Improving management of breech presentation at term
Vlemmix, F.

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Subsequent pregnancy outcome after breech delivery, a population based cohort study

Floortje Vlemmix
Brenda M. Kazemier
Ageeth N. Rosman
Michel Hof
Jelle M. Schaaf
Anita C.J. Ravelli
Johannes J. Duvekot
Joris A.M. van der Post
Ben Willem J. Mol
Marjolein Kok

Submitted
ABSTRACT

Objective To investigate the effect of the mode of delivery for term breech presentation on perinatal and maternal outcome on both the index and the subsequent pregnancy.

Study design We analysed data from the Dutch medical birth registry from 1999 to 2007. Data from 15,558 primiparous women with a singleton term breech delivery were linked with data of their subsequent pregnancy. We compared a strategy of elective cesarean versus a planned vaginal delivery for the first breech delivery. In a scenario analysis, we evaluated the effect of ‘once a cesarean always a cesarean’. The main outcome measures were perinatal and maternal morbidity and mortality.

Results Women who had an elective cesarean delivery in their index pregnancy had an increased risk of adverse neonatal outcome during the second pregnancy, compared to women who had a planned vaginal breech delivery (15.6 vs. 13.4‰, OR 1.3 (95% CI 1.0-1.7)) and an increased risk of adverse maternal outcome (59.9 vs. 43.0‰, OR 1.4, 95%CI 1.2-1.7). There was no significant reduction in perinatal mortality if outcomes of first and second pregnancies were combined. Neonatal morbidity remained significantly reduced (OR 0.47 (95% CI 0.39 – 0.58)). The scenario analysis decreased absolute risks of adverse outcomes, but still not led to a significant reduction in perinatal mortality.

Conclusions Elective cesarean delivery for term breech presentation leads to a significant increase in maternal morbidity and adverse neonatal outcome in subsequent pregnancies. Combining outcomes of the first and the subsequent pregnancy only resulted in a reduction in neonatal morbidity.
INTRODUCTION

Breech presentation occurs in 3-4% of term pregnancies and vaginal breech delivery is associated with increased neonatal mortality and morbidity.\textsuperscript{1–3} Since publication of the results of the Term Breech Trial, breech presentation is a widely accepted indication for elective cesarean delivery.\textsuperscript{1,4,5} In the Term Breech Trial, Hannah et al. reported a decrease in combined adverse perinatal outcome in case of elective cesarean delivery compared to trial of labor (1.6 vs. 5.0%, RR 0.33; 95%CI 0.19-0.56). This effect was even stronger in countries with a low perinatal mortality rate (0.04 vs. 5.7%, RR 0.07; 95%CI 0.02-0.29). Maternal outcome was found to be comparable between the two groups, with a 43% emergency cesarean delivery rate in the planned vaginal delivery group.

After publication of the Term Breech Trial, the overall cesarean delivery rate in the Netherlands increased within two months from 50% to 80%, but remained stable thereafter, and is still much lower when compared to for instance the United Kingdom (90%), Denmark (94%) or Australia (96%).\textsuperscript{6–8} Ever since the publication of the Term Breech Trial, there has been discussion whether the gain in neonatal outcome by performing primary cesarean delivery in case of breech presentation, outweighs the neonatal and maternal risks when including outcome of subsequent pregnancies.\textsuperscript{9–11}

Increasing cesarean delivery rates are a major topic of debate in obstetrics all over the world. In 1985, the World Health Organization set the recommended level at 15%.\textsuperscript{12} Nowadays, many countries face much higher cesarean delivery rates, for example in China (46%), Argentina (36%), USA (33%), Brazil (30%), Canada (24%) and United Kingdom (23%).\textsuperscript{4,8,13,14} In the Netherlands the cesarean delivery rate was 16% in 2009.\textsuperscript{5} Complication rates of a cesarean delivery reported in literature vary from 10 to 30% including mild complications like cystitis, and severe complications like bladder injury, haemorrhage, thrombo-embolism and even maternal mortality.\textsuperscript{15–17} The risks of maternal or fetal mortality during a trial of labor after cesarean delivery are 0.04‰ and 1.3‰ respectively, and after elective repeat cesarean delivery 0.13‰ and 0.5‰.\textsuperscript{4,5} As a result repeat cesarean delivery seems to decrease fetal mortality, at a cost of more maternal mortality.
We investigated the effects of the mode of delivery for term breech presentation (elective cesarean delivery versus vaginal delivery) on the maternal and neonatal outcome in the subsequent pregnancy. Secondly, we compared the health of the family as a whole (first and second pregnancy together) after a strategy of elective cesarean delivery as compared to a planned vaginal delivery in the first pregnancy.

