vaginal deliveries and the actual vaginal breech deliveries after the estimated due date and compared cases with

Table 4
Maternal outcome: Vaginal delivery out of breech presentation (pre due date vs. post due date).

Characteristic vaginal deliveries	Pre due date ($n = 330$)	Post due date ($n = 243$)	p value
Maternal birth injury	210 (57.6%)	177 (72.8%)	0.024
Perineal injury	148 (44.9%)	133 (54.7%)	0.019
1st° perineal tear	92 (27.9%)	77 (31.7%)	0.323
2nd° perineal tear	52 (15.8%)	50 (20.6%)	0.136
3rd°& 4th° Perineal tear	4 (1.2%)	6 (2.5%)	0.256
Episiotomies	9 (2.7%)	6 (2.5%)	0.854
Injury of the vagina or labia	94 (28.5%)	71 (29.2%)	0.848
Epidural	129 (44.3%)	113 (54.3%)	0.028

Table 5
Fetal Outcome: Vaginal intended deliveries out of breech presentation (induction vs. no induction).

Characteristic vaginal intended deliveries	No induction ($n = 706$)	Induction ($n = 121$)	p value	Odds ratio
Death and severe morbidity (PREMODA)	36 (5.1%)	5 (4.1%)	0.643	0.80 (0.31–2.02)
Death and severe morbidity (PREMODA) potentially related to delivery mode	15 (2.1 %)	2 (1.7%)	0.728	0.77 (0.17–3.43)
Cesarean section	96 (32.0%)	41 (51.3%)	0.0014	1.60 (1.2–2.1)

Table 6
Fetal and Maternal Outcome: Vaginal deliveries out of breech presentation (induction vs. no induction).

Characteristic vaginal deliveries	No induction ($n = 508$)	Induction ($n = 65$)	p value	Odds ratio
Death and severe morbidity (PREMODA)	25 (4.9%)	3 (4.6%)	0.914	0.94 (0.27–3.01)
Death and severe morbidity (PREMODA) potentially related to delivery mode	12 (2.4 %)	2 (3.1%)	0.734	1.30 (0.29–5.69)
Perineal injury	248 (48.4%)	33 (49.23%)	0.767	1.08 (0.65–1.81)
2nd° perineal tear	92 (18.1%)	10 (15.4%)	0.589	0.82 (0.40–1.67)
3rd°& 4th° perineal tear	8 (1.6%)	2 (3.1%)	0.384	1.98 (0.41–9.55)
PDA during birth	209 (47.2%)	33 (58.9%)	0.097	1.61 (0.91–2.82)

and without induction; here, no significant difference in the fetal outcomes was seen (Tables 8 and 9).

Discussion

Evaluating all successful vaginal breech births out of 827 intended vaginal deliveries, fetal outcomes were similar in deliveries before and after the estimated due date. This main finding rejects the common assumption of an increase in neonatal adverse short-term outcomes in vaginal breech post-term deliveries. Hence, our study documents no evidence supporting a planned cesarean section for a breech baby once the estimated due date passes.

The cesarean section rate after the onset of labor was significantly higher in intended vaginal breech deliveries after the due date. This association is also described for *cephalic* post-term pregnancies and commonly attributed to the positively correlated fetal weight with the duration of pregnancy [16–18]. For breech infants, this increased probability of a cesarean section related to a high infant's birth weight was also published by Jennewein et al. [11] in a different set of patients of the same cohort. In the "post-term" group, the increased maternal morbidity might as well be explained by an increase in fetal birth weight and birth induction rate – an association also described for *cephalic* pregnancies [19]. Furthermore, we found an increased rate of labor inductions in the post-term pregnancy group. This finding was not surprising since a "post-term pregnancy" constitutes the most common cause for birth inductions [15]. Here, the cesarean section rate was higher compared to non-induced patients. Because differences in cesarean rates lost significance when induced deliveries were excluded, this seems not a breech-associated matter. We support this assumption by other authors, who also described a positive correlation of cesarean section rates with overdue pregnancies, increased infant birth weights and labor induction for *cephalic* deliveries [16–18]. Overall, our findings underline the conclusion that a labor induction may alter the birth process in the same way as in *cephalic* deliveries.

