

Neonatal outcomes and trends in mode of delivery for breech presentation.

An Icelandic retrospective cohort study of 1335 cases in the period of 1991-2015

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ABSTRACT

Introduction: The preferred mode of delivery for term breech singletons has been a topic of debate. Our objective was to compare neonatal outcomes of term breech singletons in planned vaginal delivery with planned cesarean section.

Methods: This was a retrospective cohort study of all term breech singletons born at the same hospital (Landspítali, Iceland) during 25 years from January 1st 1991 to December 31st 2015. The cohort contained 1335 cases, for which data were collected from maternal hospital records. We also compared planned vaginal delivery with planned cesarean section across two time intervals, the former 10 years and the latter 15 years, to assess the effects of the Term Breech Trial. The main outcome measures were 5-min Apgar score <7, admission to NICU and NICU stay ≥4 days.

Results: Out of the 1335 singleton term breech deliveries, the intended mode of delivery was vaginal for 183 (13.7%) and cesarean for 1152 (86.3%). There were significantly lower mean Apgar scores at 5 minutes (8.8 vs. 9.3), a higher proportion of newborns with Apgar score <7 at 5 minutes (4.4% vs 0.6%) and significantly more admissions to NICU (12.6% vs. 7.9%) in the planned vaginal delivery group when compared to planned cesarean section. The NICU stay ≥4 days was however lower in the planned vaginal delivery group than in the planned cesarean group (0.5% vs. 2.4%). The difference was not statistically significant. The rate of planned cesarean section rose from 80.7% in 1991-2000 to 90.7% in 2001-2015 without indication of better neonatal outcomes in the latter period.

Conclusion: In a population of 183 planned vaginal breech deliveries in Iceland short-term perinatal morbidity was increased. Although no evidence was found to recommend against planned vaginal delivery based on rare severe complications, the study was not powered to detect differences in these rare outcomes.

Keywords: Breech presentation, term, vaginal breech delivery, cesarean section, mode of delivery, neonatal morbidity.

Received: 17. November 2024

Accepted: 15. May 2025

Date of publication: 24. May 2025

DOI: <https://doi.org/10.56182/qv089694>

INTRODUCTION

For over 60 years the preferred mode of delivery for term breech singletons has been a topic of debate and study and still the preferred mode is contradictory (1-5). Following the publication of the Term Breech Trial (TBT)(6) in the year 2000 many hospitals changed their clinical practices and guidelines to recommend an elective cesarean section (CS) for all term breech singletons (7, 8). This first randomized clinical trial for term breech delivery showed a reduction in perinatal mortality and morbidity for neonates delivered by planned cesarean delivery when compared to planned vaginal delivery (6). Others have concluded that planned vaginal delivery for term breech singletons is still a safe option in clinical settings with a strict selection of candidates, skilled staff and appropriate fetal surveillance during labor (9-12). We refer three systematic reviews and meta-analyses on fetal and maternal risks related to mode of delivery of term or near-term singleton breech presentation (1,2,5) with data from 1990 to 2021. The one from Gothenburg, Sweden concludes that intended cesarean delivery may reduce perinatal mortality and short-term morbidity for both mother and child but is non-conclusive about long-term risks of mother and child as well as maternal morbidity (1). Another systematic review, from Spain and Ecuador concludes that perinatal mortality and morbidity is higher when vaginal delivery is planned but risk of severe maternal morbidity is then slightly higher (2). The third meta-analysis, from Ethiopia, concludes, as the others, that perinatal mortality and morbidity is raised when vaginal delivery is intended (5). Authors of all three articles encourage though further studies and individualized, informed decision-making together with the pregnant women, because the absolute risks are low in both delivery modes and results about maternal risks are not as definite as for the child. That is why we continue and see it worthwhile to work on local data.

