Management of preterm delivery in women with abnormal fetal presentation
Bergenhenegouwen, Lester

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Preterm Breech Presentation: A Comparison of Intended Vaginal and Intended Cesarean Delivery

Lester Bergenhenegouwen
Floortje Vlemmix
Sabine Ensing
Jelle Schaaf
Joris vd Post
Ameen Abu-Hanna
Anita CJ Ravelli
Ben W Mol
Marjolein Kok

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Abstract

Objective: To study the association of the intended mode of delivery and perinatal morbidity and mortality among breech fetuses who are delivered preterm.

Methods: We conducted a nationwide cohort study of women with a singleton pregnancy in breech presentation who delivered preterm (26+0 – 36+6 weeks of gestation) in the years 2000-2011. We compared perinatal outcomes according to the intended and actual mode of delivery using multivariate logistic regression analysis. We performed subgroup analyses of gestational age and parity.

Results: We studied 8,356 women with a preterm singleton breech delivery. Intended cesarean delivery (n=1,935) was not associated with a significant reduction in perinatal mortality compared to intended vaginal delivery (n=6,421) (1.3% versus 1.5%, (aOR 0.97; 95% CI 0.60-1.57)). However, the composite of perinatal mortality and morbidity was significantly reduced in the intended cesarean delivery group (8.7% versus 10.4% (aOR 0.77; 95% CI 0.63-0.93)). In the sub-group of women delivering at 28-32 weeks, intended caesarean delivery was associated with a 1.7% risk of perinatal mortality, compared to 4.1% with intended vaginal delivery (aOR 0.27; 95% CI 0.10-0.77) and significantly reduced composite mortality and severe morbidity from, 5.9% compared to 10.1% (aOR 0.37; 95% CI 0.20-0.68).

Conclusions: In women delivering a preterm breech fetus, cesarean delivery is associated with reduced perinatal mortality and morbidity.

Introduction

The incidence of breech presentation varies according to gestational age, with an incidence of 25% at 26 weeks, 15% at 32 weeks, declining to 3 to 4% in term pregnancy.

The Term Breech Trial showed that intended cesarean delivery is safer in terms of combined short term morbidity and mortality for term breech presentation. This has led to a worldwide shift towards an intended caesarean delivery, which has been associated with a sustained reduction of neonatal mortality and morbidity in the Netherlands. Unfortunately, knowledge on the optimal mode of delivery in case of preterm breech presentation is limited, while the incidence of breech presentation in these women is much higher.

Too few women have been enrolled in randomized trials of mode of delivery of the preterm breech fetus to draw meaningful conclusions about the optimal intended mode of delivery. Therefore, the aim of the present study was to evaluate the association of intended mode of delivery and perinatal mortality and morbidity in a large national cohort of women who delivered preterm breech fetuses.

Materials and Methods

This retrospective cohort study was performed using data from the Netherlands Perinatal Registry (PRN). The PRN consists of population-based data containing information on pregnancies, deliveries and (re)admissions until 28 days after birth. The PRN database is obtained by a validated linkage of three different registries: the midwife registry (LVR 1), the obstetricians registry (LVR 2) and the neonatology registry (LNR) of hospital admissions of newborn infants. The coverage of the PRN is approximately 96% of all deliveries in the Netherlands and currently includes over 1.9 million records derived from deliveries in the last decade.

All PRN data are voluntarily recorded by the caregivers during prenatal care, delivery, and the neonatal period. The data are annually sent to the national registry office, where a number of range and consistency checks are conducted. Institutional review board approval was not necessary since the data were used anonymous, thus exempting ethics approval in the Netherlands.

