Beyond successful external cephalic version

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Chapter 6

Risk of developmental dysplasia of the hip in breech presentation: the effect of successful external cephalic version

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Abstract

OBJECTIVE

To evaluate the effect of successful external cephalic version on the incidence of developmental dysplasia of the hip (DDH) requiring treatment in singleton breech presentation at term.

DESIGN

Observational cohort study.

SETTING

Three large teaching hospitals in the Netherlands.

POPULATION

Women with a singleton breech presentation of 34 weeks of gestation or more, who underwent an external cephalic version attempt.

METHODS

We made a comparison of the incidence of DDH between children born in breech presentation and children born in cephalic presentation after a successful external cephalic version.

MAIN OUTCOME MEASURE

The incidence of DDH requiring either conservative treatment, with a harness, or surgical treatment.

RESULTS

A total of 498 newborns were included in the study, of which 40 (8%) were diagnosed with DDH and 35 required treatment. Multivariate analysis showed that female gender (OR 2.79, 95% CI 1.23–6.35) and successful external cephalic version (OR 0.29, 95% CI 0.09–0.95) were independently associated with DDH.

CONCLUSIONS

A successful external cephalic version is associated with a lower incidence of DDH, although a high percentage of children born after a successful external cephalic version still appear to have DDH. A larger cohort study is needed to establish the definite nature of this relation. Until then, we recommend the same screening policy for infants born in cephalic position after a successful external cephalic version as for infants born in breech position.

Introduction

Developmental dysplasia of the hip (DDH) refers to full spectrum of abnormalities in the immature hip that can range from subtle dysplasia to dislocation.[1] It is one of the most common musculoskeletal disorders in childhood, with an overall reported prevalence varying between 1.4 and 35 per 1000 livebirths.[2-5] DDH can predispose an infant to premature degenerative changes and secondary osteoarthritis of the hip.[6,7] The pathogenesis of DDH is not fully understood. Known risk factors are breech presentation, female gender and a positive family history of DDH.[4,8] Breech presentation imposes at least a four- to seven-fold increased risk.[3,4,9] The prolonged mechanical forces of the pelvis acting on the hip joints in persistent breech position is one of the hypotheses for the higher incidence of DDH in breech born infants.

Screening for DDH can be performed by physical examination, X-ray and ultrasound, but all tests are hampered by false-positive and false-negative results.[10,11] The current Dutch screening strategy for DDH includes a physical examination of all infants and additional ultrasound screening in cases with risk factors for DDH (positive family history of DDH, breech presentation and congenital postural or foot deformities). A recent decision analysis supports this strategy.[12] However, in the case of breech presentation, it is unknown whether children born in cephalic position after a successful external cephalic version (ECV) still have an increased risk for DDH, and whether or not these infants should receive ultrasound screening. The aim of this study was to evaluate the effect of successful ECV on the incidence of DDH requiring treatment in singleton breech presentation at term.

Methods

We performed an observational cohort study in three teaching hospitals in the Netherlands, together responsible for approximately 6000 high-risk deliveries annually. We included women with a singleton fetus in breech presentation, with a gestational age of 34 weeks or more, who underwent an ECV attempt. Exclusion criteria were a positive family history for DDH and known congenital abnormalities of the fetus. All ECV attempts were performed by either a midwife or gynaecologists experienced in the procedure. Exclusion criteria for ECV were multiple pregnancies, intrauterine growth restriction, oligohydramnios, ruptured membranes, uterine anomalies, severe pregnancy-induced hypertension or pre-eclampsia, HELLP syndrome (haemolysis, elevated liver enzymes and low platelet count), history of placental abruption and any contraindication for vaginal delivery. Fetal wellbeing was established by electronic fetal heart rate monitoring for at least 30 minutes preceding

the ECV attempt, and for 30 minutes after every procedure. For the ECV procedure both a forwards and a backwards roll were allowed. If an ECV attempt failed, women were counseled for either a primary caesarean section or a vaginal breech delivery, based on the recommendations of the Dutch Society of Obstetrics and Gynaecology. The following baseline characteristics were collected: parity, gestational age at time of the ECV, gestational age at the time of delivery, mode of delivery, birthweight, gender and type of breech presentation (frank, complete or incomplete breech). All newborns were screened for DDH by clinical examination and ultrasound examination of the hip joints at 3 months of age, and classified according to the Graf's classification: type I, α angle > 60° (normal); type IIa, α angle of 43–60°, β angle < 55°; type IIb, α angle of 43–60°, β angle > 55°; type III, α angle < 43°; type IV, subluxable/irreducible. Graf types III and IV were considered to be pathological. Infants with abnormal results at clinical examination (clicking hips, (sub)luxation or diminished abduction) or a type-IIa, or worse, on the ultrasound at three months were referred to an orthopaedist. The infants with hip dysplasia were categorized by the orthopaedists in groups of diminished abduction, mild DDH, DDH and (sub)luxation. All infants with DDH and sub(luxation) were first treated conservatively (camp abduction brace or Pavlick harness), and if no improvement was seen these children were treated surgically. Infants classified with mild DDH or diminished abduction were either treated or followed to monitor possible natural recovery. This decision was made by the examining orthopaedist.

