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# Breech presentation at term and associated obstetric risks factors—a nationwide population based cohort study

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## Abstract

**Purpose** The aim of this study was to estimate whether breech presentation at term was associated with known individual obstetric risk factors for adverse fetal outcome.

**Methods** This was a retrospective, nationwide Finnish population-based cohort study. Obstetric risks in all breech and vertex singleton deliveries at term were compared between the years 2005 and 2014. A multivariable logistic regression model was used to determine significant risk factors.

**Results** The breech presentation rate at term for singleton pregnancies was 2.4%. The stillbirth rate in term breech presentation was significantly higher compared to cephalic presentation (0.2 vs 0.1%). The odds ratios (95% CIs) for fetal growth restriction, oligohydramnios, gestational diabetes, a history of cesarean section and congenital fetal abnormalities were 1.19 CI (1.07–1.32), 1.42 CI (1.27–1.57), 1.06 CI (1.00–1.13), 2.13 (1.98–2.29) and 2.01 CI (1.92–2.11).

**Conclusions** The study showed that breech presentation at term on its own was significantly associated with antenatal stillbirth and a number of individual obstetric risk factors for adverse perinatal outcomes. The risk factors included oligohydramnios, fetal growth restriction, gestational diabetes, history of caesarean section and congenital anomalies.

**Keywords** Breech presentation · Predicting factors · Risk factors · Fetal growth restriction · Stillbirth · Oligohydramnios

## Introduction

Breech presentation occurs in 3–4% of all deliveries. The most common reason for breech presentation is preterm delivery, as up to 35% of preterm fetuses are in breech position [1] and most of the fetuses turn spontaneously into vertex position near term. If the fetus remains in breech presentation until term it is likely there is a reason preventing the turning of the fetus into vertex presentation. The factors that increase the risk of breech presentation are well described, and may be related to an impediment of fetal rotation, an outstanding fetal rotation or abnormal fetal movements. Breech presentation may also occur if the engagement of the fetal head in the maternal pelvis is disturbed [2]. As shown previously, breech presentation is associated not only with preterm delivery but also with nulliparity, female gender of the fetus, low fetal weight, oligohydramnios and maternal hip and uterus deformities [1, 3]. Planned vaginal breech delivery has been under debate at least since the time that the term breech trial reported that planned vaginal breech delivery is associated with adverse perinatal short-term outcomes [4]. The impact of the term breech trial has, however, been questioned as the stringent criteria for vaginal breech delivery were violated in many ways and many of the stillbirths occurred in growth restricted pregnancies [5]. Since then, a number of studies have been published showing that vaginal breech delivery is safe for mother and child if the women are carefully selected for a trial of labor and labor management takes place in an appropriate obstetric setting [6–12]. In the

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same line of thought, the effect of breech presentation and vaginal breech delivery on the infant's long-term neurodevelopment has also been controversial. Some studies have suggested that cesarean section reduces long-term adverse outcomes [13, 14]. On the other hand, it has been reported that breech labor has no adverse effect on the neurological outcome of the infants [15] and that adverse neonatal long-term outcome is not related to intrapartum events, but to obstetric risk factors [16, 17]. Breech presentation at term is known to be associated with congenital anomalies and an increased prenatal stillbirth rate on its own [3, 18, 19].

There are only few population-based studies [1, 3] reviewing predicting factors for breech presentation and it is not known whether the abnormal presentation itself is a marker of adverse obstetric risk. More evidence and a better understanding of factors associated with breech presentation and adverse perinatal outcome are needed to determine which women are eligible for a safe trial of vaginal breech delivery. This study was conducted to estimate whether breech presentation at term is associated on its own with factors that are known risk factors for adverse perinatal outcomes.

## Materials and methods

The study was population-based, utilizing the data of the national medical birth register and the hospital discharge register, maintained by the National Institute for Health and Welfare. Data for the medical birth register was collected at all maternity hospitals in Finland. Reporting to the national registers is obligatory, thus the data is valid and gives good, nationwide coverage. The data includes all live births and stillbirths with a birth weight of 500 g and more or a gestational age of 22 weeks and more. The hospital discharge register contains information on all inpatient periods in all Finnish hospitals and all outpatient visits recorded in the public sector. The registered information includes demographic data, maternal information before and after the delivery, intrapartum procedures and complications, as well as perinatal outcome. The information was coded according to the International statistical classification of diseases (ICD) and related health problems 10th revision (ICD-10). The studied data included all deliveries from January 1, 2005 to December 31, 2014. Multiple gestations and preterm pregnancies were excluded from the study. Comparisons were made between all breech deliveries and all deliveries with the fetus in vertex presentation.