From this database, we identified all women who delivered a singleton fetus in breech presentation between 26+0 and 36+6 weeks of gestation in the period 2000 and 2011. Exclusion criteria were (lethal) congenital abnormalities, antepartum stillbirth, placental abruption (antenatally), unknown gestational age, small for gestational age.
(defined as a birth weight below the 10th percentile), maternal hypertension (defined as DBP ≥ 95 mmHg), gestational and type 1 or 2 diabetes and preeclampsia (defined as hypertension with proteinuria). We excluded women with severe maternal co-morbidity as the cesarean section might have been performed for another reason than the breech presentation. We excluded women who delivered before 26+0 weeks of gestation because in the time period under study babies born in this time frame did not in general receive resuscitative care. Specific management data including the use of tocolytic medication, fetal lung maturation with corticosteroids, antibiotic treatment and antenatal transfer to a third level care facility were not available from the database. According to the national guidelines then in effect, tocolysis (atosiban or nifedipine) and antenatal corticosteroids to enhance fetal lung maturity were recommended from 25+0 till 33+6 weeks of gestation for a period of 48 hours in women with symptoms of threatened preterm birth, but magnesium sulphate for fetal neuroprotection was not. Women in the study were treated according to these national guidelines.

Threatened preterm birth is defined as preterm contractions combined with dilatation or cervical length shortening below 25 mm, or preterm premature rupture of membranes (PPROM). Women at risk for preterm delivery before 32 weeks of gestation are referred to tertiary centres that are equipped with Neonatal Intensive Care Units (NICU). After 32 weeks delivery typically occurred in a general hospital (secondary care). Preterm breech delivery is considered as a high risk delivery in the Netherlands and always takes place in hospital setting with a responsible obstetrician.

During the study period, the decision for intended cesarean delivery or intended vaginal delivery in preterm breech presentation was made by the pregnant woman and her responsible obstetrician. In line with Dutch guidelines, women were often counselled towards a vaginal delivery.

The actual mode of delivery was either by vaginal delivery, intended, or emergency cesarean delivery. The directions of the national database collection state that women who intend to deliver by cesarean delivery are registered as “intended cesarean section.” Thus, women who opted for a cesarean delivery were recorded as a intended cesarean delivery, even if the delivery took place when labour already started. Women who underwent an emergency (unplanned) cesarean delivery were assumed to have had an intention to deliver vaginally. The type of breech presentation was not registered in the database. The type of breech, however, generally did not influence the mode of delivery decision.

The primary outcome of the present study was intrapartum and neonatal mortality defined as fetal death during labor and neonatal death within the first 28 days after birth. We reviewed every perinatal death on case-level to ensure that the perinatal death was not caused by other factors such as congenital abnormalities or other problems that unequivocally were not associated with the mode of delivery. To do so, we obtained permission of the PRN to approach gynaecologists to study the case(s) of perinatal death that took place in their hospital. We asked the obstetricians to check the maternal and neonatal chart of the concerning case(s) and asked them to fill in a form on the exact data of the mode of delivery and the cause of perinatal death. We excluded cases of perinatal death if either the neonatal chart was lacking or if data were not complete enough to allow appropriate judgement.

Secondary perinatal outcome was a composite outcome of perinatal mortality and morbidity, in which morbidity was defined as 5-minute Apgar-score <7, birth trauma (facial nerve paralysis, cephalo hemaetoma, brachial plexus injuries, clavicle fracture, humerus fracture and asphyxia related morbidity (intraventricular haemorrhage, IRDS, hypoxic-ischimic encefalopathy, neonatal hypotonia, cerebral ischemia and neonatal seizures). Finally, we analysed a composite measure of perinatal mortality and severe morbidity, in which severe morbidity was defined as asphyxia related morbidity, intraventricular haemorrhage, IRDS, hypoxic-ischimic encefalopathy, cerebral ischemia and neonatal seizures.

We compared intrapartum and neonatal mortality and morbidity according to intended mode of delivery: i.e., women who delivered by intended cesarean compared with women who delivered vaginally or after an emergency cesarean delivery. Subsequently, we repeated this analysis for the actual mode of delivery: vaginal delivery, intended cesarean delivery and emergency cesarean delivery.

Analysis was done for the total study group and then separately for different subgroups of gestational age (26+0 to 27+6 weeks, 28+0 to 31+6 weeks and 32+0 to 36+6 weeks). We performed a logistic regression analysis with women who delivered vaginally as reference group. First, we calculated an unadjusted odds ratio. Subsequently, we adjusted the risk estimates in a logistic regression analysis (enter method) to show the association of level of care in relation to other factors with neonatal outcomes. The 95% confidence intervals (CI) were estimated to determine the precision of each odds ratio. We adjusted for the following confounders: nulliparity, gestational age (weeks), ethnicity, prolonged rupture of membranes (≥ 24 hours), birth weight and delivery in a secondary or a tertiary hospital.

