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CLINICAL ARTICLE

Intertwin birth weight discordance, mode of delivery, and fetal and neonatal outcomes in twin pregnancies

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Abstract

Objective: The aim of the present study was to evaluate the association between intertwin birth weight discordance and fetal and neonatal outcomes in twin pregnancies, and to assess its relationship with mode of delivery.

Methods: This retrospective cohort study included twin pregnancies delivered at a tertiary referral center. Intertwin birth weight discordance was calculated as the percentage difference between the larger and smaller twin and categorized as 0%–15%, 15%–25%, and >25%. Fetal and neonatal outcomes were analyzed as predefined composite outcomes. Multivariable logistic regression models were used to assess associations, adjusting for gestational age at delivery, antenatal corticosteroid exposure, chorionicity, and mode of delivery.

Results: A total of 1408 twin pregnancies (2816 newborns) were included. In bivariate analyses, higher intertwin birth weight discordance was associated with increased rates of adverse fetal and neonatal outcomes. However, after adjustment, birth weight discordance was not significantly associated with the fetal composite outcome (discordance >25%: odds ratio [OR] 2.55; 95% confidence interval [CI]: 0.89–7.27), although the magnitude of the effect suggested a possible increased risk, nor the neonatal composite outcome (OR 1.53; 95% CI: 0.97–2.40). Gestational age at delivery was inversely associated with both fetal (OR 0.75 per week; 95% CI: 0.66–0.84) and neonatal composite outcomes (OR 0.54 per week; 95% CI: 0.45–0.65). Cesarean delivery (OR 2.26; 95% CI: 1.58–3.25) and antenatal corticosteroid exposure (OR 1.75; 95% CI: 0.99–3.08) were associated with increased odds of neonatal composite morbidity.

Conclusion: Intertwin birth weight discordance was not independently associated with adverse fetal or neonatal outcomes after adjustment. Prematurity emerged as the main determinant of perinatal risk, supporting interpretation of birth weight discordance as a contextual marker rather than an independent determinant of delivery strategy or timing.

KEYWORDS
birth weight discordance, fetal outcomes, mode of delivery, neonatal outcomes, prematurity, twin pregnancy

1 | INTRODUCTION

Twin pregnancy is associated with a substantially higher risk of adverse perinatal outcomes compared with singleton gestation, including stillbirth, neonatal morbidity, and preterm birth, which remain the main determinants of neonatal outcomes in this population.[1–3] In addition, twin gestations are linked to increased maternal morbidity, including hypertensive disorders of pregnancy, postpartum hemorrhage, and higher cesarean delivery rates.[1–3] As a result, antenatal surveillance and decisions regarding timing and mode of delivery are critical components of clinical management in twin pregnancies.[1–3]

Fetal growth abnormalities are common in twin gestations and are traditionally assessed using fetal size percentiles derived from either singleton or twin-specific growth charts.[4,5] However, the clinical utility of absolute fetal size has been questioned, as twins exhibit distinct physiological growth trajectories and constraints related to the shared intrauterine environment and placentation.[4] Intertwin birth weight or estimated fetal weight (EFW) discordance has therefore emerged as a potentially more meaningful marker of imbalance in fetal growth than isolated fetal percentiles.[1] The greater the intertwin weight discordance, the higher the risk of perinatal mortality and neonatal morbidity, with the smaller twin being disproportionately affected.[1,6]

Several maternal and placental factors have been associated with increased risk of birth weight discordance, including advanced maternal age, pre-eclampsia, gestational hypertension, and monochorionicity.[7,8] In monochorionic twins, unequal placental sharing and vascular anastomoses play a critical role in determining growth patterns.[9]

Despite growing evidence supporting the prognostic value of intertwin fetal size discordance for adverse neonatal outcomes, several relevant knowledge gaps remain.[4] Most available studies have primarily focused on neonatal morbidity and mortality in relation to estimated fetal weight discordance during pregnancy, while the role of intertwin birth weight discordance (IBD) as a clinically meaningful exposure has been less consistently addressed.[1,10] In addition, the relationship between intertwin weight discordance and mode of delivery has not been adequately explored. Discordant fetal growth may influence both planned and intrapartum decisions regarding cesarean versus vaginal delivery, yet this potential interaction has received limited attention in prior studies.[4]

The Twin Birth Study demonstrated no overall neonatal benefit of planned cesarean delivery compared with planned vaginal birth in appropriately selected twin pregnancies.[11] A subsequent secondary analysis specifically evaluated birth weight discordance and found no differential benefit of planned cesarean delivery according to discordance status, while identifying gestational age at delivery as the main modifier of outcomes.[12]

While most previous studies have focused on EFW discordance assessed antenatally, IBD represents a distinct exposure that captures the cumulative effect of intrauterine growth differences and clinical management decisions throughout pregnancy. Therefore, the aim of this study was to evaluate the association between intertwin birth weight discordance and fetal and neonatal outcomes in a large contemporary cohort of twin pregnancies, and to explore its relationship with mode of delivery. We hypothesized that IBD would not be associated with adverse fetal or neonatal outcomes, and that mode of delivery would be related to neonatal morbidity.