DATA ANALYSIS

Cases of DDH requiring treatment were used as the end point of this study. Treatment was defined as conservative management with a harness or surgical treatment. The chi-square test was used to compare dichotomous and ordinal variables. As female gender is a known risk factor for DDH, we examined the interaction between gender and successful ECV in relationship to DDH. Binary logistic regression analysis was used for univariate and multivariate regression analysis to calculate unadjusted and adjusted odds ratios. Statistical analyses were performed using spss 17.0 (SPSS Inc., Chicago, IL, USA).

Results

Between March 2006 and March 2009 a total of 577 pregnant women with a fetus in breech presentation were eligible for inclusion. All 577 women were offered an ECV, with 510 (88%) women agreeing to undergo an ECV. Twelve cases were lost to follow-up, and have therefore been excluded. Table 1 shows the baseline characteristics of the 498 women included in

the study. The mean ECV success rate was 36%. There were significantly more multiparous women compared with nulliparous with a successful ECV (52 versus 25%; P < 0.01). One fetus turned again spontaneously after successful ECV, and was born in breech presentation. Vaginal delivery was achieved in 164 (93%) of the 177 cephalic presentations. Of the 321 women with a fetus in breech presentation, 98 (31%) underwent a trial of labour, of which 65 (66%) delivered vaginally. Male and female offspring were evenly distributed between both groups (trial of labour versus primary caesarean section for breech presentation).

Table 1 - Baseline characteristics

	Unsuccessful ECV n= 321(%)	Successful ECV n=177 (%)	p-value
Parity			
Nullipara	224 (70.0)	73 (41.2)	<0.01
Multipara	96 (30.0)	104 (58.8)	
Gender			
Female	184 (57.3)	96 (54.2)	0.41
Male	137 (42.7)	81 (45.8)	
Birth Weight (gram)			
<3000	65 (20.4)	20 (11.6)	<0.01
3000-3499	144 (45.1)	58 (33.7)	0.02
3500-3999	88 (27.6)	60 (34.9)	0.05
>4000	22 (6.9)	34 (19.8)	<0.01
unknown	2	5	
Breech presentation at initial assessment			
Frank	248 (77.7)	128 (72.7)	0.24
Complete	63 (19.8)	44 (25.0)	
Incomplete	8 (2.5)	4 (2.3)	
Unknown	2	1	
Gestational age at ECV (weeks)			
<36 0/7	78 (24.3)	47 (26.6)	0.08
≥36 0/7	243 (75.7)	130 (73.4)	
Gestational age at birth (weeks)			
<37 0/7	8 (2.5)	2 (1.1)	0.72
≥37 0/7	313 (97.5)	170 (96.6)	
Unknown	-	5 (2.3)	
Mode of delivery			
Elective CS	223 (69.5)	3 (1.7)	<0.01
Vaginal birth	65 (20.2)	164 (92.7)	
Emergency CS	33 (10.3)	10 (5.6)	

OCCURRENCE OF DDH

All infants were screened by ultrasound three months after birth. Of the 498 infants screened, 43 (8.6%) were referred to an orthopaedist for further physical examination. Reasons for referral were: abnormalities on ultrasound (n=31, 72%), suspicion of abnormalities on ultrasound (n=10, 23%) and poor imaging on ultrasound (n=2, 5%). Fourty of the referred infants were diagnosed with some form of DDH, representing 8% of the screened population: 21 cases of DDH, eight with a (sub)luxation, nine cases of mild DDH and two cases classified as diminished abduction. In total, 35 (88%) out of the 40 cases with DDH were treated. Conservative management with either camp abduction brace (eight cases) or Pavlik harness (27 cases) was the first choice of treatment. In four cases, additional surgical treatment was required: in three children the hips were repositioned and one child was treated with traction. Five of nine children who were diagnosed with mild DDH required no initial treatment, but were invited for follow-up scans to evaluate whether signs of hip dysplasia disappeared over time. None of these children needed treatment during a 1-year follow-up. The incidence of DDH requiring treatment among infants born after a successful ECV was 2.8%, compared with 9.3% among the infants born after a failed ECV.