To visualize the outcomes by week of gestation moving average was used. Because of the rare outcome a moving average is used, this means that for each week of gestation the two adjacent weeks (one week before and one week after the week in question) are combined and an average outcome is calculated for these three weeks together. In a subgroup analysis we assessed nulliparous and parous women separately as the mechanics of vaginal breech delivery might be different in nulliparous and in parous women.
Results

Of the 146,885 women who delivered preterm in the Netherlands between 2000 and 2011, 23,303 (16%) had a fetus in breech presentation. After exclusions, 8,356 women were included in the study cohort (Figure 1 and Table 1). In the overall study cohort, perinatal mortality was not significantly different for intended cesarean delivery and intended vaginal delivery after adjustment for parity, gestational age, delivery in a tertiary hospital, PPROM, birth weight and ethnicity (aOR 0.97, 95% CI 0.60-1.57). In the analysis according to subgroups of gestational age, perinatal mortality was significantly lower in the intended cesarean delivery subgroup of gestational age 28-32 weeks (aOR 0.27, 95% CI 0.10-0.77).

In the whole study population, composite perinatal mortality and morbidity occurred significantly less in intended cesarean delivery compared to vaginal delivery (aOR 0.77; 95% CI 0.63-0.93) and in the gestational age subgroups of 26-28 weeks (aOR 0.57; 95% CI 0.33-0.99) and 28-32 weeks (aOR 0.58; 95% CI 0.41-0.83).

In the subgroup analysis for parity, testing for interaction between parity and mode of (breech) delivery showed a statistically non-significant interaction (p= 0.64). In the whole study population composite perinatal mortality and morbidity in nulliparous women was significantly lower in the intended cesarean delivery group as compared to intended vaginal delivery group (OR 0.71; 95% CI 0.54-0.93). Subgroup analysis of gestational age 28-32 weeks of composite mortality and severe morbidity in nulliparous women showed the same trend (OR 0.39; 95% CI 0.16-1.00). All other outcomes according to parity were not statistically different (Table 3).

Table 4 shows the data on perinatal mortality and morbidity according to the actual mode of delivery. The overall perinatal mortality was 2.3% (79 of 3,426) in women who delivered vaginally, 1.3% (26 of 1,935) in women who delivered by intended cesarean delivery while for emergency cesarean delivery the overall neonatal mortality was 0.63% (19 of 2,995).

Perinatal mortality was significantly lower in emergency cesarean delivery for the whole study group (aOR 0.47; 95% CI 0.28-0.79 ). In the subgroups by gestational age there was a similar trend but differences were not statistically different (26-28 weeks; aOR 0.43, 95% CI 0.18-1.01); (28-32 weeks (aOR 0.48, 95% CI 0.21-1.13)); (32-37 weeks (aOR 0.45, 95% CI 0.16-1.29)).

Emergency cesarean delivery was not associated with a reduced risk of composite perinatal mortality and severe morbidity as compared to vaginal delivery (aOR 0.76; 95% CI 0.58-0.99) for the whole study-group. This applied also for the subgroup of 32-37 weeks of gestation favouring emergency cesarean delivery (aOR 0.76; 95% CI 0.58-0.99).