MATERIALS AND METHODS

Study population

This study was performed using data from a prospective national cohort registered in 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 midwifery registry (LVR 1), the obstetrics registry (LVR 2) and the neonatology registry (LNR) of hospital admissions of new-borns. The coverage of the PRN registry is about 96% of all deliveries in the Netherlands. All PRN data are voluntarily recorded by the caregivers during prenatal care, delivery and the neonatal period. Data on neonatal admissions are registered in 99 of the 109 (90%) hospitals in the Netherlands. Data on neonatal follow up to 28 days after birth are provided by 49% (46/94) of neonatal care units in the Netherlands. The data are annually sent to the national registry office, where a number of range and consistency checks are conducted. For this study all births between January 1<sup>st</sup> 1999 and December 31<sup>st</sup> 2007 were selected.

A longitudinal probabilistic linkage procedure was developed to connect the first and subsequent pregnancies of the same mother in the PRN registry, and has been described in detail previously. The linkage procedure was necessary as the records included in the PRN were entered at the child’s level and there was no unique maternal identifier available in the registry to follow up on outcomes of subsequent pregnancies of the same mother. The longitudinal linkage was based on the variables birth date of mother, birth date of (previous) child, and zip code of mother. All children from second deliveries (n = 509, 559) registered in the PRN registry were subjected to linkage with their siblings born during a first delivery (nulliparous woman) registered in
the PRN registry for all births between 1 January 1999 and 31 December 2007. The final linked cohort with complete data on first and second deliveries of the same mother consisted of 272,551 women who had 545,102 (2 times 272,551) deliveries. From the longitudinal linked cohort, all first pregnancies with singleton breech presentations born between 37 0/7 and 41 6/7 weeks of gestation were selected. Exclusion criteria for the first pregnancies were antepartum death, death caused by placental abruption, and major congenital malformations. Major congenital malformations were defined as abnormalities of the central nervous system (spina bifida, meningo-myelocele, exencephaly, anencephaly, hydrocephaly and microcephaly) and cardiovascular and gastrointestinal system.

Main outcome measures

Outcomes of the first and second pregnancies were compared based on the mode of delivery in the index pregnancy, distinguishing between planned vaginal and planned cesarean breech delivery. Planned vaginal delivery was defined as initially intended vaginal delivery and included true vaginal delivery and emergency cesarean delivery (due to failure to progress or fetal distress).

Perinatal mortality was defined as perinatal and neonatal mortality up to 28 days. Neonatal morbidity was defined as an Apgar score of less than 7 at five minutes, and birth trauma (which included intracerebral bleeding, cephalic hematoma, facial nerve paresis, brachial plexus lesion, fracture of clavicle, humerus or femur and other trauma). Adverse neonatal outcome was defined as a composite measure of mortality and morbidity.

Maternal mortality was defined as mortality up to 28 days. Maternal morbidity was defined as uterine rupture, placental abruption and postpartum haemorrhage (PPH, defined as > 1000 mL, according to Dutch guidelines). Adverse maternal outcome was defined as a composite measure of maternal mortality and morbidity.

Statistical analysis

A comparison was made between the outcomes of the second pregnancy, distinguishing between a planned vaginal breech delivery and an elective cesarean delivery in the first pregnancy. Odds ratios and their 95% confidence intervals were calculated, which were adjusted for presentation at
birth and trial of labor. We did a subgroup analysis to assess the effect of the mode of delivery on neonatal outcome if all women with a trial of labor in the second pregnancy were excluded. We did this to mimic a scenario of elective cesarean deliveries in case of a previous cesarean delivery. For this subgroup analyses, we excluded the antenatal mortality as the occurrence of a stillbirth influences the chosen mode of delivery (vaginal delivery) and inclusion of stillbirth would thus cause a selection bias. We used an interaction term to test the effect of mode of delivery on perinatal mortality and composite neonatal outcome in the group with trial of labor and repeat cesarean delivery.