2 | MATERIALS AND METHODS

This was a retrospective single-center cohort study conducted at "Virgen de la Arrixaca" Clinic University Hospital in Murcia (Spain). All twin pregnancies delivered at our institution between 2009 and 2022 with available birth weight data for both twins were eligible for inclusion in the analysis. Data were obtained from routinely collected clinical and ultrasound records.

The study adhered to the ethical principles outlined in the 2013 Helsinki Declaration by the World Medical Association. The study was approved by the local institutional review board (2018-10-4-HCUVA), with a waiver of informed consent due to the retrospective and anonymized nature of the data.

2.1 | Study participants

Eligible for inclusion were twin pregnancies of known chorionicity with a confirmed birth outcome in our center. Pregnancies were excluded if they were affected by structural anomaly, chromosomal abnormality or miscarriage (up to 21^{+6} weeks' gestation). Monoamniotic monochorionic pregnancies and triplet pregnancies, were also excluded. Chorionicity and gestational age were determined by first-trimester ultrasound assessment following International Society of Ultrasound in Obstetrics and Gynecology (ISUOG) guidelines.[3]

Case identification was carried out via a retrospective review of ultrasound databases in each location, and maternal demographic data, pregnancy characteristics and outcomes were extracted from the electronic ultrasound records and medical files. Twins were labeled based on presenting twin as first or lower twin and second or upper twin. IBD was calculated as the difference between the birth weights of the larger and smaller twins, divided by the birth weight

of the larger twin and expressed as a percentage. IBD was categorized in 0%–15%, 15%–25% and above 25%.

$$\text{Intertwin birth weight discordance (\%)} = \frac{|\text{Birth weight of larger twin} - \text{Birth weight of smaller twin}|}{\text{Birth weight of larger twin}} \times 100$$

Our center adheres to the updated ISUOG practice guidelines on the management of twin pregnancies, employing standardized Doppler surveillance of the umbilical artery, fetal middle cerebral artery and ductus venosus (when indicated).[3] In uncomplicated monochorionic pregnancies, assessments were performed every 2 weeks starting from 16 weeks' gestation, while in uncomplicated dichorionic pregnancies, Doppler evaluation was conducted every 4 weeks from 20 weeks' gestation. In cases of fetal growth restriction, the frequency of Doppler assessments was increased, with evaluations performed at least once a week in monochorionic pregnancies and approximately every 2 weeks in dichorionic pregnancies, depending on the severity of the condition.

Vaginal delivery was attempted in twin pregnancies with cephalic presentation of first fetus with: (a) one or non-previous cesarean section, (b) normal weight or type 1 fetal growth restriction and (c) no maternal contraindication for vaginal delivery. Newborns were evaluated immediately after delivery by a neonatologist.

Fetal and neonatal outcomes were predefined a priori and analyzed as composite outcomes. Fetal composite was considered when a stillbirth of at least one co-twin and/or iatrogenic early preterm birth (PTB) (delivery <34 weeks) was performed to prevent a perinatal loss in the case of indications such as abnormal findings on ultrasound examination, Doppler assessment or cardiotocography. The fetal composite outcome was defined to capture severe intrauterine compromise, including stillbirth and iatrogenic preterm birth before 34 weeks performed due to suspected fetal deterioration (e.g., suspected intrauterine infection or fetal compromise). A sensitivity analysis restricted to stillbirth alone was also performed. Neonatal composite was considered when a newborn required continuous positive airway pressure (CPAP), invasive mechanical ventilation, when a respiratory distress syndrome, grade III or IV intraventricular hemorrhage, necrotizing enterocolitis, sepsis or retinopathy was diagnosed or if the newborn suffered anemia that required blood transfusion.

2.2 | Statistical analysis

Continuous variables were assessed for distributional characteristics using the Kolmogorov–Smirnov test and summarized as mean and standard deviation (SD). Categorical variables are summarized as counts and percentages and were compared using the chi-square test, as appropriate.

Multivariable logistic regression models were constructed to evaluate the association between IBD and fetal and neonatal composite outcomes. For fetal and neonatal outcomes, analyses were conducted at the individual level, considering each fetus/newborn as a separate observational unit. Given the hierarchical structure of twin data, clustering within twin pairs was accounted for using robust standard errors.

