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MATERNAL-FETAL MEDICINE

Outcome of small for gestational age-fetuses in breech presentation at term according to mode of delivery: a nationwide, population-based record linkage study

Pia Hinnenberg[1] · Anna Toijonen[1] · Mika Gissler[2] · Seppo Heinonen[1] · Georg Macharey[1]

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Abstract

Purpose To evaluate whether a trial of planned vaginal labor is associated with adverse perinatal outcome in singleton, small for gestational agefetuses in breech presentation at term.

Methods This is a Finnish nationwide, population-based record linkage study. The studied population included all small for gestational age breech labors from January 1, 2004 to December 31, 2014. "Small for gestational age" was defined as birth weight below the 10th percentile according to gestational age. An odds ratio with 95% confidence intervals was used to estimate the relative risk for perinatal mortality and morbidity in a trial of vaginal labor. The reference group included all small for gestational age infants born in breech presentation by planned cesarean section.

Results During the study period of eleven years, 1841 small for gestational age infants were delivered in breech position at term. A trial of vaginal breech labor is associated with a higher rate of neonates with an umbilical pH below seven [odds ratio 7.82 (1–61.21)], a lower 5-min Apgar score < 7 [adjusted odds ratio 6.39 (1.43–28.46)] and < 4 [adjusted odds ratio 6.39 (1.43–28.46)], a higher rate of postpartum neonatal intubations [adjusted odds ratio 6.52 (1.93–22)], an increased rate of neonatal antibiotic therapy [adjusted odds ratio 3.31 (1.85–5.93)], and with a higher rate of combined severe adverse perinatal outcome [adjusted odds ratio 4.24 (1.43–12.61)].

Conclusion A trial of vaginal breech labor in SGA fetuses is associated with adverse perinatal outcome and should be avoided.

Keywords Breech · Small for gestational age · SGA · Mortality · Morbidity · Term

Introduction

Small for gestational age SGA) is defined as a birth weight below the 10th percentile for gestational age [1, 2]. Up to 10% of all fetuses suffer from SGA [2, 3]. The majority of these fetuses are constitutionally small and not at risk for an increased adverse perinatal outcome [4]. SGA is linked to neonatal morbidity and mortality in preterm birth and high-risk term births. In SGA fetuses at term, with absent or reverse end diastolic blood flow velocity in the umbilical artery, the choice of delivery is usually a prompt abdominal delivery [5, 6]. However, SGA fetuses with normal or slightly increased pulsatility in the umbilical artery, may undergo a trial of vaginal labor [2, 6–8]. But SGA is not only a risk factor for adverse perinatal outcome, it is also a risk factor for breech presentation of the fetus at term. A trial of vaginal breech labor is itself associated with an increased risk for perinatal mortality and morbidity [9, 10], as breech fetuses have an increased risk of asphyxia during vaginal labor caused by cord compression during the delivery of the fetal trunk and head. Nevertheless, recent research has shown that a better selection of women eligible for vaginal breech labor and improvements in vaginal breech delivery management lower the risk of a trial of labor in an optimal setting [11–14, 16–20]. The complete exclusion

Pia Hinnenberg and Anna Toijonen; first authors shared equal authorship.

✉ Georg Macharey
georg.macharey@hus.fi

[1] Department of Obstetrics and Gynecology, University of Helsinki, Helsinki University Hospital, HUS, Haartmaninkatu 2, 00029 Helsinki, Finland

[2] National Institute for Health and Welfare (THL), Helsinki, Finland

of SGA fetus in breech presentation at term from a trial of vaginal labor is recommended by many national guidelines [16, 17] or fetuses in breech presentation are recommended to have at least a weight above 2500 g at term [16, 18]. However, there are only a small number of studies that have actually reviewed this subject. Our hypothesis is that a trial of vaginal labor in SGA fetuses in breech presentation is associated with adverse perinatal outcome. The aim of our present study is to determine whether SGA fetuses should be completely excluded from a trial of vaginal breech labor at term.