Breech and vertex presentation were chosen as dependent variables for the model. The variables chosen as possible obstetric risk factors were chosen based on previous literature [1, 3, 13, 18–23]. Maternal age, smoking, gestational diabetes (O24.4), diabetes mellitus type I (O24.0),

preeclampsia (O13, O14, O15), small size for gestational age [defined as 2 S.D. below mean or as <2.5th percentile using a Finnish intrauterine growth curve (O36.5, P05.0–P05.9)], infertility (N97, Z35.0), stillbirth (intrauterine stillbirths before onset of labor) (O36.4), congenital malformations of the fetus (not including dysplasia of the hip) (Q00–Q64 and Q66–Q99), oligohydramnios [defined as amniotic fluid index below 5 cm (O41.0)], parity, fetal sex (male), birth weight, history of caesarean section (O34.2) and the mother's body mass index (BMI) before pregnancy were included as independent variables. The adjustment was done for all significant variables excluding intrauterine stillbirth. Gestational age was not chosen as a variable, as only term pregnancies were analyzed.

Statistical differences in categorical variables were evaluated with the Chi-square test and differences in continuous variables by the Mann–Whitney *U* test as appropriate. Differences were deemed to be significant if  $p < 0.05$ . The odds ratios (ORs with their 95% CIs) of adverse outcomes were calculated using binary logistic regression. A multi-variable logistic regression model was used for adjustment. The data was analyzed using SPSS for Windows V.19.0, Chicago, Illinois, USA. The reporting of this study conforms to the STROBE statement.

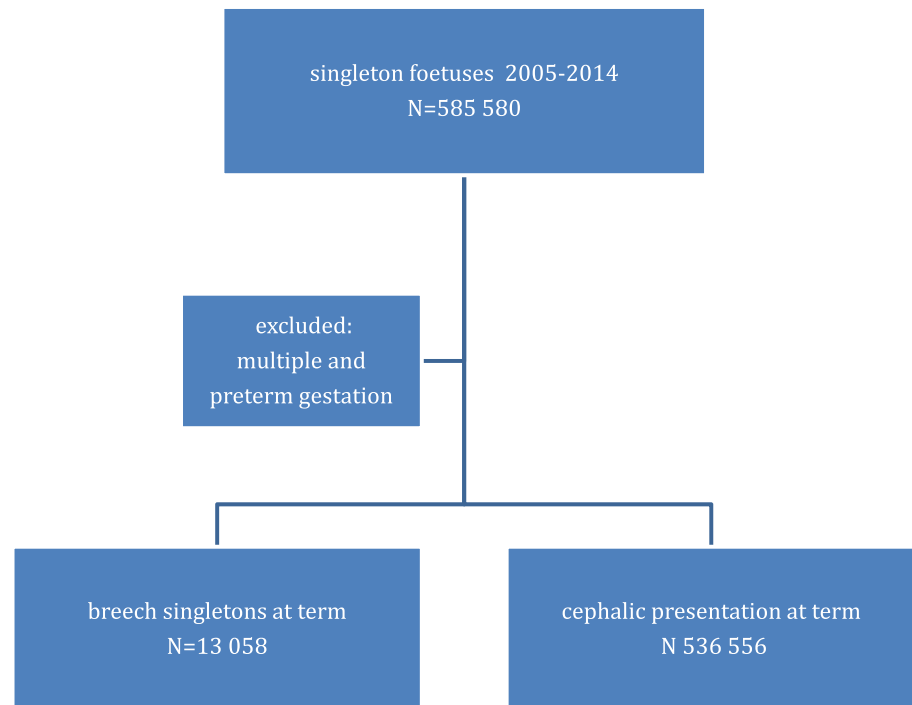
All data linkages were performed using unique personal identity codes, which were anonymized by the authorities. Authorization to use the data was obtained from the National Institute for Health and Welfare as required by the national data protection legislation law in Finland (Reference number THL/1200/5.05.00/2012).