Variables included in the models were those identified as clinically relevant or statistically significant in univariable analyses. The main models were adjusted for gestational age at delivery, antenatal corticosteroid exposure, chorionicity, and relevant maternal factors. Birth weight was not included in the primary models due to its mathematical relationship with IBD. Collinearity between these variables was formally assessed, and sensitivity analyses including birth weight were performed to evaluate the robustness of the results. To account for multiple comparisons in secondary analyses, *P* values were adjusted using the false discovery rate according to the Benjamini–Hochberg procedure.

Model assumptions were assessed using standard diagnostic procedures, including visual inspection of residuals and assessment of model fit. Predicted probabilities were estimated from adjusted models and graphically displayed across increasing levels of birth weight discordance.

A *P* value less than 0.05 was considered statistically significant. All statistical analyses were performed using R statistical software (version 4.3.0, R Core Team, 2023) and Stata/BE 19.5 (StataCorp, College Station, Texas, USA).

3 | RESULTS

3.1 | Study population and baseline characteristics

A total of 1408 twin pregnancies with 2816 newborns were included in the analysis. Of these, 976 (69.2%) had an IBD of 0%–15%, 299 (21.2%) of 15%–25%, and 134 (9.5%) greater than 25%. Baseline maternal characteristics were largely comparable across discordance groups, including maternal age, body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters), use of assisted reproductive technologies (ART), and chorionicity (Table 1).

Increasing IBD was associated with a higher prevalence of smoking (Table 1). Labor onset differed significantly across groups, with pregnancies with birth weight discordance greater than 25% showing a higher proportion of no labor onset (Table 1).

3.2 | Perinatal outcomes according to intertwin birth weight discordance

Perinatal outcomes are shown in Table 2. No differences in neonatal death nor stillbirth were found between IBD groups. Both fetal and neonatal composite outcomes were more frequent among pregnancies with discordance greater than 25% compared with those with lower degrees of discordance (Table 2). Pregnancies with discordance greater than 25% showed lower mean birth weight, and lower Apgar scores.

Rates of neonatal admission, neonatal intensive care unit (NICU) admission, respiratory morbidity, intraventricular hemorrhage, sepsis,

TABLE 1 Baseline maternal, pregnancy, and delivery characteristics by intertwin birth weight discordance.

	0%–15%	15%–25%	>25%	Total	
	n = 975 (69.2%)	*n* = 299 (21.2%)	*n* = 134 (9.5%)	*n* = 1408 (100%)	*p*
Maternal age (years)	34.2 (5.11)	34.3 (5.07)	33.7 (5.55)	34.2 (5.14)	0.546
BMI	24.8 (4.32)	24.8 (3.97)	24.9 (4.66)	24.8 (4.28)	0.935
Chorionicity					
Dichorionic-diamniotic	762 (78.2%)	244 (81.6%)	111 (82.8%)	1117 (79.3%)	0.250
Monochorionic-diamniotic	213 (21.8%)	55 (18.4%)	23 (17.2%)	291 (20.7%)	
ART	408 (41.8%)	136 (45.5%)	63 (47%)	607 (43.1%)	0.340
Nulliparous	464 (47.6%)	152 (51.2%)	78 (58.2%)	694 (49.4%)	0.055
Smoke	97 (9.95%)	44 (14.7%)	23 (17.2%)	164 (11.6%)	**0.009**
Race					
White	950 (97.4%)	294 (98.3%)	130 (97%)	1374 (97.6%)	0.724
Black	20 (2.05%)	3 (1%)	4 (2.99%)	27 (1.92%)	
Asian	4 (0.41%)	2 (0.669%)	0 (0%)	6 (0.426%)	
Mixed	1 (0.103%)	0 (0%)	0 (0%)	1 (0.071%)	
Diabetes mellitus	76 (7.79%)	26 (8.7%)	11 (8.21%)	113 (8.03%)	0.879
Pre-eclampsia	59 (6.05%)	30 (10%)	9 (6.72%)	98 (6.96%)	0.060
Steroid administration	230 (23.6%)	79 (26.4%)	43 (32.1%)	352 (25%)	0.084
Gestational age at steroid administration (weeks)	31.4 (3.24)	31.9 (2.89)	32.2 (2.72)	31.6 (3.11)	
Gestational age at delivery (weeks)	36.1 (2.59)	36.2 (2.53)	35.5 (2.83)	36.1 (2.6)	
Labor onset					
Spontaneous	426 (43.7%)	113 (37.8%)	49 (36.6%)	588 (41.8%)	**0.015**
Induced	304 (31.2%)	98 (32.8%)	34 (25.4%)	436 (31%)	
No labor	245 (25.1%)	88 (29.4%)	51 (38.1%)	384 (27.3%)	
Internal version	221 (22.7%)	53 (17.7%)	21 (15.7%)	295 (21%)	0.053
Presentation at delivery					
Cephalic	669 (77.4%)	203 (72.5%)	97 (73.5%)	969 (75.9%)	0.192
Breech	195 (22.6%)	77 (27.5%)	35 (26.5%)	307 (24.1%)	
Delivery					
Vaginal delivery	447 (45.8%)	128 (42.8%)	45 (33.6%)	620 (44%)	0.098
Emergent cesarean section	271 (27.8%)	89 (29.8%)	43 (32.1%)	403 (28.6%)	
Scheduled cesarean section	257 (26.4%)	82 (27.4%)	46 (34.3%)	385 (27.3%)	