Methods

Study design and data sources

We conducted a population-based record linkage study using anonymized data of mothers and infants recorded on the National Medical Birth Register (MBR), maintained by the National Institute for Health and Welfare. The MBR collects baseline data on pregnancies, deliveries, and newborn outcomes during the first days of life. All Finnish maternity hospitals are obliged to report to the MBR. The data include all live births and stillbirths with a birth weight of 500 g and beyond or with a gestational age of 22 weeks or older. Less than 0.1% of the data concerning all newborns is missing, but missing data gets supplemented by the central population register for live births and the cause of death register for stillbirths and neonatal deaths. The register has shown a good validity and coverage [21].

Authorization to use the data was obtained from the National institute for health and welfare as required by the national data protection law in Finland (Reference number THL/1200/5.05.00/2012).

Study population

The studied population included all breech deliveries from January 1, 2004 to December 31, 2014. Exclusion criteria were: multiple gestations, preterm deliveries, infants with chromosomal abnormalities, stillbirths, pregnancies with a placental abruption, or placenta previa. SGA was defined as a neonatal birth weight below the 10th percentile for gestational age. We compared all neonates born in breech presentation by planned cesarean section with all neonates born in breech presentation vaginally or by emergency cesarean section after a trial of labor. The vaginal delivery group included cases of spontaneous and induced delivery regardless of cesarean delivery along the course of delivery ($N=425$) Fig. 1.

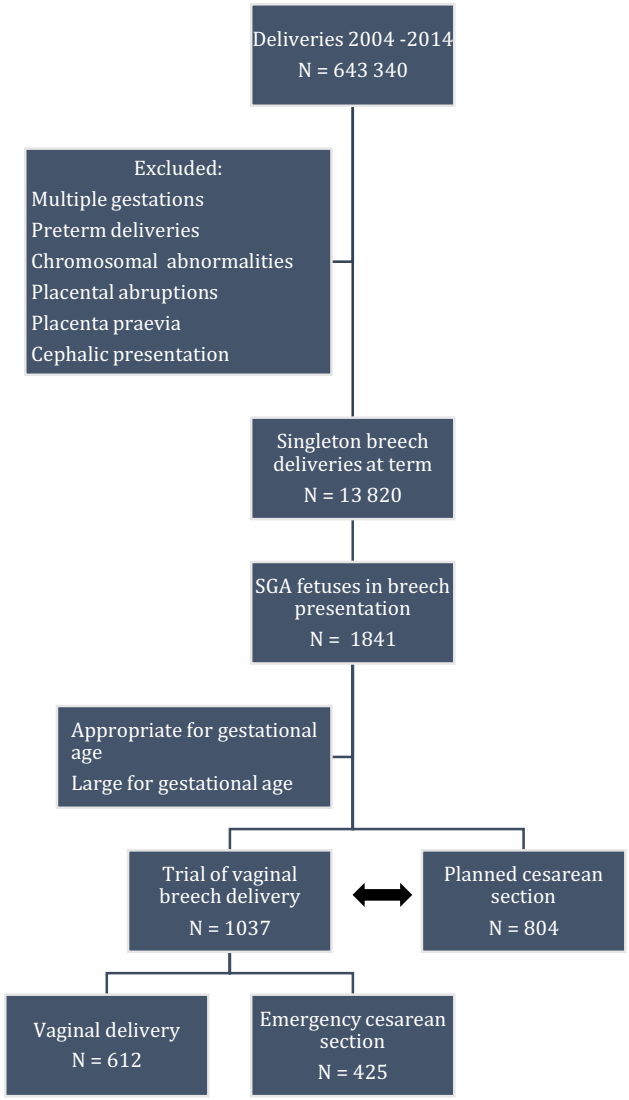

Fig. 1 Flow of deliveries through the study period

Outcomes

The main outcomes were perinatal mortality and morbidity. We reviewed admission to neonatal intensive care unit (NICU), neonatal intubation, neonatal administration of antibiotics, umbilical artery pH below seven, a 5-min Apgar score below seven, a 5-min Apgar score below four and neonatal death during the first 27 days after birth. Severe adverse perinatal outcome was assigned fetuses with one or more of the following outcomes: neonatal death, umbilical artery pH below seven or a 5-min Apgar score below four. The following characteristics were collected from the MBR: maternal age, parity, number of previous deliveries, smoking, body mass index, history of

artificial abortion, history of miscarriage, history of cesarean section, the use of assisted reproduction technology, diabetes mellitus type I, diabetes mellitus type II, gestational diabetes, oligohydramnios, preeclampsia, neonatal sex, use of epidural during labor, induction of labor, the administration of antenatal corticosteroids and premature rupture of membranes.