## Results

During the study period of 10 years, 585 580 deliveries were observed. Of all analyzed pregnancies, 13 058 (2.4%) had the fetus in breech position. The detailed steps of the patient selection are shown in Fig. 1.

Breech presentation at term was significantly associated with the following obstetric risk factors: fetal growth restriction [adjusted OR 1.19 CI (1.07–1.32)], oligohydramnios [adjusted OR 1.42 CI (1.27–1.57)], gestational diabetes [adjusted OR 1.06 CI (1.00–1.13)], a history of caesarean section [adjusted OR 2.13 (1.98–2.29)] and congenital malformations of the fetus [adjusted OR 2.01 CI (1.92–2.11)]. The prenatal stillbirth rate in pregnancies with the fetus in breech presentation (0.2%) was significantly higher [adjusted OR 2.12 (1.98–2.28)] than in deliveries with the fetus in vertex position (0.1%). The predicting factors for breech presentation at term are shown in Table 1.

We found that women with the fetus in breech position were more likely to be nulliparous [adjusted OR 2.68

**Fig. 1** Breech presentation for singleton pregnancies at term during the period of 2005–2014 in Finland**Table 1** Unadjusted and adjusted odds ratios for risk factors in singleton at term breech and vertex presentations

All term singletons. 2005–2014	All breech deliveries (vaginal and Cesarean deliveries)		Deliveries with the fetus in vertex presentation (vaginal and Cesarean deliveries)		<i>p</i> value	Odds ratio 95% CI	Adjusted odds ratio 95% CI
	<i>N</i> 13,058%/mean	%/SD	<i>N</i> 536,556%/mean	%/SD			
Nulliparous	7928	60.7	219,403	40.9	<0.001	2.69 (2.59–2.80)	2.68 (2.58–2.79)
Maternal age in years. (mean + SD)	30.1	5.3	30.4	5.2	<0.001	1.03 (1.03–1.04)	1.03 (1.03–1.04)
BMI ≥ 30	1351	10.3	61,776	11.5	<0.001	0.89 (0.84–0.95)	0.89 (0.84–0.95)
Body mass index before pregnancy	24.3	4.8	24.2	4.7	<0.001		
Smoking	2018	15.5	80,819	15.1	0.217	1.04 (0.99–1.10)	
Diabetes mellitus type I	74	0.6	2215	0.4	0.007	1.19 (0.94–1.50)	
History of cesarean section	971	7.4	29,180	5.4	<0.001	2.12 (1.98–2.28)	2.13 (1.98–2.29)
Fetal abnormalities	2170	16.6	47,087	8.8	<0.001	1.42 (1.27–1.57)	2.01 (1.92–2.11)
Assisted reproduction technology	364	2.8	10,904	2.0	<0.001	1.17 (0.91–1.51)	
Gestational diabetes	1270	9.7	48,976	9.1	0.019	1.06 (1.00–1.13)	1.06 (1.00–1.13)
Preeclampsia	481	3.7	17,025	3.2	0.001	0.97 (0.88–1.06)	
<−2SD /IUGR	366	2.8	9912	1.8	<0.001	1.54 (1.01–2.34)	1.19 (1.07–1.32)
Stillbirth	23	0.2	544	0.1	0.009	2.12 (1.98–2.28)	
Placenta previa	62	0.5	1987	0.4	0.053	1.17 (0.91–1.51)	
Oligohydramnios	373	2.9	8842	1.6	<0.001	1.42 (1.27–1.57)	1.42 (1.27–1.57)
Neonatal gender (male)	5912	45.3	273,931	51.1	<0.001	0.78 (0.75–0.81)	0.78 (0.75–0.81)
Birth weight in grams	3581	467	3376	457	<0.001		

(2.58–2.79)]. The women in the studied group had a BMI that was lower than 30 before the pregnancy [adjusted OR 0.89 (0.84–0.95)]. Female infants were more prone to be born in breech position than male [adjusted OR for neonatal sex (male) 0.78 (0.75–0.81)]. A lower maternal age was more common for women with the fetus in breech presentation than for women with the fetus in vertex position [adjusted OR 1.03 (1.03–1.04)]. The birth weight of breech fetuses was higher (mean 3581 g) compared to the birth weight of children in vertex presentation (mean 3376 g). Breech presentation at birth was not significantly more common in women who smoked, had diabetes mellitus type I, had an assisted reproduction, had preeclampsia or had placenta previa.