Planned vaginal delivery (PVD) for term breech singletons has always been included in clinical practice in Iceland with strict selection criteria

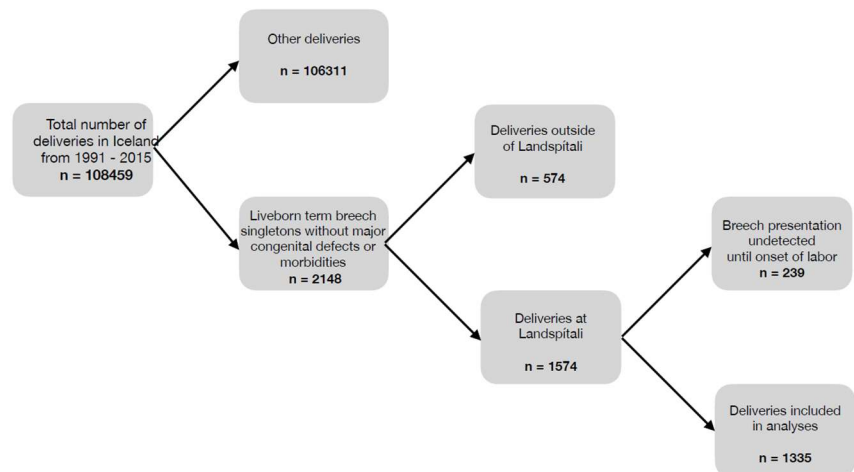


Figure 1: A flowchart of the formation of the study group.

summarized in Table 1. Following the publication of the TBT (6) there was a significant shift in clinical practice in Iceland and for a few years planned vaginal delivery for breech singletons was almost non-existent. The loss of clinical skills of obstetricians and midwives in breech deliveries has been cause for concern.

The objective of this study was to compare neonatal morbidity of term breech singletons in planned vaginal delivery (PVD) with planned cesarean section (PCS) to conclude whether PVD should still be included in clinical practice. Another objective of the study was to assess the successfulness of external cephalic version (ECV) after completed 36 GW.

MATERIALS AND METHODS

This was a retrospective cohort study of all term (≥ 37 GW) breech singletons born at Landspítali University Hospital from January 1st 1991 to December 31st 2015.

Landspítali has the only delivery ward in Iceland where PVD for breech presentation is available. About 70% of all deliveries in Iceland take place at this hospital, making the data considerably representative for the whole population.

Exclusion criteria were birth before 37 completed weeks of gestation (confirmed by ultrasound before 20 weeks), multiple pregnancy, antenatal death and major congenital defects or morbidities that would contribute to low Apgar score at birth. Because of the small size of the Icelandic population, data on mortality did not reach sufficient amount to be included.

Table 1: Icelandic clinical recommendations for choosing planned vaginal delivery in breech presentation, valid through the entire study period. Recommendations are generally based on the assumption that the woman is healthy in a normal pregnancy

1.	Informed consent of the mother and/or parents.
2.	Length of pregnancy ≥ 34 weeks
3.	Fetal weight estimated by ultrasound between 2000g and 4000g
4.	Frank or complete breech
5.	Pelvimetry for women with history of previously difficult births or if they have not previously delivered a baby ≥ 3000 g: - CV ≥ 11.5 cm - Pelvic outlet ≥ 34.5 cm
6.	No deflection of fetal head on ultrasound examination.

The Icelandic Medical Birth Register provided information about breech presentation at birth from 1991-2015 based on ICD-10 classifications (breech presentation O32.1) and the NOMESCO classification of surgical procedures (external version, MASB10 and MASB20). The data variables were collected from the women's birth records, either paper-based or electronic by what was available. Two of the authors (STG and MKG) collected all data manually.

The flow chart in Fig. 1 displays the following: There were 108.459 deliveries in Iceland during the study period. Of those, 2148 were singleton term breech deliveries (2%). Of these 574 were outside Landspítali and therefore not included in the study. Breech presentation was undetected until onset of labor in 239 of the remaining 1574 women. Since the focus here is on the intended mode of delivery these women are excluded, resulting in a total of 1335 singleton term breech deliveries analyzed.

Maternal age, height, gestational age at delivery, fetal presentation, and results of pelvimetry were registered. For the part of the study group giving birth in the former period 1991-2000 the parity was also registered. Pregnancy outcomes collected were birth weight, Apgar scores, admittance to neonatal intensive care unit (NICU) with duration of stay. Umbilical artery pH at birth was not standard clinical practice in the study period and was therefore not recorded.