Differences in the management of breech deliveries exist in different hospitals and countries. It is still controversially discussed whether a planned cesarean section or an intended vaginal birth poses the safest option - especially when the woman passes the estimated due date. The Term Breech Trial by Hannah et al. [6,10,20] regarded a planned cesarean section as the overall safest option for neonate and mother. Numerous studies were published with opposing results [21–24]. For mothers expecting babies in *cephalic* lies, numerous guidelines do not recommend a planned cesarean section just because the patient has passed her due date. Here, a vaginal birth is still associated with a low complication rate; the benefits are outweighing the possible associated complications [19]. In light of our findings, we propose

Table 7
Fetal Outcome: Vaginal intended deliveries out of breech presentation without induction (pre due date vs. post due date).

Vaginal intended deliveries without Induction	Pre due date ($n = 406$)	Post due date ($n = 300$)	p value	Odds ratio
Death and severe morbidity (PREMODA) potentially related to delivery mode	15 (3.7%)	21 (7.0%)	0.057	1.89 (1.0–3.6)
Cesarean section	102 (25.1%)	96 (32.0%)	0.051	1.27 (1.0–1.6)

Table 8
Fetal Outcome: Vaginal intended delivery out of breech presentation post due date (induction vs. no induction).

Characteristic vaginal intended post due date	No induction ($n = 300$)	Induction ($n = 80$)	p value	Odds ratio
Death and severe morbidity (PREMODA)	21 (7%)	2 (2.5%)	0.100	0.34 (0.08–1.49)
Death and severe morbidity (PREMODA) potentially related to delivery mode	8 (2.7 %)	(0%)	0.050	(0%)

Table 9
Fetal and Maternal Outcome: Vaginal delivery out of breech presentation post due date (Induction vs. no induction).

Characteristic vaginal post due date	No induction ($n = 204$)	Induction ($n = 39$)	p value	Odds ratio
Death and severe morbidity (PREMODA)	15 (7.4%)	(0%)	0.019	
Death and severe morbidity (PREMODA) potentially related to delivery mode	6 (2.9 %)	(0%)	0.145	

that this particular clinical management should also be applied to an intended vaginal breech birth of a post-term pregnancy. Our study provides evidence for doing so while showing no difference in infant morbidity before or after their estimated due date. Hence, a recommendation for an elective cesarean section after passing the due date seems unnecessary and not beneficial for mother and child. Maternal injury and the overall cesarean section rates were increased in the post-term group, what can be attributed to the fact that the estimated due date has passed – not the breech position. Hence, it is important to counsel the women about these risks so an informed decision- making process is possible for them. Particularly in breech deliveries, clinicians hesitate to perform birth inductions. Also, the green-top guideline on breech presentation [1] does not recommend labor inductions in these cases. We want to point out that this study's findings showed no difference in the fetal outcome when induced and non-induced deliveries were compared. Hence, a breech presentation should not be seen as a contraindication for labor induction, when established medical indications are present. It is strength of this study to have investigated our scientific questions in such a large patient cohort. We also acknowledge an important limitation due to the monocentric nature of the study. Hence, further investigations in multi-center settings are needed to further advance guidelines on vaginal breech deliveries.

In conclusion, this study provides no evidence that an elective cesarean section for women with breech presentation babies is beneficial when 40 weeks of gestation are completed. Also, the breech presentation should not be a contraindication for labor induction. We recommend applying stringent selection criteria for eligible patients intending a vaginal breech birth. Also, the expertise of obstetricians, an adequate pelvis, an upright birth position and thorough counseling, e.g. the increased rates of maternal birth injuries and overall cesarean sections, are crucial for successful and safe vaginal breech births after the due date.

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