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Perinatal Outcomes in Cephalic Compared With Noncephalic Singleton Presentation in the Setting of Preterm Premature Rupture of Membranes Prior to 32 Weeks of Gestation

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Abstract

Objective—To investigate the relationship between fetal presentation at time of admission for preterm premature rupture of membranes (PROM) and perinatal outcomes, including gestational latency, among women in a large and well-characterized population with preterm PROM <32 weeks.

Methods—This was a secondary analysis of data from women randomized to receive magnesium sulfate versus placebo in the previously reported Maternal-Fetal Medicine Units Network BEAM (Beneficial Effects of Antenatal Magnesium Sulfate; 1997-2004) trial. Women with a singleton gestation and preterm PROM were included. Fetal presentation at the time of randomization was recorded. Associations of fetal position (cephalic vs. noncephalic) with perinatal outcomes were compared using chi-square, Fisher's exact, and Wilcoxon rank sum tests. Perinatal outcomes included gestational latency, abruption, and neonatal morbidity and mortality. Multivariable regression (logistic, linear and Cox) analyses were used to adjust for potential confounding factors.

Results—Of the 1,767 eligible women, 439 (24.5%) had a non-cephalic presentation. Noncephalic presentation was associated with an earlier median gestational age at time of preterm PROM (26.6 vs 28.4 weeks, $p < 0.001$), but no difference in gestational latency (7.5 vs 7.7 days, $p = 0.7$, adjusted hazard ratio 1.09 [95% CI 0.97-1.23]). There were no differences in risk of abruption or neonatal morbidity in multivariable analyses. However, even after controlling for potential confounding factors including gestational age at delivery and mode of delivery, risk of neonatal death before discharge was greater for non-cephalic gestations (3.4% vs 11.5%, $p < 0.001$; aOR 2.24 [95% CI 1.12-4.48]).

Conclusion—Even after controlling for gestational age and route of delivery, noncephalic fetuses in the setting of preterm PROM are at greater risk of neonatal death.

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Introduction

Preterm premature rupture of membranes (PROM), defined as rupture of amniotic membranes prior to 37 weeks' gestational age, complicates approximately 3% of pregnancies.¹ Pregnancies complicated by preterm PROM are at increased risk of placental abruption, intraamniotic infection, cord prolapse, intrauterine fetal demise, sepsis, and endometritis or postpartum infection.¹ While delivery will occur within one week in approximately half of women who experience preterm PROM, a number of factors are thought to influence gestational latency, including gestational age at preterm PROM.¹⁻³ Although it is well established that earlier gestational age is associated with a higher likelihood of a non-cephalic presentation of a singleton fetus^{4,5}, it is not well understood whether differences in adverse perinatal outcomes are associated with fetal presentation at the time of membrane rupture.

The limited data that do exist have suggested some differences in maternal and neonatal outcomes based on fetal presentation. A study of 48 women with preterm PROM identified that there was no difference in gestational latency or in composite maternal or neonatal morbidity based on presentation.⁶ In contrast, a study of 74 patients identified a higher chance of cord prolapse in pregnancies with a non-cephalic presentation, as well as a higher frequency of low cord gases or 5-minute Apgar scores, but no statistically significant differences in major neonatal morbidity.⁷ A larger report of 566 women with preterm PROM suggested that non-cephalic presentation at time of preterm PROM diagnosis was associated with an increased risk of endometritis, abruption, oligohydramnios, and a maternal composite adverse outcome (i.e., abruption, oligohydramnios, or intra-amniotic infection).⁸ These reports suggest there are conflicting and insufficient data regarding differential outcomes based on presentation at the time of preterm PROM diagnosis.

Thus, the objective of this study was to investigate the relationship between fetal presentation at time of admission for preterm PROM and perinatal outcomes among women in a large and well-characterized population who experienced preterm PROM <32 weeks. We hypothesized non-cephalic presentation in the setting of preterm PROM will be associated with longer gestational latency and increased risk of adverse perinatal outcomes.