Figure 2 shows the moving average on perinatal mortality according to the intended mode of delivery. Before 32 weeks of gestation the risk of perinatal mortality is higher among women with a intended vaginal delivery. After 32 weeks of gestation, the perinatal mortality risk between the two groups become comparable. Figure 3 shows moving average on perinatal mortality according to the actual mode of delivery. Perinatal mortality is low among very preterm infants (<31 weeks of gestation) delivered by emergency cesarean delivery.
Table 1: Characteristics of preterm singleton births with a fetus in breech presentation in The Netherlands from 2000-2010 according to the mode of delivery

<table>
<thead>
<tr>
<th>Intended Cesarean Delivery</th>
<th>Intended Vaginal delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population, N, %</td>
<td>1935 (23.2%)</td>
</tr>
<tr>
<td>Number of previous deliveries, n (%)</td>
<td>1049 (54.2%)</td>
</tr>
<tr>
<td>≥1, n (%)</td>
<td>886 (45.8%)</td>
</tr>
<tr>
<td>Maternal age, ≤25 years, n (%)</td>
<td>172 (8.9%)</td>
</tr>
<tr>
<td>25-29 years, n (%)</td>
<td>513 (26.5%)</td>
</tr>
<tr>
<td>30-34 years, n (%)</td>
<td>884 (45.7%)</td>
</tr>
<tr>
<td>&gt;35 years, n (%)</td>
<td>366 (18.9%)</td>
</tr>
<tr>
<td>Ethnicity, Caucasian, n (%)</td>
<td>1673 (86.5%)</td>
</tr>
<tr>
<td>Non-Caucasian, n (%)</td>
<td>262 (13.5%)</td>
</tr>
<tr>
<td>Socio-economic status, High/middle, n (%)</td>
<td>1436 (74.2%)</td>
</tr>
<tr>
<td>Low, n (%)</td>
<td>499 (25.8%)</td>
</tr>
<tr>
<td>Birth weight, mean (±SD) (grams)</td>
<td>2219 (±720)</td>
</tr>
<tr>
<td>Gestational age in days, mean (±SD)</td>
<td>238 (±18)</td>
</tr>
<tr>
<td>Female fetal sex, n (%)</td>
<td>1099 (56.8%)</td>
</tr>
<tr>
<td>Male fetal sex, n (%)</td>
<td>836 (43.2%)</td>
</tr>
<tr>
<td>Antenatal Corticosteroids, Yes, n (%)</td>
<td>115 (5.9%)</td>
</tr>
<tr>
<td>No, n (%)</td>
<td>978 (50.6%)</td>
</tr>
<tr>
<td>Unknown, n (%)</td>
<td>842 (43.5%)</td>
</tr>
<tr>
<td>Gestational age, 26-27+6 weeks, n (%)</td>
<td>76 (3.9%)</td>
</tr>
<tr>
<td>28+0-31+6 weeks, n (%)</td>
<td>290 (15.6%)</td>
</tr>
<tr>
<td>32-36+6 weeks, n (%)</td>
<td>1569 (81.1%)</td>
</tr>
<tr>
<td>PPROM, Yes, &gt; 24 hours, n (%)</td>
<td>206 (10.4%)</td>
</tr>
<tr>
<td>No (+≤24 hours), n (%)</td>
<td>1739 (89.6%)</td>
</tr>
<tr>
<td>Location of delivery NICU hospital, n (%)</td>
<td>601 (31.1%)</td>
</tr>
<tr>
<td>General hospital, n (%)</td>
<td>1334 (68.9%)</td>
</tr>
<tr>
<td>Previous CS, Yes, n (%)</td>
<td>300 (15.5%)</td>
</tr>
<tr>
<td>No, n (%)</td>
<td>1635 (84.5%)</td>
</tr>
<tr>
<td>Reason for intrapartum CS</td>
<td>- No intrapartum CS 1889 (97.6%)</td>
</tr>
<tr>
<td>- Fetal distress</td>
<td>27 (1.4%)</td>
</tr>
<tr>
<td>- Failure to progress</td>
<td>0</td>
</tr>
<tr>
<td>- Fetal distress and FTP</td>
<td>0</td>
</tr>
<tr>
<td>- other reasons</td>
<td>19 (1.0%)</td>
</tr>
</tbody>
</table>

Table 2: Neonatal Morbidity and Perinatal Mortality According to the Intended Mode of Delivery in Preterm Breech Presentation