Statistical analysis

Statistical differences in categorical variables were evaluated with the hi-square or Fisher test as appropriate. Categorical characteristics of the neonates and their mothers were given by number of values as percentages. Differences were deemed to be significant if $p < 0.05$. For perinatal outcomes, we calculated odds ratios (OR) with 95% confidence intervals (CI) as estimates of the relative risk that a SGA neonate with a planned vaginal breech labor would be diagnosed with adverse perinatal outcome, using neonates with a planned cesarean section as mode of delivery as the reference group. If possible, we adjusted the neonatal outcomes for: maternal age 35 years or more, nulliparity, gestational age in days, history of cesarean section, oligohydramnios, preeclampsia or maternal hypertonia, and preterm rupture of membranes. The data w analyzed using SPSS for Windows V0.19.0, Chicago, Illinois, United States of America. The reporting of this study conforms to the STROBE statement [22

Results

During the study period of eleven years, 13 820 singleton fetuses in breech position were delivered. From these fetuses, 1841 (13.3%) were born with a birth weight below the tenth percentile. Out of these, 1037 (56.3%) fetuses had a trial of vaginal labor and 804 (43.7%) fetuses were born by planned cesarean section.

In the planned vaginal labor group, the number of nulliparous [OR 0.6 (0.49–0.74)] women and women with a history of a cesarean section [OR 0.41 (0.28–0.59)] was lower compared to the group of women that underwent a planned cesarean section. The rate of oligohydramnios [OR 0.62 (0.42–0.93)] and preeclampsia/hypertonia [OR 0.6 (0.4–0.91)] was also lower in the planned vaginal labor group compared to the rate in the planned cesarean section group. In the vaginal labor group, the amount of pregnancies with premature rupture of membranes was higher [OR 4.95 (2.43–10.07)] Table 1.

SGA fetuses that underwent a trial of vaginal labor more often had an umbilical artery pH below seven, 1% versus

Table 1 Background data of SGA breech deliveries according to the planned mode of delivery

	Planned vaginal delivery $N = 1037$	Planned cesarean section $N = 804$	OR 95% CI
Maternal age < 25	23 (2.2%)	22 (2.7%)	0.81 (0.45–1.46)
Maternal age 25–34	841 (81.1%)	625 (77.7%)	1.23 (0.98–1.54)
Maternal age 35 or more	173 (16.7%)	157 (19.5%)	0.83 (0.65–1.05)
Nulliparous	698 (67.3%)	622 (77.4%)	0.6 (0.49–0.74)
Multipara 3 or more deliveries	39 (3.8%)	22 (2.7%)	1.39 (0.82–2.36)
Maternal smoking	200 (19.3%)	169 (21%)	0.9 (0.71–1.13)
BMI 30 or more	57 (5.5%)	61 (7.6%)	0.71 (0.49–1.03)
History of induced abortion	121 (11.7%)	86 (10.7%)	1.1 (0.82–1.48)
History of miscarriage	183 (17.6%)	133 (16.5%)	1.08 (0.85–1.38)
History of cesarean section	48 (4.6%)	85 (10.6%)	0.41 (0.28–0.59)
Assisted reproduction technology	31 (3%)	17 (2.1%)	1.43 (0.78–2.6)
Diabetes mellitus type I	0	0	
Diabetes mellitus type II	2 (0.2%)	1 (0.1%)	1.55 (0.14–17.14)
Gestational diabetes mellitus	47 (4.5%)	45 (5.6%)	0.8 (0.53–1.22)
Oligohydramnios	47 (4.5%)	57 (7.1%)	0.62 (0.42–0.93)
Preeclampsia/hypertonia	44 (4.2%)	55 (6.8%)	0.6 (0.4–0.91)
Emergency cesarean section	425 (41%)	0	
Neonatal gender (female)	564 (54.4%)	427 (53.1%)	1.05 (0.88–1.27)
Epidural	360 (34.7%)	0	
Induced delivery	118 (11.4%)	0	
Administration of antenatal corticosteroids	15 (1.4%)	6 (0.7%)	1.95 (0.75–5.05)
Premature rupture of membranes	55 (5.3%)	9 (1.1%)	4.95 (2.43–10.07)