To assess the combined outcome of index and subsequent pregnancies we calculated the average maternal and neonatal composite outcome scores over the two pregnancies.

Furthermore, we calculated the number needed to treat (NNT) based on the amount of primary cesarean deliveries are needed to prevent one adverse outcome, and the number needed to harm (NNH), the amount of elective cesarean deliveries that lead to one extra adverse outcome.

All statistical analyses were carried out with SAS 9.2 (SAS Institute, Cary, NC). Permission for record use and analysis of data for the purpose of this study was obtained from the Netherlands Perinatal Registry (registered as data petition 11.44).

RESULTS

Of the 272,551 women in the linked database, 15,558 (5.7%) women had a healthy term singleton fetus in breech presentation during the first pregnancy. Mode of delivery and maternal and neonatal outcome of the first and second pregnancy are presented in Figure I.

In the first pregnancy, 8,116 (52%) women had an elective cesarean delivery for breech presentation. Of the remaining 7,442 (48%) women with a planned vaginal breech delivery, 3,287 (44%) delivered vaginally while 4,155 (56%) had an emergency cesarean delivery.
# Chapter 3

## Subsequent pregnancy outcome after breech delivery

### Breech presentation (between 37 0/7 and 41 6/7 weeks gestation)

<table>
<thead>
<tr>
<th>First pregnancy (breech)</th>
<th>Second pregnancy outcome after breech delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Elective CD</strong> (N=8,116, 52%)</td>
<td><strong>Planned vaginal breech delivery</strong> (N = 7,442, 48%)</td>
</tr>
<tr>
<td>Maternal morbidity 111 (13.7 %)</td>
<td>Maternal morbidity 147 (19.3 %)</td>
</tr>
<tr>
<td>Perinatal mortality 0</td>
<td>Perinatal mortality 19 (2.6 %)</td>
</tr>
<tr>
<td>Neonatal morbidity 30 (3.7 %)</td>
<td>Neonatal morbidity 195 (26.3 %)</td>
</tr>
</tbody>
</table>

**Vaginal birth** (N = 3,293, 44%)
- Maternal morbidity 102 (31.0 %)
- Perinatal mortality 13 (3.9 %)
- Neonatal morbidity 141 (42.8 %)

**Emergency CD** (N = 4,149, 56%)
- Maternal morbidity 45 (10.8 %)
- Perinatal mortality 5 (1.4 %)
- Neonatal morbidity 55 (13.3 %)

### Subsequent pregnancies

<table>
<thead>
<tr>
<th>Elective CD</th>
<th>Trial of labour *</th>
<th>Elective CD</th>
<th>Vaginal delivery</th>
<th>Elective CD</th>
<th>Trial of labour *</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N=1,427, 28%)</td>
<td>(N=6,685, 72%)</td>
<td>(N =122, 4%)</td>
<td>(N=3,171, 95%)</td>
<td>(N=527, 13%)</td>
<td>(N=3,622, 87%)</td>
</tr>
<tr>
<td>Maternal morbidity 46 (32.2 %)</td>
<td>Maternal morbidity 440 (65.8 %)</td>
<td>Maternal morbidity 4 (32.8 %)</td>
<td>Maternal morbidity 89 (30.4 %)</td>
<td>Maternal morbidity 16 (30.4 %)</td>
<td>Maternal morbidity 211 (58.3 %)</td>
</tr>
<tr>
<td>Perinatal mortality 2 (1.4 %)</td>
<td>Perinatal mortality 18 (2.7 %)</td>
<td>Perinatal mortality 1 (8.2 %)</td>
<td>Perinatal mortality 3 (0.9 %)</td>
<td>Perinatal mortality 3 (3.8 %)</td>
<td>Perinatal mortality 4 (1.1 %)</td>
</tr>
<tr>
<td>Neonatal morbidity 10 (7.0 %)</td>
<td>Neonatal morbidity 117 (7.0 %)</td>
<td>Neonatal morbidity 2 (16.4 %)</td>
<td>Neonatal morbidity 33 (10.4 %)</td>
<td>Neonatal morbidity 5 (9.5 %)</td>
<td>Neonatal morbidity 60 (16.5 %)</td>
</tr>
<tr>
<td>*14% emergency CS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*13% emergency C5
Perinatal outcome in the second pregnancy

Perinatal mortality up to 28 days occurred twice as often in the second pregnancy if the first delivery was an elective cesarean delivery compared to a planned vaginal delivery but this did not reach statistical significance (2.5 vs. 1.3‰; aOR 2.1 (95% CI 0.96 – 4.5)) (Table 1).