Note: BMI, calculated as weight in kilograms divided by the square of height in meters. Baseline characteristics of twin pregnancies stratified by intertwin birth weight discordance categories (0%–15%, 15%–25%, and >25%). Continuous variables are presented as mean (SD), and categorical variables as number (percentage). *p* values correspond to comparisons across discordance groups. Bold values indicate statistically significant results based on the reported *p*-values for the corresponding variables.

Abbreviations: ART, assisted reproductive technologies; BMI, body mass index; SD, standard deviation.

and phototherapy increased progressively with higher birth weight discordance.

3.3 | Association between birth weight discordance and fetal composite outcome

In multivariable logistic regression analysis, IBD was not independently associated with the fetal composite outcome (Table 3). Compared with pregnancies with discordance of 0%–15%, those with discordance greater than 25% showed increased odds of the fetal composite outcome (odds ratio [OR] 2.55; 95% confidence interval [CI]: 0.89–7.27; $p = 0.080$) (Table 3).

A lower risk of the fetal composite outcome was independently associated with gestational age at delivery (OR 0.76; 95% CI: 0.61–0.94; $p = 0.011$), while monochorial pregnancies were associated with an increased risk of fetal composite (OR 6.06; 95% CI: 3.19–11.51; $p < 0.001$) (Table 3).

Model-based predicted probabilities demonstrated a progressive increase in the risk of the fetal composite outcome with increasing IBD (Figure 1). Sensitivity analyses including birth weight yielded consistent results (Table S1).

TABLE 2 Perinatal outcomes by intertwin birth weight discordance.

	0%–15%	15%–25%	>25%	Total	
	n = 1950	*n* = 598	*n* = 268	*n* = 2816	*p*
Outcome					0.205
Live birth	1929 (98.9%)	592 (99%)	261 (97.4%)	2782 (98.8%)	
Neonatal death	12 (0.615%)	2 (0.334%)	4 (1.49%)	18 (0.639%)	
Stillbirth	9 (0.462%)	4 (0.669%)	3 (1.12%)	16 (0.568%)	
Sex					0.539
Male	980 (50.3%)	285 (47.7%)	133 (49.6%)	1398 (49.6%)	
Female	970 (49.7%)	313 (52.3%)	135 (50.4%)	1418 (50.4%)	
Larger twin					**<0.001**
First twin larger	990 (50.8%)	360 (60.2%)	172 (64.2%)	1522 (54%)	
Second twin larger	960 (49.2%)	238 (39.8%)	96 (35.8%)	1294 (46%)	
Birth weight (g)	2393 (489)	2345 (531)	2133 (689)	2358 (525)	**<0.001**
Birth weight discrepancy	6.8% (4.26)	19.5% (2.91)	32.6% (6.54)	11.9% (9.47)	**<0.001**
Apgar score at first minute	8.7 (0.979)	8.74 (0.968)	8.41 (1.52)	8.68 (1.04)	**<0.001**
Apgar score at first minute below 7	187 (9.62%)	40 (6.69%)	37 (13.8%)	264 (9.4%)	**0.003**
Apgar score at fifth minute	9.72 (0.775)	9.74 (0.846)	9.48 (1.34)	9.7 (0.862)	**<0.001**
Apgar score at fifth minute below 7	36 (1.85%)	14 (2.34%)	15 (5.6%)	65 (2.31%)	**<0.001**
Apgar score at 10th minute	9.84 (0.608)	9.84 (0.73)	9.63 (1.27)	9.82 (0.726)	**<0.001**
Apgar score at 10th minute below 7	12 (0.68%)	5 (0.90%)	10 (4.05%)	27 (1.05%)	**<0.001**
pH cord blood below 7	16 (2.03%)	5 (2.23%)	4 (4.35%)	25 (2.26%)	0.366
Neonatal admission	561 (28.9%)	189 (31.6%)	137 (51.1%)	887 (31.6%)	**<0.001**
Neonatal ICU admission	163 (8.39%)	41 (6.87%)	47 (17.7%)	251 (8.95%)	**<0.001**
Composite fetal	29 (1.49%)	10 (1.67%)	10 (3.73%)	49 (1.74%)	**<0.001**
Composite neonate	244 (12.5%)	62 (10.4%)	59 (22.0%)	365 (13.0%)	**<0.001**
Ventilation	205 (10.6%)	51 (8.54%)	45 (17%)	301 (10.7%)	**<0.001**
Intubation	28 (1.44%)	8 (1.34%)	5 (1.89%)	41 (1.46%)	0.819
CPAP	183 (9.42%)	43 (7.2%)	34 (12.8%)	260 (9.27%)	**0.029**
IMV	64 (3.3%)	14 (2.35%)	14 (5.28%)	92 (3.28%)	0.082
RDS	221 (11.4%)	48 (8.04%)	41 (15.5%)	310 (11.1%)	**0.004**
Phototherapy	343 (17.7%)	89 (14.9%)	60 (22.6%)	492 (17.5%)	**0.022**
Intraventricular hemorrhage	39 (2.01%)	8 (1.34%)	12 (4.53%)	59 (2.1%)	**0.009**
Anemia	54 (2.78%)	19 (3.18%)	13 (4.91%)	86 (3.07%)	0.167
Necrotizing enterocolitis	10 (0.515%)	4 (0.67%)	0	14 (0.499%)	0.430
Retinopathy	24 (1.24%)	7 (1.17%)	5 (1.89%)	36 (1.28%)	0.653
Sepsis	35 (1.8%)	10 (1.68%)	12 (4.53%)	57 (2.03%)	**0.010**
Blood transfusion	29 (1.49%)	12 (2.01%)	9 (3.4%)	50 (1.78%)	0.080