Materials and Methods

This study is a secondary cohort analysis of a previously reported multicenter randomized clinical trial completed by the Maternal-Fetal Medicine Units Network. The initial study recruited women from 1997-2004 at 20 centers. The trial procedures, inclusion criteria, randomization protocol and data collection process for the original study have been described.⁹ Briefly, women were eligible for trial inclusion if deemed to be at high risk for preterm delivery between 24 and 31 weeks' gestational age due to rupture of membranes (22 to 31 weeks), spontaneous labor with cervical dilation (4-8cm), or anticipated indicated iatrogenic preterm delivery (in the next 2 to 24 hours).⁹ Exclusion criteria included hypertension or preeclampsia, recent exposure to magnesium sulfate, delivery expected in <2 hours or >8 centimeters dilation at time of evaluation, multiple gestation, maternal medical complications contraindicating magnesium treatment, prior study participation, fetal

death, known fetal anomaly, or known non-viable fetus.⁹ Women were randomized to receive either magnesium or placebo for fetal neuroprotection. All data were edited and validated on a regular basis. Each participating center and the data coordinating center received institutional review board approval prior to initiation. The present study, using de-identified data, was considered exempt by the Institutional Review Board at Northwestern University.

This analysis includes only women with singleton gestations who were in the study due to preterm PROM. The sample size was fixed and based on the total sample for the primary trial. Fetal presentation at the time of randomization was recorded routinely in the original study; randomization occurred proximate to admission for preterm PROM, and thus the fetal presentation is referred to as presentation at the time of admission for preterm PROM. Study groups in the present analysis were defined as cephalic if the fetal head was the presenting part, and non-cephalic if any other fetal part was presenting (breech or transverse). Perinatal outcomes investigated included abruption, intrauterine fetal demise, 5-minute Apgar score <7, neonatal sepsis, neonatal seizures, stage 2 or 3 necrotizing enterocolitis, mechanical ventilation, grade III or IV intraventricular hemorrhage, respiratory distress syndrome, pulmonary hypoplasia, confirmed cerebral palsy, and neonatal death before discharge (death in the neonatal intensive care unit). Definitions for these outcomes were based on the primary study protocol.⁹

Perinatal outcomes were then compared for cephalic versus non-cephalic presentations using chi-square tests, Fisher's exact test, and Wilcoxon rank-sum tests for categorical and continuous variables, as appropriate. Logistic regression models were developed to estimate the independent association of non-cephalic presentation with perinatal adverse outcomes when adjusting for potential confounders. Linear regression models were created to estimate the independent association of non-cephalic presentation with gestational age at preterm PROM and gestational age at delivery. Cox proportional hazards models were performed to estimate the independent association of non-cephalic presentation with gestational latency (time from preterm PROM to birth). Given the possibility of interaction between delivery mode and presentation, an interaction term between cesarean delivery and cephalic presentation was generated and tested with each perinatal outcome. In addition, an interaction term between postnatally diagnosed major anomalies and non-cephalic presentation was generated and tested with the outcome of neonatal death, given the potential interaction between fetal anomalies and non-cephalic presentation. Finally, given the possibility of relationships between gestational age or fetal anomalies and neonatal death, a post hoc subgroup analysis was performed with a sample matched (1:2) by gestational age at time of preterm PROM. An additional subgroup analysis assessed neonatal death in the gestational age-matched cohort with exclusion of the neonates with postnatally diagnosed anomalies. Factors with p-value <0.1 in bivariable analysis were included in the regression models. Odds ratios, beta coefficients, and hazard ratios, all with 95% confidence intervals were estimated. All tests were two-tailed and used p<0.05 for statistical significance. Stata v.13.0 was used for all analyses.