<table>
<thead>
<tr>
<th>Intended Cesarean Delivery</th>
<th>Intended Vaginal Delivery</th>
<th>Adjusted OR Unadjusted OR (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (26-36 weeks), n</td>
<td>26/1935 (1.3%)</td>
<td>0.88 (0.57-1.35)</td>
</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>98/6421 (1.5%)</td>
<td>0.77 (0.60-0.97)</td>
</tr>
<tr>
<td>Composite mortality and morbidity, n (%)</td>
<td>62/6421 (9.8%)</td>
<td>0.97 (0.60-1.57)</td>
</tr>
<tr>
<td>Composite mortality and severe morbidity, (n%)</td>
<td>33/6421 (5.1%)</td>
<td>0.97 (0.60-1.57)</td>
</tr>
<tr>
<td>26+0-27+6 weeks, n</td>
<td>15/76 (1.7%)</td>
<td>1.10 (0.54-2.25)</td>
</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>48/319 (15.1%)</td>
<td>0.27 (0.10-0.77)</td>
</tr>
<tr>
<td>Composite mortality and morbidity, n (%)</td>
<td>149/319 (46.7%)</td>
<td>0.57 (0.33-0.99)</td>
</tr>
<tr>
<td>Composite mortality and severe morbidity, (n%)</td>
<td>78/319 (24.5%)</td>
<td>0.82 (0.43-1.56)</td>
</tr>
<tr>
<td>28+0-31+6 weeks, n</td>
<td>5/290 (1.7%)</td>
<td>0.27 (0.10-0.77)</td>
</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>33/806 (4.1%)</td>
<td>0.77 (0.41-1.04)</td>
</tr>
<tr>
<td>Composite mortality and morbidity, n (%)</td>
<td>214/806 (26.6%)</td>
<td>0.58 (0.41-0.83)</td>
</tr>
<tr>
<td>Composite mortality and severe morbidity, (n%)</td>
<td>81/806 (10.1%)</td>
<td>0.37 (0.20-0.68)</td>
</tr>
<tr>
<td>32+0-36+6 weeks, n</td>
<td>6/1569 (0.4%)</td>
<td>1.10 (0.54-2.25)</td>
</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>17/5296 (0.3%)</td>
<td>0.27 (0.10-0.77)</td>
</tr>
<tr>
<td>Composite mortality and morbidity, n (%)</td>
<td>305/5296 (5.8%)</td>
<td>0.77 (0.41-1.04)</td>
</tr>
<tr>
<td>Composite mortality and severe morbidity, (n%)</td>
<td>105/5296 (2.0%)</td>
<td>0.37 (0.20-0.68)</td>
</tr>
</tbody>
</table>

OR, odds ratio, CI, confidence interval.
*Adjusted for: nulliparity, gestational age (weeks), NICU center, prolonged rupture of membranes (≥24 hours), birth weight (grams) and ethnicity.
Table 3 Neonatal Morbidity and Perinatal Mortality According to the Intended Mode of Delivery in Preterm Breech Presentation According to Parity