Note: Perinatal outcomes stratified by intertwin birth weight discordance categories (0%–15%, 15%–25%, and >25%). Continuous variables are presented as mean (SD), and categorical variables as number (percentage). Fetal and neonatal composite outcomes are defined in the Methods section. *p* values correspond to comparisons across discordance groups. Outcomes are reported per neonate, whereas baseline characteristics are defined per pregnancy. Bold values indicate statistically significant results based on the reported *p*-values for the corresponding variables.

Abbreviations: CPAP, continuous positive airway pressure; ICU, intensive care unit; IMV, invasive mechanical ventilation; RDS, respiratory distress syndrome; SD, standard deviation.

3.4 | Association between birth weight discordance and neonatal composite outcome

In adjusted analyses, IBD was not independently associated with the neonatal composite outcome (Table 4).

Gestational age at delivery (OR 0.60; 95% CI: 0.46–0.77; $P < 0.001$) remained strongly associated with a lower risk of neonatal composite outcome, while antenatal corticosteroid exposure was associated with increased odds (OR 1.78; 95% CI: 1.26–2.51; $p = 0.001$) (Table 4). Cesarean delivery showed higher odds of

TABLE 3 Multivariable logistic regression analysis for the fetal composite outcome.

Fetal composite logistic regression			
Variable	**OR**	**CI 95%**	***p***
Birthweight discrepancy			
0%–15%	Reference		
15%–25%	1.48	0.56–3.89	0.430
>25%	2.55	0.89–7.27	0.080
Gestational age at delivery (weeks)	0.75	0.66–0.84	**<0.001**
Steroids	0.50	0.17–1.52	**0.223**
Chorionicity			
Dichorial-diamniotic	Reference		
Monochorial-diamniotic	5.83	2.52–13.47	**<0.001**
Diabetes mellitus	0.66	0.08–5.16	0.703

Note: aORs with 95% CIs for the association between intertwin birth weight discordance and the fetal composite outcome. Bold values indicate statistically significant results based on the reported *p*-values for the corresponding variables.

Abbreviations: aORs, adjusted odds ratios; CIs, confidence intervals; OR, odds ratio.