For 862 women, with breech presentation after 36 gestational weeks, giving birth during 2001-2015,

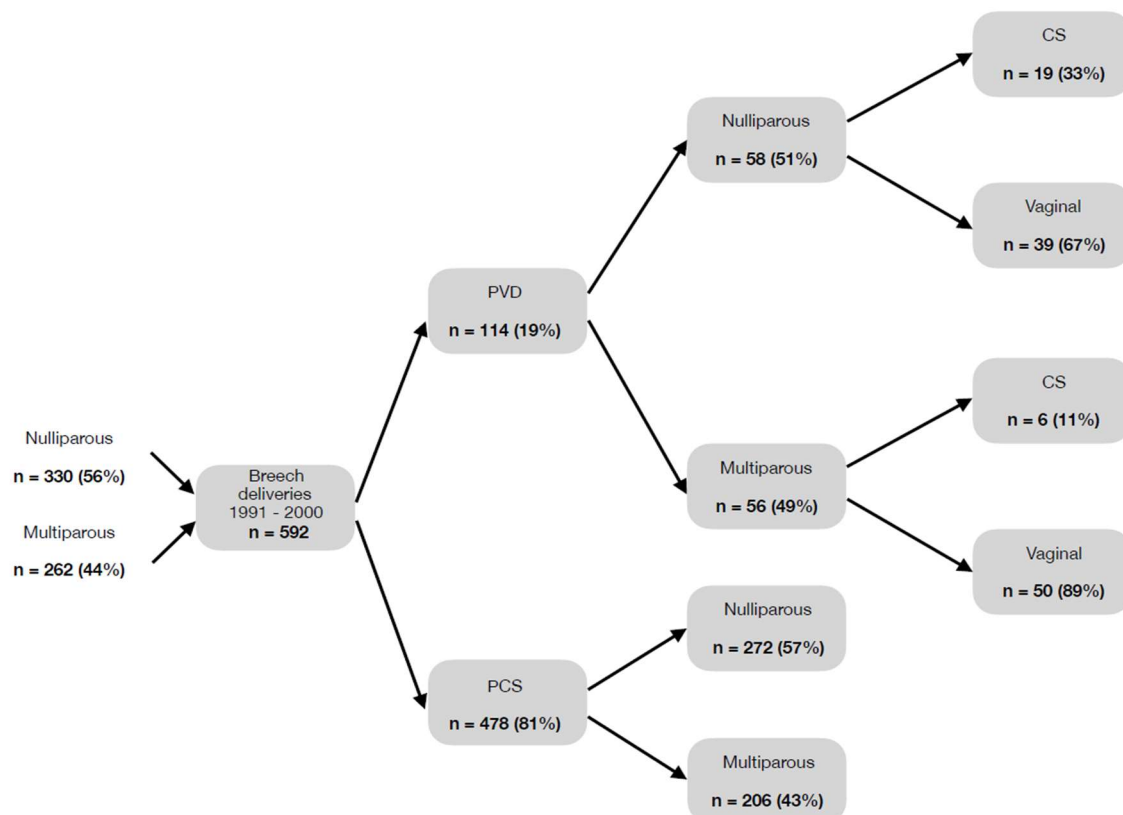


Figure 2: The effect of parity on the chance of successful vaginal breech delivery. Parity was known for 592 women who gave birth during the former study period 1991-2000.