ASSOCIATION BETWEEN DDH AND RISK FACTORS

Out of 177 infants born in cephalic presentation, after a successful ECV, five (2.8%) were treated for DDH. Out of the 321 infants born in breech presentation, after an unsuccessful ECV, 30 (9.3%) were treated for DDH. There were 280 female and 218 male infants, and treatment for DDH was required in 26 (9.3%) and nine (4.1%) of these infants, respectively. Univariate analysis showed that mode of delivery was related to DDH (OR 2.15, 95% CI 1.06–4.37; Table 2). Birthweight and gestational age at birth were not related to DDH after univariate analysis. Successful ECV was associated with a lower DDH rate after univariate analysis (OR 0.29, 95% CI 0.11– 0.77). Female gender was associated with a higher rate of DDH (OR 2.38, 95% CI 1.09–5.37). After multivariate analysis, female gender remained associated with a significantly higher risk for DDH (OR 2.79, 95% CI 1.23– 6.35), whereas successful ECV was associated with a lower risk for DDH (OR 0.29, 95% CI 0.09–0.95). In Tables 3 and 4 we separated our data for male and female gender. Only successful ECV in female infants was associated with a lower rate of DDH (OR 0.32, 95% CI 0.11–0.94) after univariate analysis.

Table 2 - Association between DDH and risk factors

	Controls n=463 (%)	Treated DDH n=35 (%)	Unadjusted OR	95% CI	Adjusted OR*	95% CI
ECV attempt						
Unsuccessful	291 (62.9)	30 (85.7)	1.00			
Successful	172 (37.1)	5 (14.3)	0.29	0.11 - 0.77	0.29	0.09 – 0.95
Gender						
Male	209 (45.1)	9 (25.7)	1.00			
Female	254 (54.9)	26 (74.3)	2.38	1.09 – 5.18	2.79	1.23 – 6.35
Gestational age at birth**						
<37 weeks	9 (2.0)	1 (2.9)	1.00			
≥37 weeks	450 (98.0)	33 (97.1)	0.66	0.08 – 5.37	0.62	0.07 – 5.76
Birth weight (grams)**						
<3000	77 (16.9)	8 (22.9)	1.00			
3000-3499	186 (40.8)	16 (45.7)	0.96	0.38 – 1.42	0.81	0.32 – 2.04
3500-3999	143 (31.6)	5 (14.3)	0.39	0.12 – 1.27	0.41	0.13 – 1.36
>4000	50 (10.9)	6 (17.1)	1.34	0.43 – 4.21	2.68	0.78 – 9.18
Mode of delivery						
Trial of labour	259 (55.9)	13 (37.1)	1.00			
Elective CS	204 (44.1)	22 (62.9)	2.15	1.06 – 4.37	1.38	0.56-3.23

*adjusted for gender, birth weight, mode of delivery, hospital
**<2% missing values

Table 3 - Association between DDH and risk factors in females

	Controls n=254 (%)	Treated DDH n=26 (%)	Unadjusted OR	95% CI	Adjusted OR*	95% CI
ECV attempt						
Unsuccessful	161 (63.4)	22 (84.6)	1.00			
Successful	93 (36.6)	4 (15.3)	0.32	0.11 - 0.94	0.45	0.13 – 1.59
Gestational age at birth**						
<37 weeks	4 (1.6)	1 (3.8)	1.00			
≥37 weeks	249 (98.4)	25 (96.2)	0.42	0.04 – 3.73	0.54	0.05 – 5.78
Birth weight (grams)**						
<3000	49 (19.5)	8 (30.8)	1.00			
3000-3499	112 (44.6)	15 (57.7)	0.82	0.33 – 2.61	0.90	0.34 – 2.38
3500-3999	71 (28.3)	0 (0)	0.00		0.00	
>4000	19 (7.6)	3 (11.5)	0.97	0.23 – 4.04	1.30	0.29 – 5.78
Mode of delivery						
Trial of labour	139 (55.9)	10 (38.5)	1.00			
Elective CS	115 (44.1)	16 (61.5)	1.93	0.85 – 4.43	1.46	0.55-3.89