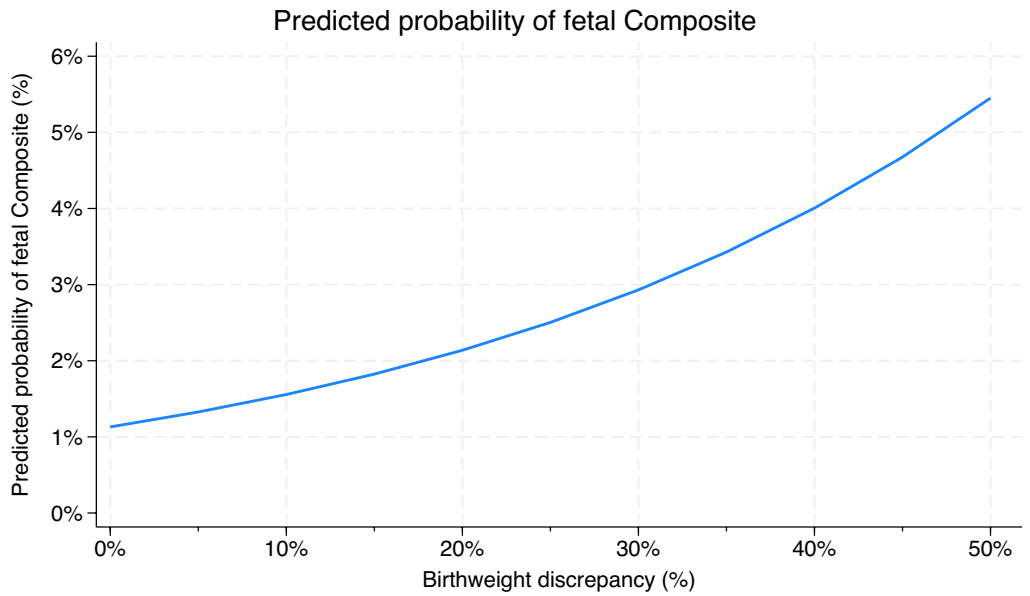

FIGURE 1 Model-based predicted probability of the fetal composite outcome according to intertwin birth weight discordance.

neonatal composite outcome compared with vaginal delivery (OR 2.17; 95% CI: 1.58–2.99; $p < 0.001$) (Table 4). Chorionicity, diabetes mellitus, and pre-eclampsia were not independently associated with neonatal composite morbidity in the adjusted model (Table 4).

Predicted probabilities derived from the adjusted model showed minimal variation across increasing levels of IBD (Figure 2). Sensitivity analyses including birth weight yielded consistent results (Table S2).

4 | DISCUSSION

In this large contemporary cohort of twin pregnancies, IBD showed limited independent prognostic value for adverse outcomes once relevant clinical covariates were considered. Although higher degrees of discordance were associated with increased rates of fetal and neonatal adverse events in unadjusted analyses, these associations were largely attenuated in multivariable models. Specifically, birth weight discordance was not independently associated with either fetal or neonatal composite outcomes after adjustment, including among pregnancies with discordance greater than 25%.

These findings refine and contextualize previous evidence reporting a graded association between increasing intertwin weight discordance and adverse perinatal outcomes at the population level. Previous studies have described higher risks of adverse outcomes with increasing degrees of discordance, particularly at more severe thresholds; however, these associations have largely been reported

TABLE 4 Multivariable logistic regression analysis for the neonatal composite outcome.

Neonatal composite logistic regression			
Variable	**OR**	**CI 95%**	***p***
Birthweight discrepancy			
0%–15%	Reference		
15%–25%	0.81	0.52–1.26	0.346
>25%	1.53	0.97–2.40	0.065
Gestational age at delivery (weeks)	0.54	0.45–0.65	**<0.001**
Steroids	1.75	0.99–3.08	**0.052**
Chorionicity			
Dichorial-diamniotic	Reference		
Monochorial-diamniotic	1.34	0.91–1.97	0.134
Preeclampsia	1.26	0.70–2.28	0.443
Diabetes mellitus	0.56	0.25–1.25	0.158
Mode of delivery			
Vaginal delivery	Reference		
Cesarean delivery	2.26	1.58–3.25	**<0.001**

Note: aORs with 95% CIs for the association between intertwin birth weight discordance and the neonatal composite outcome. Bold values indicate statistically significant results based on the reported *p*-values for the corresponding variables.

Abbreviations: aORs, adjusted odds ratios; CIs, confidence intervals; OR, odds ratio.