Breech Delivery Trends and Neonatal Outcomes in Iceland

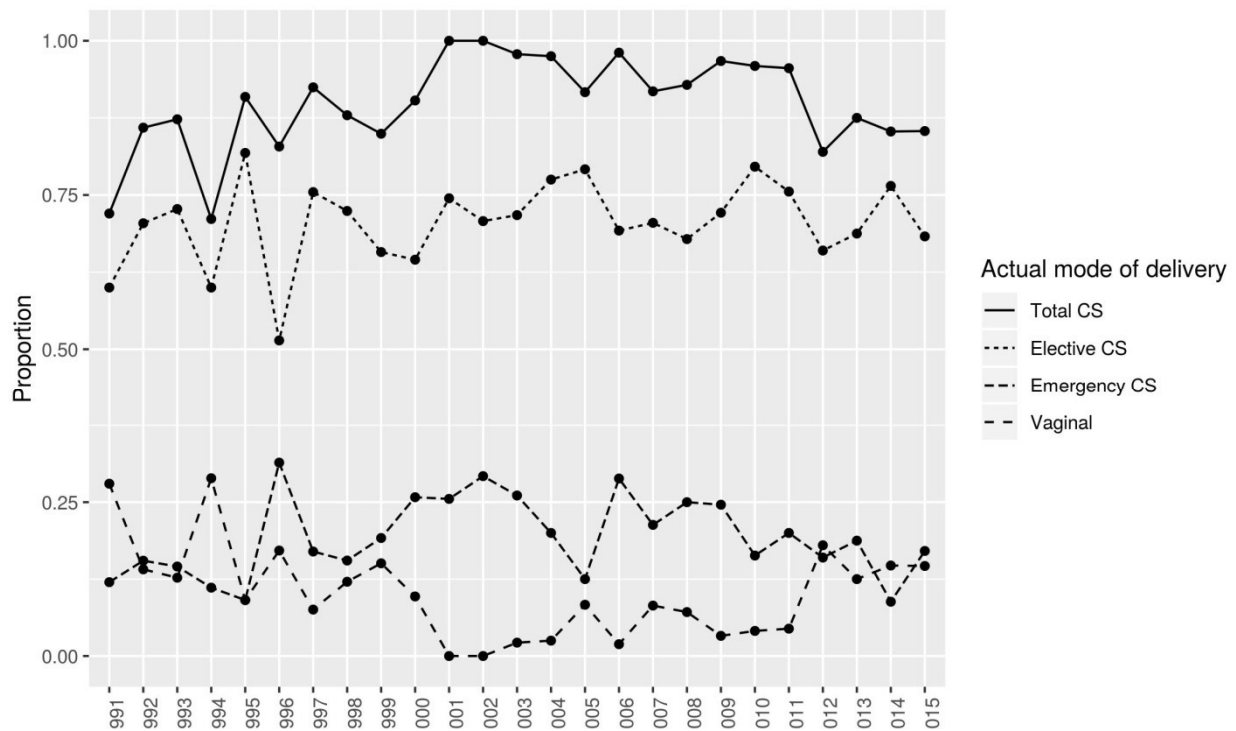


Figure 3: Rates of actual mode of delivery in term breech presentation 1991–2015.

trial and result of external cephalic version (ECV) was registered. Only a part of this group belonged to the main study group.

These planned delivery modes were decided upon after a dialogue between the woman and an obstetrician, taken into account the wishing of the mother and the selection criteria (Table 1) that constitutes the practice in the Landspítali delivery ward. In the PVD group delivery could end with either vaginal breech delivery or emergency cesarean section (emCS) while in the PCS group CS was carried out as planned or an emCS was needed. Data was also collected for breech presentation not diagnosed until the onset of labor, with no pre-existing plan for mode of delivery. That group was excluded when comparing endpoints for the PVD and PCS groups.

Statistical analyses were performed using the R version 3.4.4.(13) Outcomes were compared using t-tests, Fisher's exact tests and chi-squared tests as appropriate. Statistical significance was based on $p \leq 0.05$.