A five-minute Apgar score below 7 occurred more often in the second pregnancy if women had an elective cesarean delivery in their first pregnancy compared to a planned vaginal delivery in the first pregnancy (13.8 vs. 11.4‰; aOR 1.5 (95% CI 1.1 – 1.9)), while birth trauma did not differ significantly between both groups (2.1 vs. 1.6‰; aOR 1.4 (95% CI 0.6–2.8). The adverse neonatal outcome in the second pregnancy was higher in the group of women with an elective cesarean delivery compared to women with a planned vaginal delivery in their first pregnancy (15.6 vs. 13.4‰; aOR 1.3 (95% CI 1.0-1.7)).

Table 1. Outcome of second pregnancies of women with term breech delivery in their first pregnancy

<table>
<thead>
<tr>
<th></th>
<th>Elective CD in first pregnancy</th>
<th>Planned vaginal delivery in first pregnancy</th>
<th>Adjusted OR (b)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth trauma</td>
<td>17 (2.1)</td>
<td>12 (1.6)</td>
<td>1.4</td>
<td>0.65-2.8</td>
</tr>
<tr>
<td>Five-minute Apgar score &lt;7</td>
<td>112 (13.8)</td>
<td>84 (11.3)</td>
<td>1.5</td>
<td>1.1-1.9</td>
</tr>
<tr>
<td>Perinatal mortality (^c)</td>
<td>20 (2.5)</td>
<td>10 (1.3)</td>
<td>2.1</td>
<td>0.96-4.5</td>
</tr>
<tr>
<td>Adverse neonatal outcome (^d)</td>
<td>127 (15.6)</td>
<td>99 (13.4)</td>
<td>1.3</td>
<td>1.0-1.7</td>
</tr>
<tr>
<td>Uterine rupture</td>
<td>18 (2.2)</td>
<td>4 (0.5)</td>
<td>4.9</td>
<td>1.6-14.7</td>
</tr>
<tr>
<td>Placental abruption</td>
<td>7 (0.9)</td>
<td>4 (0.5)</td>
<td>1.3</td>
<td>0.35-4.4</td>
</tr>
<tr>
<td>PPH (&gt;1000ml)</td>
<td>464 (57.2)</td>
<td>312 (41.9)</td>
<td>1.4</td>
<td>1.2-1.6</td>
</tr>
<tr>
<td>Maternal mortality</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Adverse maternal outcome (^e)</td>
<td>486 (59.9)</td>
<td>320 (43.0)</td>
<td>1.4</td>
<td>1.2-1.7</td>
</tr>
</tbody>
</table>

\(^a\) Vaginal breech birth and emergency caesarean delivery (CD).

\(^b\) Planned vaginal delivery versus elective CD, adjusted for presentation at birth and trial of labour

\(^c\) Perinatal and neonatal mortality until 28 days postpartum

\(^d\) Composite score of perinatal and neonatal mortality up to 28 days, five-minute Apgar score <7, birth trauma.

\(^e\) Composite score of maternal mortality, PPH>1000 ml, placental abruption and uterine rupture
Intended mode of delivery of the subsequent pregnancy (trial of labor versus repeat elective cesarean delivery) was a significant effect modifier in the association of mode of delivery in the index pregnancy and neonatal outcome in the second pregnancy (interaction terms were highly significant for mortality (p<0.001) and the composite outcome (p=0.01)). Thus a scenario analysis excluding women with a trial of labor after previous cesarean delivery was justified (Table 2).

In this scenario analysis, the perinatal mortality rates in the second pregnancy were lower in the women who had an elective cesarean delivery compared to a planned vaginal delivery in their first pregnancy, but this was not statistically significant (1.4 vs. 1.6‰; aOR 0.5 (95% CI 0.1 – 2.8)). In Table 1, there are 20 cases of perinatal mortality reported in the elective cesarean group.