Results

For this analysis, 1,767 women met inclusion criteria, of whom 439 (24.5%) had non-cephalic presentations. There were few clinically significant demographic differences between women with cephalic and non-cephalic presentation (Table 1). Women with non-cephalic presentations were slightly older and had a slightly higher body mass index (BMI) than women with cephalic presentation. Women with non-cephalic presenting fetuses were more likely to be married (55.3% vs 45.6%, $p=0.001$), less likely to be nulliparous (27.8% vs 36.3%, $p=0.001$), and less likely to have engaged in illicit drug use during pregnancy (7.1% vs 11.5%, $p=0.009$) than women with cephalic presentation. Women with non-cephalic presentation also had a higher likelihood of second or third trimester bleeding (20.7% vs 11.9%, $p<0.001$) and a higher likelihood of fetal anomalies (5.5% vs 2.9%, $p=0.01$). Notably, anomalies were diagnosed postnatally, as known fetal anomalies were cause for exclusion from the (Beneficial Effects of Antenatal Magnesium Sulfate; 1997-2004) BEAM trial. Birth weights for non-cephalic presenting gestations were lower (1247g vs 1514g, $p<0.001$) than women with cephalic presentations, consistent with their earlier gestational age at delivery. There were no differences in proportion of male neonates, proportion randomized to magnesium treatment, or rates of chorioamnionitis between the cephalic versus non-cephalic groups.

Women with non-cephalic presentation experienced preterm PROM at an earlier gestational age than women with a cephalic presentation (Table 2). The median gestational age of preterm PROM for women with a non-cephalic presentation was 26.6 weeks, compared to 28.4 weeks for cephalic presentation ($p<0.001$). Median gestational age at birth also was earlier for women with non-cephalic presentations (28.6 weeks vs 30.4 weeks, $p<0.001$). After adjusting for maternal age, BMI, race and ethnicity, prenatal care, marital status, parity, drug use, 2nd or 3rd trimester bleeding, and major anomalies, the gestational ages at time of preterm PROM and at birth remained statistically significantly earlier for women with non-cephalic presentations. However, the median latency was not different for women with non-cephalic presentations compared to those with cephalic presentation (7.5 days vs 7.7 days, $p=0.7$; adjusted hazard ratio 1.09, 95% CI 0.97-1.23), and there was no statistically significant difference between groups ($p=0.69$) in their Kaplan-Meier curves for latency.

Next, we investigated perinatal adverse outcomes based on presentation (Table 3). No differences in risk of abruption, intrauterine fetal demise, necrotizing enterocolitis, grade III or IV intraventricular hemorrhage, or pulmonary hypoplasia were identified. While women who had non-cephalic presenting fetuses had a higher frequency of 5-minute Apgar <7, neonatal sepsis, neonatal seizures, mechanical ventilation, grade III or IV intraventricular hemorrhage, respiratory distress syndrome, and definite cerebral palsy on bivariable analyses, none of these associations remained statistically significant after accounting for potential confounders, including gestational age and delivery mode. Conversely, neonatal death before discharge was more frequent among neonates with a non-cephalic presentation (11.5% vs 3.4%, $p<0.001$) at preterm PROM, and this association remained statistically significant in the multivariable logistic regression model (aOR 2.24, 95% CI 1.12 – 4.48). These findings were unchanged when the regression model accounted for gestational age at time of enrollment rather than gestational age at time of delivery. Of note, there was no

significant interaction between mode of delivery and fetal presentation with regard to the outcome of neonatal death.

Given the results identified above, we investigated whether the relationship between fetal position and neonatal death was driven by fetal anomalies. While there was an increased frequency of neonatal death among anomalous neonates compared to non-anomalous neonates (24.6% vs 4.7%, $p < 0.001$), entry of an interaction term between anomalies and non-cephalic presentation into the regression analysis for neonatal death demonstrated there was no significant interaction (aOR 1.64, 95% CI 0.32-8.31) with regard to this outcome. In this regression model, there remained an independent association between non-cephalic presentation and neonatal death (aOR 2.11, 95% CI 1.03-4.33) and between anomalies and neonatal death (aOR 7.15, 95% CI 2.15-23.77). These findings indicate that while both non-cephalic presentation and anomalies were independently associated with death, the magnitude of association between non-cephalic presentation and neonatal death did not differ based on whether an anomaly was present.