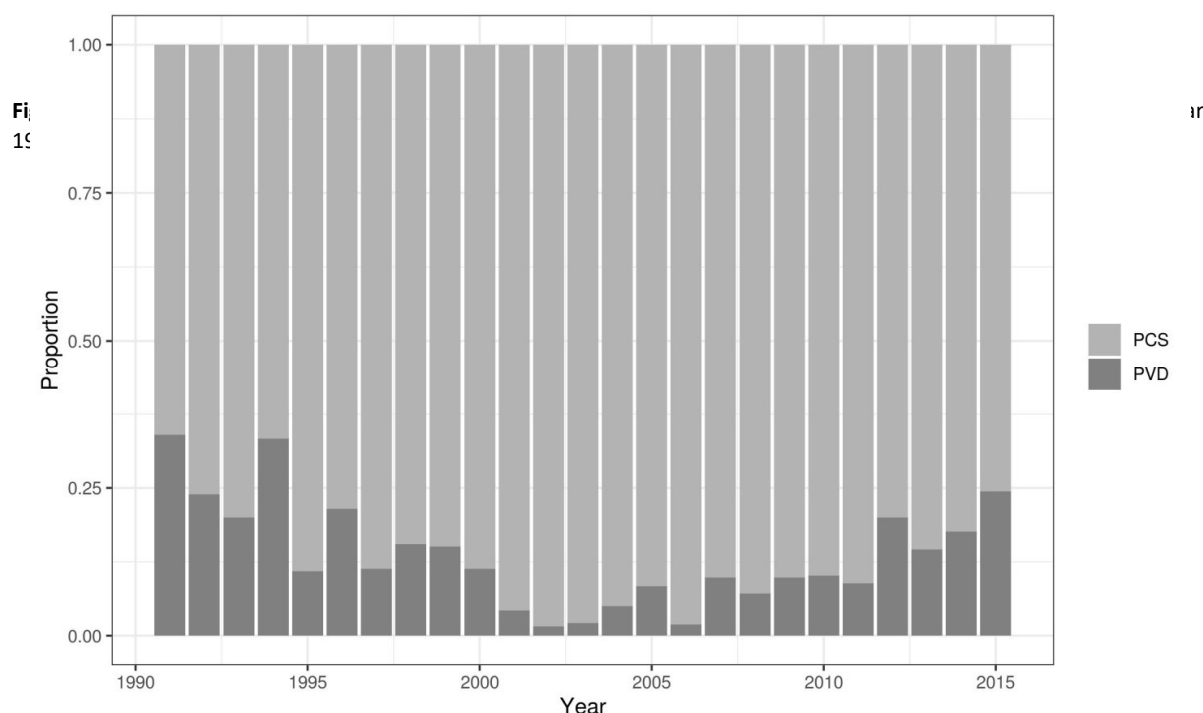
Ethical approval

The study was approved by the Institutional Review Board of Landspítali – the National University Hospital of Iceland by two permissions, no. 87/2001 dated December 17th 2001, and no. 12/2013 dated March 19th 2013, and by the Icelandic Data Protection Authority, also twice, no. 555/2002, dated January 8th 2002 and no. 318/2013, dated March 6th 2013.

Table 2: Comparison of 5-min Apgar scores and admission to the neonatal intensive care unit (NICU) between the planned cesarean section (PCS) and the planned vaginal delivery (PVD) groups. The first line describes a t-test, the other three lines Fisher exact tests.

	PCS (n = 1152)	PVD (n = 183)	p-value	OR 95% CI
Apgar (5 min), mean sd	9.3 (0.8)	8.8 (1.2)	<0.001	-
Apgar (5 min), n (%)			<0.001	7.46 (2.67-20.84)
<7	7 (0.6)	8 (4.4)		
≥ 7	1143 (99.4)	175 (95.6)		
NICU, n (%)			0.046	1.67 (1.03-2.72)
Yes	932 (7.9)	23 (12.6)		
No	1057 (92.1)	160 (87.4)		
NICU, n (%)			0.163	0.23 (0.03-1.69)
≥ 4 days	27 (2.4)	1 (0.5)		
<4 days	1121 (97.6)	182 (99.5)		

data on prenatally estimated birth weight was not



RESULTS

A total of 1335 singleton term breech deliveries were analyzed. The intended mode of delivery was vaginal (PVD) for 183 (13.7%) cases and cesarean (PCS) for 1152 (86.3%). Of the women with PVD the actual mode of delivery was vaginal for 137 (74.3%) and 46 (25.7%) ended as an emCS. The parity was registered for the 592 women, who gave birth during the former study period 1991–2000. In Figure 2 the effect of parity on successful vaginal delivery is shown for this part of the study group. Among the nulliparas with PVD the actual mode of delivery was 67% of cases vaginal and in 33% a CS. Among the multiparas the actual mode of delivery was in 89% of cases vaginal and in 11% a CS. This difference between parity groups was significant ($p=0.009$).

Mean age of the mothers was 29 years at delivery and did not differ between the PVD and the PCS groups. On average, delivery occurred around gestational week 39 in both groups although a small significant difference was detected in the means (39.0 weeks in the PCS group and 39.3 weeks in the PVD group, $p < 0.001$). This was expected as PCS had predetermined delivery dates. Mean birth weight was higher in the PCS group compared with the PVD group (3506g vs. 3395g, $p = 0.002$), but

available.

External cephalic version (ECV) was attempted for 862 women with breech presentation after 36 gestational weeks from 2001 to 2015, 39.6% were successful.

Rates of actual mode of delivery in term breech presentation during the study period can be seen in Figure 3. A sudden drop in vaginal deliveries can be seen in 2001 along with a corresponding increase in CS.