After exclusion of all trial of labours, this is reduced to 2 cases (Table 2). Thus the perinatal mortality rate was 2.6‰ in case of a trial of labor after elective cesarean delivery ((20-2) / (8116-1427)), which is similar to the mortality rate in the first pregnancy of the planned vaginal breech delivery group (Table 3).

### Table 2. Outcome of second pregnancies of women with term breech delivery in their first pregnancy, after exclusion of women with trial of labour in the second pregnancy after a caesarean delivery in the first pregnancy.

<table>
<thead>
<tr>
<th>Birth trauma</th>
<th>Elective CD in first pregnancy N=1,427 (%)</th>
<th>Planned vaginal delivery in first pregnancy</th>
<th>Adjusted OR(^b)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth trauma</td>
<td>2 (1.7)</td>
<td>2 (0.5)</td>
<td>3.3</td>
<td>0.42-25.9</td>
</tr>
<tr>
<td>Five-minute Apgar score &lt;7</td>
<td>7 (4.9)</td>
<td>33 (8.6)</td>
<td>0.41</td>
<td>0.17-0.97</td>
</tr>
<tr>
<td>Perinatal mortality(^c)</td>
<td>2 (1.4)</td>
<td>6 (1.6)</td>
<td>0.52</td>
<td>0.10-2.8</td>
</tr>
<tr>
<td>Adverse neonatal outcome(^d)</td>
<td>10 (7.0)</td>
<td>39 (10.2)</td>
<td>0.51</td>
<td>0.25-1.1</td>
</tr>
<tr>
<td>Uterine rupture</td>
<td>1 (0.7)</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Placental abruption</td>
<td>2 (1.7)</td>
<td>2 (0.5)</td>
<td>3.3</td>
<td>0.42-25.9</td>
</tr>
<tr>
<td>PPH (&gt;1000ml)</td>
<td>44 (30.8)</td>
<td>107 (28.0)</td>
<td>1.04</td>
<td>0.59-1.8</td>
</tr>
<tr>
<td>Maternal mortality</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Adverse maternal outcome(^e)</td>
<td>46 (32.2)</td>
<td>109 (28.5)</td>
<td>1.3</td>
<td>0.90-1.9</td>
</tr>
</tbody>
</table>

\(^a\)Vaginal breech birth and emergency caesarean delivery (CD).

\(^b\)Planned vaginal delivery versus elective CD, adjusted for presentation at birth

\(^c\)Perinatal and neonatal mortality until 28 days post-partum

\(^d\)Composite score of neonatal mortality up to 28 days, five-minute Apgar score <7 and birth trauma

\(^e\)Composite score of maternal mortality, PPH>1000 ml, placental abruption and uterine rupture
A 5-minute Apgar score <7 occurred less frequent in the second pregnancy in the elective cesarean delivery group compared to the vaginal delivery group after exclusion of trial of labor after cesarean delivery, but this did not reach statistical significance (4.9 vs. 8.6‰; aOR 0.4 (95% CI 0.2 – 1.0)). The combined outcome score was also not significantly different (7.0 vs. 7.9‰; aOR 0.5 (95% CI 0.2 – 1.0)).

**Table 3**: Neonatal and maternal outcomes of first and second pregnancy in nulliparous women with a breech presentation in the first pregnancy. NNT is the number of extra caesarean deliveries (CD) needed to perform

<table>
<thead>
<tr>
<th></th>
<th>Elective CD first pregnancy (average risk per child)</th>
<th>Planned vaginal delivery first pregnancy (average risk per child)</th>
<th>OR (95% CI)</th>
<th>NNT / NNH† primary CS (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome of first pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of birth</td>
<td>8116</td>
<td>7442</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality</td>
<td>0</td>
<td>19 (2.6)</td>
<td>0.16 (0.10 –)</td>
<td>392 (251-612)</td>
</tr>
<tr>
<td>Neonatal morbidity</td>
<td>30 (3.7)</td>
<td>196 (26.3)</td>
<td>0.16 (0.10 –)</td>
<td>45 (38-53)</td>
</tr>
<tr>
<td>Maternal morbidity</td>
<td>111 (13.7)</td>
<td>147 (19.8)</td>
<td>0.69 [0.53 -]</td>
<td>165 (98-485)</td>
</tr>
</tbody>
</table>