Finally, in order to confirm that the relationship between non-cephalic presentation and neonatal death was not due to gestational age or anomalies, we performed a subgroup analysis with a cohort matched by gestational age at time of preterm PROM. In this analysis, we matched 431 women with non-cephalic presentation to 862 women with cephalic presentation within one week of the gestational age at rupture of membranes (demographic and clinical characteristics of the matched subgroup are shown in Table 4). The mean gestational age at rupture of membranes of this sample was 26.8 weeks (SD 2.4). In this matched subgroup, there remained an increased risk of death among the non-cephalic neonates (11.2% vs 4.8%, $p < 0.001$; aOR 3.15, 95% CI 1.62-6.13) when accounting for potential confounders with $p < 0.1$ on bivariable analyses. In this subgroup, the outcomes of analyses with the above described interaction factors were unchanged, and the relationship between death and anomalies persisted (aOR 3.90, 95% CI 1.84-8.23). When performing an additional subgroup analysis eliminating those with anomalies from this matched cohort (demographic and clinical characteristics shown in Table 5), there remained an independent association between non-cephalic presentation and risk of death (10.1% vs 4.4%, $p < 0.001$; aOR 2.82, 95% CI 1.46-5.48) when accounting for potential confounders with $p < 0.1$ on bivariable analyses.

Discussion

The intent of this secondary analysis of a large and diverse cohort of women with preterm PROM <32 weeks was to evaluate whether fetal presentation at the time of admission for preterm PROM was associated with adverse perinatal outcomes. These data suggest that fetuses with a non-cephalic presentation at admission for preterm PROM were at significantly increased risk of death before discharge compared to those with cephalic presentation, even after controlling for factors such as gestational age and mode of delivery. In addition, while those with non-cephalic presentations were more likely to experience preterm PROM at an earlier gestational age and subsequently deliver at an earlier gestational age, we did not identify any difference in gestational latency based on fetal presentation. The finding that there was no statistically significant difference in latency based on fetal

presentation may aid providers with both counseling and pregnancy monitoring in the setting of preterm PROM.

While there is a known increased risk of placental abruption in the setting of preterm PROM¹⁰, in contrast to prior reports, we did not identify differences in the likelihood of abruption based on fetal presentation. Yet, we did note that women with a non-cephalic presentation had a greater likelihood of experiencing second or third trimester bleeding, which is potentially associated with the earlier gestational age at preterm PROM. Prior work has suggested that the increased risk of abruption associated with non-cephalic presentation does not remain statistically significant if analyzing only women who had a latency period of greater than one day, which suggests this differential risk of abruption may not be due to fetal presentation but rather to the confounding factors that are associated with delivery within 24 hours of preterm PROM.⁸ Moreover, our data do not identify statistically significant associations between neonatal morbidity and fetal presentation, which is a finding consistent with that of Goodman et al.⁸ It should be noted, though, that the study lacked power to identify differences in rare neonatal adverse events.

However, we did identify an increased risk for neonatal death before hospital discharge among neonates who had non-cephalic presentations. The reason why these neonates were more likely to experience death remains uncertain, as the data lacked granularity about specific causes of death and the study was not powered to investigate differences in cause of death. However, it does not appear to be related to the possible complications associated with breech vaginal delivery, nor does it appear to be solely related to anomalies, as these possibilities were accounted for in regression analysis. While anomalies were associated with neonatal death, non-cephalic presentation additionally remained independently associated with neonatal death. Moreover, in a gestational age-matched subgroup analysis eliminating cases with postnatally diagnosed anomalies, this relationship persisted. Thus, anomalies do not fully explain the relationship between non-cephalic presentation and neonatal death. One potential explanation is that differences in neonatal morbidity identified on bivariable analysis, such as sepsis, may have contributed to the differences in death, but were not identified due to lack of power to assess differences in rare neonatal events. Additional prospective investigation is required to better understand the potential mechanisms behind this identified risk of death.