When looking at the intended mode of delivery, the neonates in the PCS group had a higher mean value of 5-min Apgar score than those in the PVD group (9.3 vs 8.8; $p < 0.001$), but both mean values approximate 9. A higher proportion of the neonates had 5-min Apgar scores of < 7 in the PVD group than in the PCS group (4.4% vs. 0.6%, $p < 0.001$) and more neonates in the PVD group (12.6%) compared to the PCS group (7.9%) were admitted to the neonatal intensive care unit (NICU) ($p = 0.046$). The study is underpowered to evaluate severity among infants transferred to NICU (there is only one infant with NICU ≥ 4 in the PVD group). However, it can be noted that the proportion of neonates staying four days or longer in the NICU was lower in the PVD group, 0.5%, compared to 2.4% in the PCS group. The difference was not significant ($p = 0.163$) (Table 2).

Table 3: Comparison of 5-min Apgar scores and admission to the neonatal intensive care unit (NICU) between the two periods 1991-2000 and 2001-2105. The first line describes a t-test, the other three lines Fisher exact tests.

	1991 – 2000 (n = 592)	2001 – 2015 (n = 743)	p-value	OR 95% CI
Apgar (5 min), mean sd	9.1 (0.9)	9.3 (0.8)	0.001	
Apgar (5 min), n (%)			1.00	0.91 (0.33-2.51)
<7	7 (1.2)	8 (1.1)		
≥ 7	583 (98.8)	735 (98.9)		
NICU, n (%)			<0.001	0.27 (0.17-0.41)
Yes	83 (14.1)	31 (4.2)		
No	506 (85.9)	711 (95.8)		
NICU, n (%)			1.00	1.06 (0.50-2.26)
≥ 4 days	12 (2.0)	16 (2.2)		
<4 days	577 (98.0)	726 (97.8)		

The proportion of PVD and PCS year by year is shown in Figure 4. From 1991-2000 the intended mode of delivery was CS in 80.7% of cases but 90.7% from 2001-2015 ($p < 0.001$). The difference in proportions of 5-min Apgar scores lower than 7 in the two periods was not significant (1.2% vs. 1.1%, $p=1$). Furthermore, 14.1% vs. 4.2% of the neonates were admitted to the NICU in the former and latter period, respectively ($p < 0.001$). However, when looking at the proportion of neonates staying four days or longer at the NICU, the difference in the two periods was not significant, 2.2% vs. 2% ($p=1$) (Table 3).

DISCUSSION

The study covered breech presentation at birth in about 70% of the population of Iceland, 1335 cases, over a period of 25 years. The rate of PVD was low, and lowest during the years after the publication of TBT (6). Neonates in PVD group had lower mean 5-min Apgar score, higher risk of being <7 at 5-min and were more likely to be admitted to NICU, but not more likely to stay there for >4 days. External cephalic version was successful in approximately 40% of cases.

The yearly rates of vaginal breech delivery (i.e. the actual mode) were relatively low compared to other studies, ranging from 0 – 20% over the study period. This may be explained by the strict Icelandic criteria for recommending vaginal delivery for breech through the decades, especially regarding pelvimetry (Table 1), but also by our small population size, giving practicing clinicians few opportunities to acquire the necessary skills for vaginal

breech delivery, so the tradition of vaginal breech birth has not been established. The lowest yearly rates in the beginning of the century (2001-2004) probably reflect the effect of the results of the TBT results, published year 2000 (6). Even if the rate of vaginal breech delivery was low, the actual mode of delivery in the PVD group showed a higher rate of successful vaginal mode than other comparable studies (1,6) for both multiparas and nulliparas (89% vs. 67% successful vaginal delivery respectively). This may also be explained by the strict Icelandic criteria for recommending vaginal delivery. When comparing PVD to PCS the results show an increased risk for an Apgar score <7 at five minutes for PVD and an increase in admittance to NICU for these babies.

However, the proportion of neonates staying four days or longer in the NICU was lower in the PVD group, 0.5%, compared to 2.4% in the PCS group, indicating only a short-lasting delayed recovery after delivery or even a lowered threshold of NICU admittance for vaginally born breech infants. It should be noted that the difference was not significant, likely due to the low statistical power of the test. These findings are similar to those of Mattila et. al from Finland in 2015 (11). It is well established that vaginal delivery for term breech babies results in a short-lasting delayed recovery immediately after birth, as evidenced by lower Apgar scores (5,11,12). Our results are concurrent with that. However, the increased risk of low Apgar scores in vaginal breech deliveries highlights the need to optimize intrapartum management, particularly by ensuring continuous and effective pushing after the birth of the fetal pelvis, but also to recognize the need for an emergency cesarean earlier.