<table>
<thead>
<tr>
<th>Intended Cesarean Delivery</th>
<th>Intended Vaginal Delivery (Vaginal Delivery + Emergency Cesarean Delivery)</th>
<th>Unadjusted OR (95% CI)</th>
<th>Adjusted OR (95% CI) *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (26-36 weeks), n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality nulliparous, n (%)</td>
<td>15/1177 (1.3%)</td>
<td>57/4239 (1.3%)</td>
<td>0.95 (0.53-1.68)</td>
</tr>
<tr>
<td>Perinatal mortality parous, n (%)</td>
<td>11/758 (1.5%)</td>
<td>41/2182 (1.9%)</td>
<td>0.77 (0.39-1.55)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity nulliparous, n (%)</td>
<td>87/1177 (7.4%)</td>
<td>389/4239 (9.2%)</td>
<td>0.79 (0.62-1.01)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity parous, n (%)</td>
<td>82/758 (10.8%)</td>
<td>279/2182 (12.8%)</td>
<td>0.83 (0.64-1.08)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity nulliparous, n (%)</td>
<td>30/1177 (2.5%)</td>
<td>147/4239 (3.5%)</td>
<td>0.73 (0.49-1.08)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity parous, n (%)</td>
<td>32/758 (4.2%)</td>
<td>117/2182 (5.4%)</td>
<td>0.78 (0.52-1.16)</td>
</tr>
<tr>
<td>26+0-27+6 weeks, n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality nulliparous, n (%)</td>
<td>8/40 (20.0%)</td>
<td>33/175 (18.9%)</td>
<td>1.08 (0.45-2.21)</td>
</tr>
<tr>
<td>Perinatal mortality parous, n (%)</td>
<td>7/36 (19.4%)</td>
<td>15/144 (10.4%)</td>
<td>2.08 (0.78-5.55)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity nulliparous, n (%)</td>
<td>16/40 (40%)</td>
<td>86/175 (49.1%)</td>
<td>0.69 (0.34-1.39)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity parous, n (%)</td>
<td>11/36 (30.6%)</td>
<td>63/144 (43.8%)</td>
<td>0.57 (0.26-1.24)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity nulliparous, n (%)</td>
<td>10/40 (25%)</td>
<td>50/175 (28.6%)</td>
<td>0.83 (0.38-1.83)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity parous, n (%)</td>
<td>8/36 (22.2%)</td>
<td>28/144 (19.4%)</td>
<td>1.18 (0.49-2.88)</td>
</tr>
<tr>
<td>28+0-31+6 weeks, n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality nulliparous, n (%)</td>
<td>3/159 (1.9%)</td>
<td>14/471 (3.0%)</td>
<td>0.63 (0.18-2.21)</td>
</tr>
<tr>
<td>Perinatal mortality parous, n (%)</td>
<td>2/131 (1.5%)</td>
<td>19/335 (5.7%)</td>
<td>0.26 (0.06-1.12)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity nulliparous, n (%)</td>
<td>34/159 (21.3%)</td>
<td>119/471 (25.3%)</td>
<td>0.81 (0.52-1.24)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity parous, n (%)</td>
<td>34/131 (21.4%)</td>
<td>95/335 (28.4%)</td>
<td>0.81 (0.52-1.24)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity nulliparous, n (%)</td>
<td>8/159 (5.0%)</td>
<td>40/471 (8.5%)</td>
<td>0.57 (0.26-1.25)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity parous, n (%)</td>
<td>9/131 (6.9%)</td>
<td>41/335 (12.2%)</td>
<td>0.53 (0.25-1.12)</td>
</tr>
<tr>
<td>32+0-36+6 weeks, n</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality nulliparous, n (%)</td>
<td>4/978 (0.4%)</td>
<td>10/3593 (0.3%)</td>
<td>1.47 (0.46-4.70)</td>
</tr>
<tr>
<td>Perinatal mortality parous, n (%)</td>
<td>2/591 (0.3%)</td>
<td>7/1703 (0.4%)</td>
<td>0.82 (0.17-3.97)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity nulliparous, n (%)</td>
<td>37/978 (4.4%)</td>
<td>184/3593 (5.1%)</td>
<td>0.73 (0.51-1.05)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity parous, n (%)</td>
<td>43/1703 (2.7%)</td>
<td>121/3593 (7.1%)</td>
<td>1.01 (0.72-1.47)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity nulliparous, n (%)</td>
<td>12/978 (1.2%)</td>
<td>57/3593 (1.6%)</td>
<td>0.77 (0.41-1.44)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity parous, n (%)</td>
<td>15/591 (2.5%)</td>
<td>48/1703 (2.8%)</td>
<td>0.90 (0.50-1.62)</td>
</tr>
</tbody>
</table>

*Adjusted for: NICU center, gestational age (weeks), prolonged rupture of membranes (≥24 hours), birth weight (grams) and ethnicity.
Table 4 Neonatal Morbidity and Perinatal Mortality in Preterm Singleton Births With a Breech Presentation in Subgroups of Gestational Age According to the Actual Mode of Delivery