Strengths of this study are that it is a large, diverse cohort that was well characterized and had clear clinical definitions for each prospectively-collected outcome measure. Preterm PROM was confirmed using standard protocol, and pregnancies included in the study had reliable dating. The size of the study allowed for comparisons with less chance of type II error than in prior work due to smaller sample sizes. In addition, participants in this study received care in a large number of hospitals in different regions and with varying practice patterns, suggesting these data are generalizable. The inclusion of postnatally diagnosed fetal anomalies also contributes to generalizability, as any woman without a known fetal anomaly may still experience a fetal anomaly.

However, there are several limitations to consider. This study included women with preterm PROM prior to 32 weeks, and thus data may not be generalizable to preterm PROM patients

presenting beyond 32 weeks. Importantly, although we identified an association between non-cephalic presentation and mortality, it is not possible to determine a causal relationship, and it is possible that other factors, such as uterine abnormalities, could have contributed to the findings. Further, study groups were based on fetal presentation at the time of randomization, rather than presentation at the time of delivery, as data on presentation at time of delivery were not available; however, as the evidence suggests that spontaneous version following preterm PROM is rare¹¹, and as counseling should occur at the time of presentation with preterm PROM and not be delayed until delivery, we do not believe this issue limits clinical applicability. Further, abruption in the BEAM trial was based on clinical suspicion, rather than placental pathologic evaluation; it is possible that alternative criteria for the diagnosis of abruption would yield different results. Additionally, it is possible that residual confounding may occur from variables that were unmeasured; notably, this was an unplanned secondary analysis of the BEAM trial, and thus not all data relevant to this study question were available for this analysis. Finally, it is important to note that that we were underpowered to detect relatively small differences in rare outcomes. The lack of relationship between fetal presentation and adverse neonatal outcomes aside from death may be due to lack of statistical power to detect differences in rare events, rather than a true absence of an association.

In summary, in this large and well-characterized population, women with non-cephalic presentation at the time of admission for preterm PROM did not experience any difference in gestational latency or in the majority of neonatal adverse outcomes, although ability to examine differences in rare neonatal morbidities was limited. However, neonates with a non-cephalic presentation at admission for preterm PROM were at increased risk of death before discharge, for reasons that cannot be well elucidated by this analysis. These findings may have utility in the counseling and observation of women experiencing preterm PROM.

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Table 1
Cohort demographic and clinical characteristics by fetal presentation

Characteristics	Non-cephalic (N=439)	Cephalic (N=1328)	p-value
Age (years)	27.1 (5.6)	26.3 (5.8)	0.01
Body mass index (kg/m ²)	26.8 (7.3)	26.0 (6.5)	0.04
Ethnicity			0.09
Caucasian	184 (41.9%)	478 (36%)	
African American	170 (38.7%)	614 (46.2%)	
Hispanic	75 (17.1%)	204 (15.4%)	
Asian	4 (0.9%)	14 (1.1%)	
Other	6 (1.4%)	18 (1.4%)	
No prenatal care	23 (5.2%)	107 (8.1%)	0.05
Married	242 (55.3%)	604 (45.6%)	0.001
Years of education	11.9 (2.6)	11.8 (2.4)	0.18
Nulliparous	122 (27.8%)	482 (36.3%)	0.001
Prior preterm birth	123 (28.0%)	370 (27.9%)	0.95
Smoking	124 (28.3%)	389 (29.3%)	0.68
Illicit drug use	31 (7.1%)	152 (11.5%)	0.01
Alcohol use	34 (7.7%)	130 (9.8%)	0.20
Diabetes mellitus	20 (4.6%)	71 (5.4%)	0.52
First trimester bleeding	76 (17.3%)	213 (16.0%)	0.53
Second or third trimester bleeding	91 (20.7%)	158 (11.9%)	<0.001
Birth weight (grams)	1247 (509)	1514 (584)	<0.001
Major fetal anomaly*	24 (5.5%)	38 (2.9%)	0.01
Male fetus	240 (54.7%)	700 (52.7%)	0.48
Randomized to magnesium	209 (47.6%)	655 (49.3%)	0.53
Chorioamnionitis	55 (12.5%)	164 (12.4%)	0.92