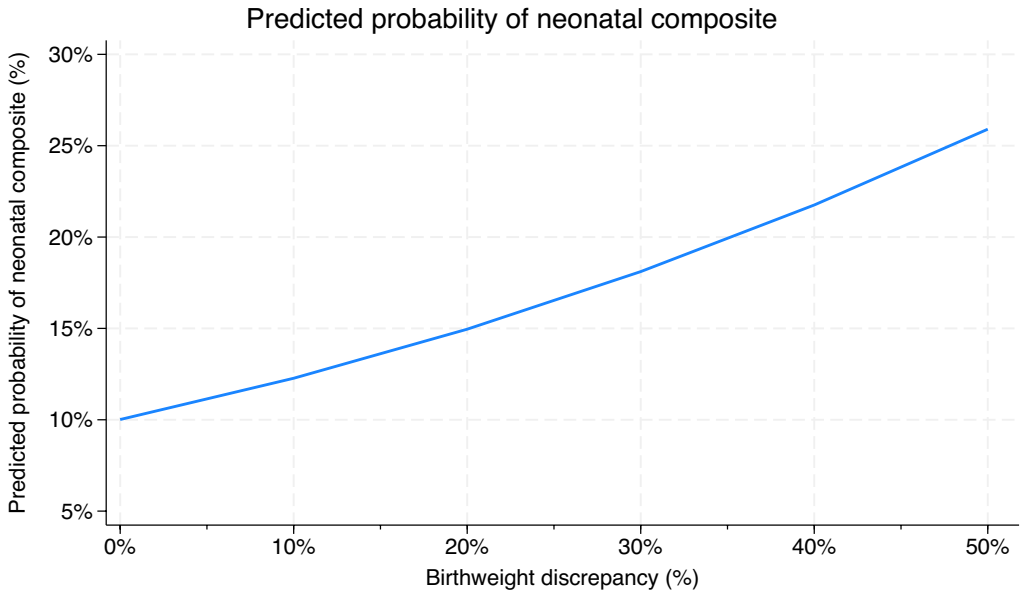

FIGURE 2 Model-based predicted probability of the neonatal composite outcome according to intertwin birth weight discordance.

in unadjusted or minimally adjusted analyses.[1,6,13] More recently, discordance-based approaches have been shown to outperform fetal size percentiles derived from singleton or twin-specific growth charts in identifying twins at risk of adverse outcomes.[5,14] Unlike antenatal estimated fetal weight discordance, birth weight discordance reflects the final growth imbalance and is not influenced by ultrasound estimation error, but it also incorporates the effects of clinical management decisions, including timing of delivery. This approach provides a complementary perspective by focusing on the final growth imbalance, potentially reducing the influence of ultrasound estimation error, while still reflecting the impact of clinical management decisions during pregnancy. Using birth weight instead of estimated fetal weight reduces the impact of ultrasound measurement error and allows a more direct assessment of true growth imbalance.

In this context, our results suggest that the incremental prognostic contribution of intertwin birth weight discordance is limited once

key clinical covariates are considered. After adjustment for gestational age at delivery and perinatal management variables, birth weight discordance was not independently associated with either fetal or neonatal composite outcomes. This finding is consistent with evidence indicating that discordance metrics capture fetal growth imbalance but may not function as independent predictors once prematurity and clinical decision making are accounted for.[6,10] Together, these observations support the interpretation of discordance as a marker embedded within a broader clinical trajectory rather than a standalone determinant of adverse outcome.

Our findings differ from several recent studies that have reported a strong independent predictive value of intertwin discordance for adverse perinatal outcomes. Giorgione et al. demonstrated that EFW discordance outperformed fetal growth percentiles in predicting adverse outcomes,[5] while Prasad et al. identified longitudinal patterns of discordance, particularly persistently high discordance trajectories, as being strongly associated with perinatal morbidity.[11] While EFW discordance is central to antenatal risk stratification, it is inherently subject to measurement error, which may partly influence the strength of observed associations. Several methodological differences may explain these discrepancies. First, our study focused on IBD measured at delivery rather than antenatal EFW discordance. Second, we evaluated discordance as a single measurement rather than longitudinal trajectories. Third, differences in outcome definitions and the extent of multivariable adjustment, particularly for gestational age at delivery and perinatal management factors, may substantially influence observed associations.

Gestational age at delivery emerged as a key determinant of both fetal and neonatal composite outcomes in our cohort. Each additional week of gestation was associated with a substantial reduction in the odds of adverse outcomes, highlighting prematurity as a major contributor to perinatal risk in twin pregnancies. This finding is in line with population-based data demonstrating that gestational age largely mediates the association between multiple pregnancy–related risk factors and neonatal morbidity.[1,15] Current ISUOG practice guidelines similarly emphasize individualized surveillance and timing of delivery as key elements in the management of twin gestations.[3] Importantly, our findings do not support modification of the optimal timing of delivery based solely on the presence of IBD. This is consistent with evidence indicating that, although discordance increases absolute perinatal risk, the gestational age associated with the lowest combined risk of stillbirth and neonatal morbidity remains unchanged.[1,12]

In contrast to birth weight discordance, mode of delivery and antenatal corticosteroid administration were independently associated with neonatal composite morbidity. Cesarean delivery and exposure to antenatal corticosteroids were both associated with higher odds of neonatal composite outcome. Notably, both planned and emergency cesarean delivery showed a similar direction of association with neonatal morbidity. These findings should be interpreted with caution. They may reflect confounding by indication and the higher baseline risk of the pregnancies in which these interventions are used.[4,16] Although antenatal corticosteroids are well established in singleton pregnancies,[17] their role in twin gestations remains uncertain, with inconsistent findings in the literature.[16,18]