Outcome of first and second pregnancy (of which 66.3% underwent trial of labour)

<table>
<thead>
<tr>
<th></th>
<th>Elective CD first pregnancy (average risk per child)</th>
<th>Planned vaginal delivery first pregnancy (average risk per child)</th>
<th>OR (95% CI)</th>
<th>NNT / NNH† primary CS (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of birth</td>
<td>16232</td>
<td>14884</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality</td>
<td>20 (1.2)</td>
<td>29 (1.9)</td>
<td>0.63 (0.34 –1.2)</td>
<td>1397</td>
</tr>
<tr>
<td>Neonatal morbidity</td>
<td>157 (9.7)</td>
<td>301 (20.2)</td>
<td>0.47 (0.39 –)</td>
<td>95 (76-127)</td>
</tr>
<tr>
<td>Maternal morbidity</td>
<td>597 (36.8)</td>
<td>467 (31.4)</td>
<td>1.2 (1.0-1.3)</td>
<td>186†</td>
</tr>
</tbody>
</table>

Outcome of first and second pregnancy, exclusion of trial of labour

<table>
<thead>
<tr>
<th></th>
<th>Elective CD first pregnancy (average risk per child)</th>
<th>Planned vaginal delivery first pregnancy (average risk per child)</th>
<th>OR (95% CI)</th>
<th>NNT / NNH† primary CS (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of birth</td>
<td>2854</td>
<td>7640</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perinatal mortality</td>
<td>2 (0.7)</td>
<td>15 (2.0)</td>
<td>0.36 (0.04 - 1.5)</td>
<td>793 (1454†-374)</td>
</tr>
<tr>
<td>Neonatal morbidity</td>
<td>20 (7.0)</td>
<td>193 (25.3)</td>
<td>0.27 (0.16 –)</td>
<td>55 (44-75)</td>
</tr>
<tr>
<td>Maternal morbidity</td>
<td>82 (28.7)</td>
<td>213 (27.9)</td>
<td>1.03 (0.79 – 1.3)</td>
<td>1174†</td>
</tr>
</tbody>
</table>

†number needed to harm
‡perinatal and neonatal mortality up to 28 days in first and second pregnancy
Maternal outcome in second pregnancy

No case of maternal mortality was reported in the 15,558 subsequent pregnancies. Uterine rupture occurred five times more often in women with a previous elective cesarean delivery compared to those with a planned vaginal delivery (2.2 vs. 0.5‰; aOR 4.9 (95% CI 1.6-14.7)) (Table 1). The risk of uterine rupture among women with a previous elective, versus emergency cesarean delivery during planned vaginal breech delivery was doubled, although this did not reach statistical significance (2.2 vs. 1.0‰; aOR 2.3 (95% CI 0.8-6.8)). Placental abruption differed not statistically significant between these two groups (0.9 vs. 0.7‰; aOR 1.2 (95% CI 0.3-4.6)). Postpartum haemorrhage (PPH) occurred more often in women with a previous elective cesarean delivery compared to previous vaginal delivery (57.2 vs. 41.9‰; aOR 1.4 (95% CI 1.2-1.6)). The combined poor maternal outcome occurred significantly more often in women with a previous elective cesarean delivery than previous planned vaginal delivery (59.9 vs. 42.9‰; aOR 1.4 (95% CI 1.2-1.7)) (Table 1).

Table 2 shows the result of the scenario analysis, in which we excluded all women with a trial of labor in the second pregnancy after an elective or emergency cesarean delivery in the first pregnancy. The number of uterine ruptures decreased from 18 to 1 in the elective cesarean delivery group (from 2.2 to 0.7‰; aOR 0.3 (0.03-2.0)); and from 4 to none in the women in the vaginal group who underwent an emergency cesarean delivery in their first pregnancy. There was no significant difference in the combined maternal outcome of the second deliveries between the elective cesarean delivery group (both pregnancies) versus the vaginal delivery group (32.2 vs. 28.5‰; aOR 1.3 (95% CI 0.9-1.9)).