Data presented as N(%) or mean (standard deviation).

* Anomalies were diagnosed postnatally, as known fetal anomalies were excluded from the BEAM trial.

Table 2
Association of gestational age delivery and gestational latency after rupture with fetal presentation at admission for Preterm PROM

Gestational age or latency	Bivariable analysis			Multivariable analysis
	Non-cephalic (N=439)	Cephalic (N=1328)	p-value [*]	Adjusted beta coefficient or hazard ratio ^{**} (95%CI)
Gestational age at rupture of membranes (weeks)	26.6 (24.4-29.0)	28.4 (26.0-30.4)	<0.001	-1.36 (-1.67 - -1.05)
Gestational age at birth (weeks)	28.6 (26.3-30.9)	30.4 (28.0-32.0)	<0.001	-1.55 (-1.90 - -1.20)
Latency from rupture of membranes to birth (days)	7.5 (3.6-16.9)	7.7 (3.4-16.6)	0.7	1.09 (0.97-1.23) ^{***}

Data presented as median (interquartile range)

^{*} Wilcoxon rank-sum

^{**} Compared to cephalic presentation. Adjusted for maternal age, BMI, race and ethnicity, prenatal care, marital status, parity, drug use, 2nd or 3rd trimester bleeding, major anomalies

^{***} Hazard ratio

Table 3
Association of perinatal outcomes with fetal presentation at admission for Preterm PROM

Outcome	Bivariable analysis			Multivariable analysis
	Non-cephalic (N=439)	Cephalic (N=1328)	p-value	Adjusted OR* (95% CI)
Abruption	41 (9.3%)	97 (7.3%)	0.17	1.07 (0.71-1.64)
Intrauterine fetal demise	4 (0.9%)	7 (0.5%)	0.48	1.35 (0.29-6.27)
5-minute Apgar <7	116 (26.5%)	212 (16%)	<0.001	1.29 (0.86-1.95)
Sepsis	100 (23.0%)	178 (13.5%)	<0.001	1.24 (0.80-1.94)
Seizures	14 (3.2%)	21 (1.6%)	0.04	1.33 (0.41-4.29)
Stage 2 or 3 necrotizing enterocolitis	21 (4.8%)	53 (4.0%)	0.47	1.08 (0.50-2.33)
Mechanical ventilation	312 (71.7%)	623 (47.2%)	<0.001	1.23 (0.82-1.84)
Grade III or IV intraventricular hemorrhage	6 (1.5%)	24 (1.9%)	0.83	0.36 (0.11-1.22)
Respiratory distress syndrome	265 (60.9%)	597 (45.2%)	<0.001	0.75 (0.52-1.08)
Pulmonary hypoplasia	4 (0.9%)	4 (0.3%)	0.11	5.47 (0.29-102.72)
Definite cerebral palsy	26 (7.3%)	46 (3.9%)	0.01	1.35 (0.64-2.82)
Neonatal death before discharge	50 (11.5%)	45 (3.4%)	<0.001	2.24 (1.12-4.48)

Data presented as N(%)

* Compared to cephalic presentation. Adjusted for maternal age, BMI, race and ethnicity, prenatal care, marital status, parity, drug use, 2nd or 3rd trimester bleeding, major anomalies, gestational age at birth, and delivery mode. Regression analysis for abruption and IUFD are not adjusted for mode of delivery.