<table>
<thead>
<tr>
<th>Gestational Age</th>
<th>Intended Cesarean Delivery</th>
<th>Vaginal Delivery</th>
<th>Emergency Cesarean Delivery</th>
<th>OR (unadjusted) (95%CI)*</th>
<th>OR (unadjusted) (95%CI)</th>
<th>OR (Adjusted 95%CI)*</th>
<th>OR (Adjusted 95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (26-36 weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>26/1935 (1.3%)</td>
<td>79/3426 (2.3%)</td>
<td>19/2995 (0.6%)</td>
<td>0.58 (0.37 – 0.90)</td>
<td>0.27 (0.16 – 0.45)</td>
<td>0.79 (0.48-1.30)</td>
<td>0.47 (0.28-0.79)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity, n (%)</td>
<td>169/1935 (8.7%)</td>
<td>419/3426 (12.2%)</td>
<td>249/2995 (8.3%)</td>
<td>0.61 (0.52-0.77)</td>
<td>0.65 (0.55-0.77)</td>
<td>0.74 (0.60-0.92)</td>
<td>0.93 (0.77-1.11)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity, n (%)</td>
<td>62/1935 (3.2%)</td>
<td>180/3426 (5.3%)</td>
<td>84/2995 (2.8%)</td>
<td>0.60 (0.44-0.80)</td>
<td>0.52 (0.40-0.68)</td>
<td>0.69 (0.50-0.84)</td>
<td>0.76 (0.58-0.99)</td>
</tr>
<tr>
<td>26+0-27+6 weeks</td>
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</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>15/76 (19.7%)</td>
<td>41/234 (17.5%)</td>
<td>7/85 (8.2%)</td>
<td>1.16 (0.60 – 2.24)</td>
<td>0.42 (0.18-0.98)</td>
<td>0.95 (0.46-1.96)</td>
<td>0.43 (0.18-1.01)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity, n (%)</td>
<td>27/76 (35.5%)</td>
<td>107/234 (45.7%)</td>
<td>42/85 (49.4%)</td>
<td>0.65 (0.38-1.12)</td>
<td>1.16 (0.71-1.91)</td>
<td>0.59 (0.33-1.04)</td>
<td>1.15 (0.69-1.92)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity, n (%)</td>
<td>18/76 (23.7%)</td>
<td>64/234 (27.4%)</td>
<td>14/85 (16.5%)</td>
<td>0.82 (0.45-1.51)</td>
<td>0.52 (0.28-0.99)</td>
<td>0.72 (0.37-1.39)</td>
<td>0.51 (0.26-0.99)</td>
</tr>
<tr>
<td>28+0-31+6 weeks</td>
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</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>5/290 (1.7%)</td>
<td>26/528 (4.9%)</td>
<td>7/278 (2.5%)</td>
<td>0.34 (0.13 – 0.89)</td>
<td>0.50 (0.21 – 1.16)</td>
<td>0.22 (0.08- 0.64)</td>
<td>0.48 (0.21 – 1.11)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity, n (%)</td>
<td>62/290 (21.4%)</td>
<td>134/528 (25.4%)</td>
<td>80/278 (28.8%)</td>
<td>0.80 (0.57-1.11)</td>
<td>1.19 (0.86-1.65)</td>
<td>0.62 (0.42-0.90)</td>
<td>1.18 (0.85-1.63)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity, n (%)</td>
<td>17/290 (5.9%)</td>
<td>58/528 (11.0%)</td>
<td>23/278 (8.3%)</td>
<td>0.51 (0.29-0.88)</td>
<td>0.73 (0.44-1.21)</td>
<td>0.33 (0.18-0.62)</td>
<td>0.71 (0.43-1.19)</td>
</tr>
<tr>
<td>32+0-36+6 weeks</td>
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</tr>
<tr>
<td>Perinatal mortality, n (%)</td>
<td>6/1569 (0.4%)</td>
<td>12/2664 (0.5%)</td>
<td>5/2632 (0.2%)</td>
<td>0.85 (0.32 – 2.27)</td>
<td>0.42 (0.15 – 1.20)</td>
<td>0.81 (0.30- 2.21)</td>
<td>0.45 (0.16 – 1.29)</td>
</tr>
<tr>
<td>Composite mortality &amp; morbidity, n (%)</td>
<td>80/1569 (5.1%)</td>
<td>178/2664 (6.7%)</td>
<td>127/2632 (4.8%)</td>
<td>0.75 (0.57-0.98)</td>
<td>0.71 (0.56-0.90)</td>
<td>0.69 (0.52-0.91)</td>
<td>0.77 (0.61-0.98)</td>
</tr>
<tr>
<td>Composite mortality &amp; severe morbidity, n (%)</td>
<td>27/1569 (1.7%)</td>
<td>58/2664 (2.2%)</td>
<td>47/2632 (1.8%)</td>
<td>0.79 (0.50-1.25)</td>
<td>0.82 (0.55-1.21)</td>
<td>0.74 (0.46-1.18)</td>
<td>0.89 (0.60-1.28)</td>
</tr>
</tbody>
</table>