Combined outcomes

Table 3 summarizes the combined maternal and neonatal outcomes of the index deliveries and subsequent pregnancies. When only looking at the index pregnancy, the perinatal mortality rate decreased from 2.6 to 0‰ due to the elective cesarean delivery in case of breech presentation (NNT 392). The neonatal morbidity decreased from 26.3 to 3.7‰ (NNT 45)

When the neonatal outcomes of the subsequent pregnancies were taken into account the perinatal mortality rate was 1.2‰ in the elective cesarean treatment arm.
delivery group and 1.9‰ in the planned vaginal delivery group, and no significant difference between the two modes of delivery was found (OR 0.63, 95%CI 0.34 – 1.2). The neonatal morbidity rate was 9.7 vs. 20.2‰ respectively (OR 0.47 (95% CI 0.39 – 0.58), NNT 95). The maternal morbidity was 36.8‰ for elective cesarean delivery vs. 31.4‰ for the planned vaginal breech delivery (OR 1.2 (95% CI 1.0-1.3), NNH 186) After exclusion of all women with a trial of labor in the second pregnancy after a cesarean delivery in the index pregnancy, the average risk of perinatal mortality over two pregnancies was 0.7‰ for planned cesarean delivery vs. 2.0‰ for planned vaginal delivery (OR 2.0 (95%CI 0.04-1.5)). The combined neonatal morbidity rate was 7.0 vs. 25.3‰ (OR 0.27 (95%CI 0.16-0.43), NNT 55). There was no significant difference in in maternal morbidity (28.7 vs. 27.9‰) (OR 1.03 (95%CI 0.79 – 1.3)).

**DISCUSSION**

To investigate the consequences of the mode of delivery for term breech presentation for future offspring, we studied 15,558 women in their second pregnancy who delivered a child in breech presentation in their first pregnancy. The NNT to prevent one case of perinatal morbidity is 95, but the gain in perinatal mortality and maternal morbidity by elective cesarean delivery for breech in the first pregnancy are lost due to an increased perinatal mortality and maternal morbidity rate in the second pregnancy. Exclusion of trial of labor after a previous cesarean section did lower the absolute risks at perinatal mortality, perinatal morbidity and maternal morbidity. However this still did not lead to a significant decrease in neonatal mortality in case of elective cesarean delivery for breech presentation.

**Strengths and limitations of our study**

Our study was based on data of a large population-based national perinatal registry. The majority of the caregivers contribute to the PRN registry and it therefore comprises approximately 96% of all pregnancy and birth characteristics in the Netherlands. The 4% missing birth data are due to 1–2% non-reporting general practitioners and 2–3% non-reporting midwives.

The fact that almost half of the women opted for planned vaginal breech delivery made it possible to evaluate the effect of a planned vaginal delivery vs. elective cesarean delivery policy. Linkage of index and subsequent deliveries allowed us to compare maternal and neonatal outcome
of these pregnancies. When interpreting the NNT, it is important to realize that this is the number of primary cesarean deliveries needed to prevent one complication. The number of extra cesarean deliveries (women who would otherwise have had a vaginal delivery) is actually lower as 56% of the women in the planned vaginal delivery group ended up with an emergency cesarean deliveries.

In the longitudinal probabilistic linkage procedure, 53% of all second deliveries could be linked to a first delivery. The probabilistic linkage method, and limitations to follow up mothers in a subsequent pregnancy, has been discussed in detail by Schaaf et al.\textsuperscript{20} Non-linkage could be explained because a first child was born before 1999, (which data were not available) in approximately half of the non-linked cases. Other explanations were missing values in the two out of the three linkage variables. It is unlikely that this non-linkage will have affected our results to a large extent, as non-linkage is neither related to fetal presentation in nulliparous singleton delivery, nor to the primary outcome measures.

A limitation of the study is that we were not able to perform a complete intention to treat analysis for mode of delivery. Women who opted for elective cesarean, but underwent a vaginal delivery (for instance due to unexpected start of delivery and fast progression), could not be identified as such and included in the cesarean group. In the Term Breech Trial, 9.7% of women with an elective cesarean underwent a vaginal breech delivery. There also might be ‘misclassification’ of emergency cesarean delivery in the database as some doctors have recorded for instance an elective cesarean delivery after PROM or onset of labor as an emergency cesarean delivery. This misclassification might have led to an underestimation of the adverse outcome of planned vaginal delivery, as a small proportion of low risk elective cesarean was added to this group.