Table 4
Gestational age-matched subgroup demographic and clinical characteristics by fetal presentation (N=1293)

Characteristics	Non-cephalic (N=431)	Cephalic (N=862)	p-value
Age (years)	27.2 (5.6)	26.5 (5.8)	0.07
Body mass index (kg/m ²)	26.9 (7.3)	26.3 (6.7)	0.17
Ethnicity			0.20
Caucasian	181 (42.0%)	319 (37.0%)	
African American	167 (38.8%)	395 (45.8%)	
Hispanic	73 (16.9%)	131 (15.2%)	
Asian	4 (0.9%)	8 (0.9%)	
Other	6 (1.4%)	9 (1.0%)	
No prenatal care	23 (5.3%)	71 (8.2%)	0.06
Married	238 (55.4%)	400 (46.5%)	0.006
Years of education	12.0 (2.6)	11.9 (2.4)	0.28
Nulliparous	121 (28.0%)	315 (36.5%)	0.002
Prior preterm birth	120 (27.8%)	229 (25.5%)	0.37
Smoking	122 (28.3%)	258 (29.9%)	0.55
Illicit drug use	31 (7.2%)	93 (10.8%)	0.04
Alcohol use	33 (7.7%)	84 (9.7%)	0.22
Diabetes mellitus	19 (4.4%)	39 (4.5%)	0.92
First trimester bleeding	76 (17.6%)	158 (18.3%)	0.76
Second or third trimester bleeding	90 (20.9%)	115 (13.3%)	<0.001
Birth weight (grams)	1243 (507)	1360 (591)	<0.001
Major fetal anomaly*	22 (5.1%)	24 (2.8%)	0.03
Male fetus	237 (55.0%)	450 (52.2%)	0.34
Randomized to magnesium	205 (47.6%)	415 (48.1%)	0.84
Chorioamnionitis	54 (12.5%)	121 (14.0%)	0.46

Data presented as N(%) or mean (standard deviation).

* Anomalies were diagnosed postnatally, as known fetal anomalies were excluded from the BEAM trial.

Table 5
Gestational age-matched subgroup cohort demographic and clinical characteristics by fetal presentation, with exclusion of fetal anomalies (N=1247)

Characteristics	Non-cephalic (N=409)	Cephalic (N=838)	p-value
Age (years)	27.1 (5.5)	26.5 (5.8)	0.15
Body mass index (kg/m ²)	26.9 (7.2)	26.3 (6.6)	0.18
Ethnicity			0.23
Caucasian	169 (41.3%)	309 (36.8%)	
African American	159 (38.9%)	385 (45.9%)	
Hispanic	72 (17.6%)	128 (15.3%)	
Asian	4 (1.0%)	8 (1.0%)	
Other	5 (1.2%)	9 (1.1%)	
No prenatal care	23 (5.6%)	69 (8.2%)	0.09
Married	242 (55.2%)	389 (46.5%)	0.006
Years of education	12.0 (2.7)	11.9 (2.4)	0.55
Nulliparous	113 (27.6%)	309 (36.9%)	0.001
Prior preterm birth	113 (27.6%)	213 (25.4%)	0.40
Smoking	117 (28.6%)	248 (29.6%)	0.72
Illicit drug use	31 (7.6%)	89 (10.6%)	0.09
Alcohol use	32 (7.8%)	84 (10.0%)	0.21
Diabetes mellitus	17 (4.2%)	38 (4.5%)	0.76
First trimester bleeding	70 (17.1%)	149 (17.8%)	0.77
Second or third trimester bleeding	82 (20.1%)	109 (13.0%)	0.001
Birth weight (grams)	1242 (509)	1354 (580)	<0.001
Male fetus	227 (55.5%)	437 (52.2%)	0.27
Randomized to magnesium	191 (46.7%)	401 (47.9%)	0.70
Chorioamnionitis	51 (12.5%)	120 (14.3%)	0.37

Data presented as N(%) or mean (standard deviation).