## Discussion

The main finding of this study is that breech presentation at term was significantly associated with factors that are known risk factors for adverse fetal outcome on their own. These obstetric risk factors included fetal growth restriction, oligohydramnios, gestational diabetes, a history of caesarean section and congenital anomalies. In addition breech presentation at term was also significantly associated with intrauterine stillbirth. The stillbirth rate in breech deliveries was doubled compared to the stillbirth rate for fetuses in vertex presentation. These findings corresponded closely with the findings of an increased stillbirth rate in a Hungarian [3] and a Swedish study [24].

The 2.4% prevalence of breech presentation at term in Finland over a period of 10 years (2000–2009) was slightly lower than those in previous studies [3, 25–27]. Fetal growth restriction (<−2SD/IUGR) was identified as an individual obstetric risk factor associated with breech presentation at term. Fetal growth restriction is a known cause for adverse fetal outcome [28, 29]. Fetal growth restriction is also associated with reduced fetal movements [18, 29, 30], which is a known obstetric risk factor for adverse fetal outcome [31–33]. Reduced fetal movement might be one reason why the fetus is not turning into vertex position.

Oligohydramnios was also noted as a predicting factor for breech position. There are several reports regarding the association of breech presentation with oligohydramnios [3, 34, 35]. Oligohydramnios is associated with placental dysfunction during the late second or third trimester and subsequently, in cases of oligohydramnios, either an immediate delivery, or close fetal surveillance has been recommended [36]. Oligohydramnios is associated with active antenatal and intrapartum management [37]. As shown before, fetuses with oligohydramnios are restrained in their movements [38]. A reduction in fetal movements might happen due to lack of space or due to restricted fetal

capability. Reduced movements have been linked to adverse perinatal outcome [39, 40].

Gestational diabetes was identified as one of the obstetric risks associated with breech presentation. It is a known risk factor for adverse perinatal outcome as it increases perinatal mortality, risk for macrosomia and preeclampsia [22]. A history of cesarean section is associated with many risk factors for adverse outcome [41, 42] and has been previously shown as a predicting factor for breech presentation [1]. We do not claim that the uterine scare was itself the reason for breech presentation in these pregnancies. It is known that women with a fetus in breech are more likely to have another fetus in breech in a subsequent pregnancy [1] and about 70–80% of all breech infants are delivered by cesarean section [1, 2]. Unfortunately we do not know the cesarean section indication in the previous deliveries [3, 6]. Congenitally malformed fetuses were found to be more often in breech presentation, which is in line with the findings of earlier studies [19, 43] and “supports the concept of an underlying problem in fetal morphogenesis or function of which breech presentation is only a sign” [19].

Other factors related to breech presentation were: nulliparity, a BMI below 30, lower maternal age and the fetus’s female sex. These factors are associated with breech presentation but are not known as individual risk factors for adverse perinatal outcome on their own. The differences in BMI (24.3 vs. 24.2) and maternal age (30.1 vs 30.2) as shown in this study were statistically significant but these results have most likely no impact on clinical decisions in real life.

This study is one of the largest population-based, cohort studies reviewing factors that are linked to breech presentation at term, which is one of the strengths of the study. The study is based on nationwide data in a country, in which the medical treatment of pregnancies is very homogenous, as there are no private hospitals dealing with pregnancies. The study has some limitations: the study did not evaluate whether the association to previous caesarean section and breech could be explained by recurrence breech or IUGR. Another shortcoming of this study is that it could not get data on factors, such as maternal uterine anomalies, which are associated with an increased risk for breech presentation.

## Conclusion

The results of this study showed that breech presentation at term compared to vertex presentation was associated with a higher intrauterine stillbirth rate and a number of variables (fetal growth restriction, oligohydramnios, gestational diabetes, a history of caesarean section and congenital anomalies) that are known individual obstetric risk factors

for adverse perinatal outcome on their own. Interestingly, many of these factors were associated with a reduction of fetal movement, which might be the reason why these fetuses remain in breech position and which is in itself a risk factor for adverse perinatal outcome [39, 40]. These background risks should be taken into account when interpreting outcome studies in breech deliveries.

#### Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflicts of interest.

**Funding** The study did not receive external funding.

**Ethical statement** Authorization to use the data was obtained from the National Institute for Health and Welfare as required by the national data protection legislation in Finland (Reference Number THL/1200/5.05.00/2012).

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