* Adjusted for: nulliparity, gestational age (weeks), hospital equipped NICU center, prolonged rupture of membranes (≥24 hours), birth weight (grams) and ethnicity.
Discussion

This population-based cohort study shows that in women with a preterm breech presentation, intended cesarean delivery is associated with reduced perinatal mortality and morbidity as compared to intended vaginal delivery. In the sub-group of women delivering at 28-32 weeks, intended caesarean delivery was associated with a 1.7% risk of perinatal mortality, compared to 4.1% with intended vaginal delivery (aOR 0.27; 95% CI 0.10-0.77). Analysis according to actual mode of delivery showed that emergency cesarean delivery was associated with the highest reduction in perinatal mortality and morbidity.

The main and important strength of our study is that we report on a very large cohort of women with an intended vaginal preterm breech delivery and analyse outcomes by intended mode of delivery in addition to actual mode of delivery. We found this important, as the intended vaginal delivery group then getting an emergency cesarean delivery had better outcomes than the intended cesarean delivery group. This may indicate selection bias in this non-randomised study in favour of the group with intended vaginal delivery.

Obstetric practice in the Netherlands is likely to differ from practice in for example the US. For instance in the US more often active management will be performed in babies born at very early gestational ages. We excluded women delivering below a gestational age of 26 weeks from our analysis. Otherwise, we think that active management in terms of steroids, antibiotics and NICU facilities between the US and the Netherlands will be comparable. Routine use of magnesium sulphate for neuroprotection was only introduced after our study period, but this is unlikely to interfere with our outcome measures. The relatively high vaginal delivery rate in The Netherlands gave us the unique opportunity to study the effect of the mode of delivery in preterm breech delivery. Obviously, the impact of our study on current Dutch practice will be strong, whereas our findings will probably more or less confirm current US policy.

Overall, in terms of perinatal mortality and morbidity the results of this study correspond with the findings of most smaller cohort studies that were summarized in our recent review ([20]). The current study is based on a larger number of women who delivered vaginally, thus increasing the power of our findings. A potential disadvantage of cesarean delivery in women with threatened preterm labor is timing of the delivery. Obviously, when vaginal delivery occurs further delay of pregnancy was either not indicated or not possible. In cesarean delivery, however, one is not sure whether the preterm birth would actually occur. As our dataset only registered the exact moment of delivery, we could not correct for the potential advantage of a further delay of pregnancy with some days. This might explain why the emergency caesarean had the
most favourable neonatal outcome in the analysis according to actual mode of delivery.

All studies concerning preterm breech presentation and perinatal mortality and morbidity according to the mode of delivery are pointing in the same direction: cesarean delivery reduces perinatal mortality and morbidity compared to vaginal delivery. However, the treatment effect seems smaller than has been found after the randomized controlled trial for term breech delivery. Ideally, the exact treatment effect would be assessed by a large RCT. A (new) RCT will however face the same problem in recruiting women as the RCT’s published until now. [21,22]. Consequently, in absence or expectation of a large RCT, clinical decision-making should be based on the current best available evidence from large cohort studies such as ours. We therefore conclude that in women presenting with a preterm breech presentation cesarean delivery is associated with reduced perinatal mortality and morbidity. This information should be used in counselling of women and their families.

References
1) NVOG guideline “term breech pregnancy” www.nvog.nl/richtlijn