0.1% [OR 7.82 (1–61.21)]. They also had a higher risk of having a 5-min Apgar score below four [adjusted OR 6.39 (1.43–28.46)] and seven [adjusted OR 4.77 (2.3–9.88)]. In the planned vaginal delivery group seven children died 0.7%) and in the planned cesarean section group one child died 0.1%). The mortality of the SGA fetuses born vaginally was higher, but not significantly [OR 5.46 (0.67–44.45)]. SGA neonates in the planned vaginal delivery group were more often intubated [adjusted OR 6.52 (1.93–22)] and needed neonatal administration of antibiotics [adjusted OR 3.31 (1.85–5.93)]. There was no difference between the two groups in the neonatal intensive care unit admission rate. The risk for severe adverse outcome was increased in SGA fetuses in breech presentation at term undergoing a trial of vaginal labor, compared to fetuses with a planned cesarean section [adjusted OR 4.24 (1.43–12.61)] Table 2.

Discussion

Our study suggests that a trial of vaginal labor in SGA fetuses, with a birth weight below the 10th percentile and breech presentation at term, is associated with an increased perinatal morbidity. A trial of vaginal labor is associated with a higher rate of neonates with an umbilical artery pH below seven, lower 5 min Apgar points, an increased need of neonatal intubation and an increased rate of antibiotic administration for the neonates. The risk for severe short-term adverse perinatal outcome (including an umbilical artery pH < 7.00, 5 min Apgar < 4, neonatal death 0–27 days) in SGA fetuses after a trial of vaginal labor was four times higher.

Vaginal delivery is an option in SGA fetuses in cephalic presentation [2, 6–8, 23, 24]. However, in breech presentation a trial of vaginal labor in SGA fetuses at term seems controversial. Many national guidelines for handling breech delivery at term declare that SGA is a contraindication for a trial of vaginal breech labor [16–18]. Already in 2000, the term breech trial provided evidence that fetal growth restriction might be a contraindication to planned vaginal breech labor. Seven of the trial's sixteen perinatal deaths were growth-restricted fetuses, as the conductors of the term breech trial violated their own inclusion criteria and also allowed SGA fetuses in the planned vaginal labor group [9]. On the contrary, the PREMODA study showed normal perinatal outcome for planned vaginal breech delivery, even though 6.1% of all neonates in the planned vaginal delivery group had a birth weight of less than 2500 g and 30.1% had a birth weight between 2500 and 3000 g [11].

The results of our study support the advice of various national guidelines for handling breech delivery at term [16–18], as our results show a significantly increased risk of adverse outcome in SGA fetuses in breech presentation at term undergoing a trial of vaginal labor. The combination of several factors most likely leads to a higher risk for adverse perinatal outcome. Breech presentation itself, independent of the mode of delivery, has been shown as a possible marker of a compromised fetus, as it is associated with intrauterine stillbirth, congenital anomalies, oligohydramnios, growth restriction, cerebral palsy, and epilepsy [10, 25–27]. In addition, vaginal breech labor is associated with an increased risk of short-term neonatal morbidity [9]. When the fetal breech crowns, the umbilical cord gets compressed by the fetal trunk and aftercoming head [28]. A normally grown fetus can tolerate this situation in which a respiratory acidosis develops, which is easily reversed once ventilation is established. A SGA fetus, however, has a higher likelihood of suffering from metabolic acidemia during labor due to placental insufficiency. Thus, the fetus might not tolerate the cord compression during expulsion and therefore develops

Table 2 Neonatal outcome of term SGA breech deliveries according to the planned mode of delivery