A disadvantage of the increased cesarean rates is the increased maternal morbidity and mortality. There was no maternal mortality reported in our study. Among all women (multiparous and nulliparous women) with a breech presentation between 2000 and 2007, two maternal death were reported. Due to the selection of women with a subsequent pregnancy, these were not included in this cohort. A previous study reported four maternal deaths after elective cesarean delivery for term singleton breech delivery between 2000-2002.\textsuperscript{22} These study results suggest that there is a potential underre-
porting of maternal complications and mortality in the Netherlands Perinatal Registry. Therefore, our results on maternal outcome should be interpreted with caution. In literature, maternal mortality rates of 0.04‰ and 0.13‰ are reported for elective and repeat elective cesarean delivery respectively.\textsuperscript{4,22} The overall risk of 0.17‰ corresponds to one maternal mortality in 5,882 women with two elective caesareans. Our study is to our knowledge the largest study to evaluate the effect of elective cesarean delivery for breech presentation on subsequent pregnancies. The perinatal outcome of the first breech presenting pregnancy, are in line with results of the Term Breech Trial which showed a significant decrease in combined perinatal outcome in case of elective cesarean delivery compared to trial of labor (1.6% vs. 5.0, RR 0.33; 95%CI 0.19-0.56). A large cohort study on breech presentations in Denmark reported a decrease in mortality rate from 1.7‰ in the planned vaginal delivery group to 0.1‰ in the elective cesarean delivery group (RR 19.0 (95%CI 2.3-154.5).\textsuperscript{1,6} Landon et al. reported on 17,898 women with trial of labor and 15,801 with repeat cesarean delivery and found lower incidences of uterine rupture of 0.7% and 0%, respectively.\textsuperscript{23} Consequently, the antenatal and neonatal mortality rates were lower than in our study. We cannot explain this risk difference among the cohorts by specific patient characteristics. The management in the United Stated of America of women undergoing a trial of labor is apparently more risk averse than in The Netherlands.

**Meaning of the study**

Our data facilitate decision making on mode of delivery for women with a singleton breech presentation at term, as they enable quantification of the risks for future pregnancies. Counselling on the mode of breech delivery should indeed start with inventory of a woman’s family plans, followed by shared decision making on mode of delivery. Although neonatal and maternal outcome of both pregnancies are insignificant regarding mode of delivery in the first breech presenting pregnancy, this does not insinuate that the elective cesarean for breech presentation has lost its indication. The high risks of perinatal mortality during a vaginal breech delivery is spread out over two pregnancies and therefor lost its significance in the overall outcome. There is no significant increase of perinatal mortality in the second pregnancy due to the scarred uterus, which is in line with other studies on trial of labor after cesarean section.\textsuperscript{24–26} Nulliparous women with a breech presentation and a desire for two children would have the lowest risk at adverse neonatal mor-
bidity with an elective cesarean delivery for breech presentation (NNT 95). The NNT is reduced to 55 if two elective cesarean sections are performed.

As maternal and fetal complications will increase with every repeat cesarean delivery, we feel that our results are not applicable to women who want a family of at least four children or more. Decision analytic modelling including the risk and consequences of subsequent uterine rupture and placenta accreta in future pregnancies should point out when the balance tips over to vaginal breech delivery due to an increase complication rate of repeat cesarean delivery. The current mean birth rate in the Netherlands is 1.76 per women, thus a large majority of women will be helped with the information presented in this study.

The necessity of preventing the first cesarean section to improve obstetric outcome is again demonstrated in this study; the initial gain in neonatal and maternal outcome is largely undone by the consequences of (a trial of labor with) a scarred uterus during the next pregnancy. External cephalic version is the only treatment proven effective to reduce the cesarean delivery rate for breech presentation at term.\textsuperscript{27} Counselling for external cephalic version is essential in order to truly improve maternal and neonatal outcome in the breech presenting and subsequent pregnancies.

**Conclusions**

In conclusion, elective cesarean delivery for term breech presentation leads to a significant increase in maternal morbidity, and adverse neonatal outcome in subsequent pregnancies. Combining outcomes of the first breech presenting pregnancy and the subsequent pregnancy only led to a reduction in neonatal morbidity. These data should be used in shared decision making for the mode of delivery in women with a child in breech presentation at term.
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