The short- and long-term effects of a vaginal breech delivery remain somewhat obscure. Available studies have found no additional risk for child health or neurodevelopment following a PVD (14, 15). Regarding maternal complications of vaginal versus cesarean delivery, research results are contradictory and sometimes difficult to interpret and apply in everyday obstetrical counseling. That is partly due to the widely varying kinds and severity of the complications studied. A recent Danish register-based study (16) of more than 30.000 first-

time, term, singleton breech deliveries during approximately three decades showed that planned cesarean delivery had significantly reduced risk, compared to planned vaginal delivery, of postoperative complications but a higher risk of uterine rupture in their subsequent pregnancies, and also higher risk of repeated cesareans. Several studies have revealed similar risk of repeated CS with exaggerated complication rate (17, 18). As important, in the counseling, is to address the increased risk of emergency CS in PVD, in which the most severe complications happen (2, 3, 16). Despite the long study period, we were unable to assess risk of mortality related to breech presentation in Iceland because of the low perinatal mortality rate. This limits our findings somewhat. However, the overall perinatal mortality rate in Iceland is among the lowest reported in the world (19). There were in total four deaths among term breech singletons during the 25-year study period, stillbirths and neonatal deaths of the excluded malformed infants, i.e. none in the study group. Like others have reported (20) our data show that the TBT did have a significant impact on obstetric practice in Iceland regarding breech deliveries with rates of PCS rising from 80.7% to 90.7% after the TBT was published. However, we did not see an impact on either Apgar <7 at five minutes or NICU stay for ≥ 4 days indicating that this change did not result in a better overall neonatal outcome. With this comparison of periods, we even observed a higher rate of admission to NICU for 1991-2000 when compared to 2001-2015. This can be due to a change in clinical practice and different definitions of admissions to NICU, in the latter period more practice of a short observation without formal admission (while the criteria for PVD were unchanged throughout both periods). Therefore, the main focus should be on >4 days stay at NICU and the Apgar score. The average 5-min Apgar score was significantly lower in the PVD group, compared to the PCS group, but both mean values approximate 9, which makes the difference clinically non-relevant. The high rate of PCS and loss of clinical obstetrical skills then seem a high price to pay to improve an average that most likely has no clinical relevance. External cephalic version was successful in about 40% of trials and remains an important part of clinical practice for lowering the CS-rate.



Figure 5: Vaginal breech delivery, second stage right before birth. The authors have permission from the patient to publish the photo.

The strengths of this study are the uniform manual data collection over a long study period in the same large hospital, which is quite representative for a whole population. The limitations are however the retrospective design of the study and lack of a comparison group of cephalic presentation at birth. The fact that mortality rate is not included in the results is another limitation as it is the ultimate morbidity and what both the expecting mother and clinicians are most concerned with regarding vaginal breech delivery. Another limitation, especially to the generalizability of the findings, is that we did not make any comparison of maternal characteristics between the PVD and PCS groups. Berhan et al (5) have raised the point of whether comparing vaginal delivery to elective CS is fair at all. According to data from WHO from 2007 (21) term singletons in cephalic presentation will have a statistically better outcome with a PCS when compared with a PVD. A vaginal delivery will have a statistically worse outcome for the babies when compared to a PCS no matter the fetal presentation. Including comparison groups of cephalic presentations could clarify this rationale.

CONCLUSION

In a population of 183 planned vaginal breech deliveries in Iceland short term perinatal morbidity was increased. Although no evidence was found to recommend against planned vaginal delivery based on rare severe complications, the study was not powered to detect differences in these rare outcomes.

Conflict of interest: The authors state explicitly that there are no conflicts of interest in connection with this article.

Funding information: The study received a grant from Landspítali University Hospital Research Fund in 2015.

Author contributions: TS designed the study and supervised STG and MKG in collecting data. They also did the analysis with statistical guidance from AHJ. All authors interpreted the results and wrote the manuscript.

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