Outcomes	SGA with a birth weight below the 10th percentile			
	Planned vaginal delivery $N = 1037$	Planned cesarean delivery $N = 804$	OR (95%)	Adjusted[#] OR (95%)
Umbilical artery pH < 7.00	10 (1%)	1 (0.1%)	7.82 (1–61.21)	Too few cases
5 min Apgar < 4	9 (0.9%)	2 (0.2%)	3.51 (0.76–16.29)	6.39 (1.43–28.46)
5 min Apgar score < 7	45 (4.3%)	9 (1.1%)	4.01 (1.95–8.25)	4.77 (2.3–9.88)
Neonatal death 0–27 days	7 (0.7%)	1 (0.1%)	5.46 (0.67–44.45)	Too few cases
NICU admission	154 (14.9%)	114 (14.2%)	1.06 (0.81–1.37)	1.12 (0.85–1.47)
Intubation	24 (2.3%)	3 (0.4%)	6.33 (1.9–21.08)	6.52 (1.93–22)
Antibiotics newborn	61 (5.9%)	15 (1.9%)	3.29 (1.85–5.83)	3.31 (1.85–5.93)
Severe adverse outcome*	12 (1.2%)	3 (0.4%)	3.13 (0.88–11.11)	4.24 (1.43–12.61)

*Umbilical artery pH < 7.00, 5 min Apgar < 4, neonatal death 0–27 days

[#]Adjusted for: Maternal age 35 or more, nulliparous, gestational age in days SD, history of cesarean section, oligohydramnios, preeclampsia/maternal hypertonia and preterm rupture of membranes

a severe early metabolic acidosis potentially causing fetal damage. The results of our study are even more interesting as there were significantly less women with preeclampsia, hypertonia and oligohydramnios in the planned vaginal labor group. If these women had been distributed equally between both delivery groups, we would have most likely recognized even higher rates of adverse perinatal outcome in the planned vaginal delivery group, as preeclampsia, maternal hypertonia and oligohydramnios are quite often associated with adverse perinatal outcome.

The strength of our analysis is the well-characterized study cohort. For instance, our study was performed in Finland, a country with a homogenous population. In addition, health care insurance covers all citizens. Furthermore, our study population consisted of the entire nation. The maternity outpatient clinics reach 99.7% of all pregnant women [29]. In Finland pregnant women have approximately 11–15 appointments with a health care professional (nurse, midwife or doctor) during pregnancy. A first trimester screening for chromosomal abnormalities and pregnancy dating, as well as a second trimester fetal organ scan with screening for growth deficiency is offered to all. Outpatient clinic visits are mandatory to be eligible for maternal economic benefits and 90% of all women participate in the voluntary screening program. Women with a fetus in breech presentation are offered an external version at 35–36 gestational weeks. After delivery the children's health and development is followed up in child health clinics until the age of six and thereafter by regular visits to the school nurse.

Nearly all deliveries 99.7%) in Finland take place in a hospital [30]. All delivery hospitals have the facilities for cardiotocography and fetal ultrasound examination and all of them have a 24/7 service for anesthesia, pediatrics and obstetrics. Finnish national registers have good coverage [21]. The data of less than 0.1% of all newborns is missing in the MBR and missing data obtained from the Central Population Register and the Cause of Death Register [31]. Reporting to the register is mandatory for all public and private clinics. The major limitation of our study is its retrospective design. A further limitation of our study is, that variables were restricted to databank availability, as we did not have access to fetal Doppler velocimetry and cardiotocography examinations.

Conclusion

Our results show that fetuses in breech presentation at term, with a birth weight below the 10th percentile that undergo a trial of vaginal labor, have a higher risk for perinatal morbidity, compared to fetuses with the same conditions that are delivered by planned cesarean section. These examination methods are unfortunately not 100% specific. We recommend whenever SGA with the fetus in breech presentation at term is suspected, that the delivery is managed extra carefully. In most cases of SGA fetuses in breech presentation at term, a planned cesarean delivery should be recommended to the future mother.

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Compliance with ethical standards

Conflict of interest The authors state explicitly that there are no conflicts of interest in connection with this article. All authors declare independence from any funding agency for this work.

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 law in Finland (reference number THL/1200/5.05.00/2012).

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