This interpretation is supported by evidence from the Twin Birth Study, which demonstrated no overall neonatal benefit of planned cesarean delivery compared with planned vaginal birth in appropriately selected twin pregnancies,[4] as well as by more recent secondary analyses and population studies highlighting the complexity of delivery decision making in twins.[19] Importantly, fetal growth discordance was not a primary focus of these studies, and our findings suggest that discordance alone does not identify a subgroup that derives a clear neonatal benefit from a specific delivery strategy.

Regarding fetal outcomes, we observed a non-significant trend toward increased odds of fetal composite events among pregnancies with severe birth weight discordance (>25%). Although this association did not reach statistical significance after adjustment, its direction is consistent with previous reports describing higher risks of fetal demise and selective growth restriction in severely discordant twin pregnancies.[6,13] The relatively low incidence of fetal composite events in our cohort may have limited statistical power to detect an independent association after adjustment for gestational age.

An important consideration not addressed in our study is the potential impact of birth weight discordance on long-term neurodevelopmental outcomes. Recent evidence from population-based studies suggests that birth weight discordance ≥20% in term twins is associated with increased risk of neurodevelopmental impairment at school age (adjusted hazard ratio [HR] 1.13), independent of absolute birth weight.[20] In monochorionic twins with selective fetal growth restriction, the smaller twin demonstrates significantly lower full-scale IQ scores compared with the larger co-twin (median difference 6 points, $p < 0.0001$), with a higher prevalence of mild neurodevelopmental impairment (36% vs. 11%).[9] These findings suggest that while birth weight discordance may not independently predict immediate neonatal morbidity in our cohort, it may have implications for longer-term developmental outcomes that warrant further investigation. Standardized long-term neurodevelopmental follow-up should be considered for discordant twin pairs, particularly those with severe discordance (>25%).

This observational study carries some limitations. Intertwin birth weight discordance was assessed as a single measurement at delivery, and longitudinal patterns could not be evaluated. Doppler indices and cerebroplacental ratio were not available, limiting assessment of their additive prognostic value. The fetal composite outcome included iatrogenic preterm birth before 34 weeks, which reflects a clinical decision and may introduce confounding by indication, although sensitivity analysis restricted to stillbirth yielded consistent findings.

The relatively small number of pregnancies with severe discordance (>25%) may have limited statistical power. In addition, detailed information on the indications for cesarean delivery and relevant intrapartum variables (including second twin presentation, interdelivery interval, and specific obstetric maneuvers) was not consistently available. Finally, the retrospective single-center design

may introduce residual confounding and limit causal inference and generalizability.

The main strengths of this study include its large, well-characterized cohort of twin pregnancies managed within a single tertiary referral center, ensuring consistent clinical protocols and comprehensive outcome ascertainment. Importantly, by focusing on birth weight discordance rather than estimated fetal weight, this study provides a complementary perspective less influenced by ultrasound measurement error.

In addition, the use of predefined fetal and neonatal composite outcomes and multivariable adjustment for key confounders—including gestational age at delivery, chorionicity, mode of delivery, and antenatal corticosteroid exposure—allowed a nuanced assessment of the independent prognostic value of birth weight discordance. Sensitivity analyses including birth weight confirmed the robustness of the findings.

5 | CONCLUSION

In conclusion, intertwin birth weight discordance was not independently associated with adverse fetal or neonatal outcomes after adjustment for clinically relevant covariates, although severe discordance showed a trend toward increased fetal risk. Gestational age at delivery emerged as the key determinant of perinatal risk in twin pregnancies, while associations observed with mode of delivery and antenatal corticosteroid exposure are likely to reflect underlying clinical severity rather than causal effects. These findings support interpreting birth weight discordance as a marker of underlying clinical complexity rather than as an isolated determinant of delivery strategy or timing.

AUTHOR CONTRIBUTIONS

Data compilation was conducted by AMMZ, JSR, RL, PCB. Statistical analysis was executed by JSR and CdPM. Technical and academic guidance were generously provided by JEBC, AND, MPR, WPA and CdPM. All the authors participated in drafting and redaction of the manuscript and approved the final version.

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CONFLICT OF INTEREST STATEMENT

Javier Sánchez-Romero, Ana Martínez-Zarco, José Eliseo Blanco-Carnero, Miriam Pertegal-Ruiz, Catalina de Paco-Matallana and Aníbal Nieto-Diaz are affiliated with the University of Murcia and have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Research data are not shared.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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