*adjusted for birth weight, mode of delivery, hospital
**<2% missing values

Table 4 - Association between DDH and risk factors in males

	Controls n=209 (%)	Treated DDH n=9 (%)	Unadjusted OR	95% CI	Adjusted OR*	95% CI
ECV attempt						
Unsuccessful	130 (62.2)	8 (88.9)	1.00			
Successful	79 (37.8)	1 (11.1)	0.21	0.03 – 1.68	0.16	0.01 – 2.27
Gestational age at birth**						
<37 weeks	5 (2.4)	0 (0)	1.00			
≥37 weeks	201 (97.6)	8 (100)	0.48	0.02-9.47		
Birth weight (grams)**						
<3000	28 (13.7)	0 (0)	1.00			
3000-3499	74 (36.1)	1 (11.1)	1.16	0.05-29.40		
3500-3999	72 (45.1)	5 (55.6)	4.64	0.25-86.80		
>4000	31 (15.1)	3 (33.3)	7.00	0.35-141.77		
Mode of delivery						
Trial of labour	120 (57.4)	3 (33.3)	1.00			
Elective CS	89 (42.6)	6 (66.7)	2.70	0.66 – 11.08	2.37	0.33 – 16.89

*adjusted for birth weight, mode of delivery, hospital
**<2% missing values

Discussion

In this study we evaluated the incidence of DDH requiring treatment in singleton breech presentation at term after successful ECV, and assessed the influence of successful ECV on the risk of DDH. We found a lower incidence of DDH after successful ECV: 2.8 versus 9.3%. Furthermore, we found that female gender was associated with a higher incidence of DDH. Upon separating the data for male and female infants, we only found a significantly lower incidence of DDH in female infants after a successful ECV in univariate analysis.

This study has several important strengths. To our knowledge this is the first study that investigates the relationship between ECV attempt and DDH using multivariate analysis. We found only one previous study that examined the incidence of DDH in infants born after an ECV attempt.[13] In a cohort study of 257 breech presentations, 137 underwent an ECV attempt and 62 infants were born vaginally in cephalic presentation. The 75 breech presentations after failed ECVs were all delivered by caesarean section. The incidence of DDH after successful ECV was higher compared with failed ECV (3.2 versus 1.0%), but this was not statistically significant. Furthermore, no correction for confounding factors was undertaken. Results of previous studies reporting on the effect of mode of delivery in breech infants on the incidence of DDH are conflicting, with some studies reporting an increased risk following

vaginal and emergency caesarean section,[9,12] and others reporting no such association.[14,15] Only one study made a distinction between the severity of DDH and the effect of mode of delivery, and found that the incidence of Graf types III and IV DDH were increased in the vaginal delivery group.[16] However, none of these studies performed a multivariate analysis to correct for confounding factors such as gender. Furthermore, none of these studies reported on the effect of ECV on the incidence of DDH. One limitation of our study is the sample size. A larger observational study or individual patient data meta- analysis might provide the number of patients needed to support or reject the hypothesis that (early) ECV has a relationship with DDH. A second limitation is the fact that we did not include a control group of children born in cephalic presentation without an ECV attempt, and who have not been lying in breech presentation. It would be interesting to compare the incidence of DDH in children born after a successful ECV with this group. From the literature we know that the prevalence of DDH ranges from 1.4 to 35 per 1000 live births, depending on the definition of DDH,[2-5] whereas in studies reporting on children treated for DDH the prevalence is mostly below 1%.[2-5] We found an incidence of DDH of 2.8% in the group of children born in cephalic presentation after a successful ECV, which seems remarkably high. The precise aetiology of DDH is unknown, but genetic and environmental factors may act as internal or external influences. Known risk factors for DDH are breech presentation in the last trimester, a positive family history of DDH and female gender.[4,8] In the case of breech presentation, one could reason that a successful ECV might prevent the development of DDH because these fetuses do not descend into the pelvis in breech presentation, which may protect them against mechanical forces acting on the hips during the last part of pregnancy and labour. Or it could be that DDH might be one reason for breech position in utero: i.e. that as a consequence of malfunction in the hip and different leg function in utero resulting from DDH, these children are more likely to remain in breech presentation. An audit cycle by Dryden et al. reported that only 56% of the breech infants had been referred for hip ultrasound.[17]

Our results confirm the overall agreement that attention should be paid to the referral for ultrasound of all neonates who presented in breech position, because of the incidence of 7.0% of DDH requiring treatment in our study population. Although children born in cephalic presentation after a successful ECV seem to have a lower incidence of DDH, it is still 2.8%, which is higher than the incidence reported in the general population of 1%.[2-5] Special attention should be paid to the referral of these children for screening by ultrasound, as these children are easily forgotten because they are born in cephalic presentation.

Conclusion

Children born in cephalic presentation after successful ECV seem to be at decreased risk for DDH, compared with children born in breech presentation after unsuccessful ECV. Nevertheless, a high percentage of children born after successful ECV appear to have DDH. A larger cohort study is needed to establish the definitive nature of this relation. Until then, we recommend the same screening policy for infants born in cephalic position after successful ECV as for infants born in breech position. Future research on this topic should also focus on the duration of breech position in relationship to the risk for DDH, to determine if early ECV could be of interest for these infants.

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