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Growth Discordance is not an Independent Risk Factor for Adverse Perinatal Outcomes in Twin Pregnancies

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Abstract

Background: The aim of this study was to investigate the perinatal characteristics and outcomes in growth discordant monochorionic and dichorionic twin pregnancies concerning the difference of actual weight of each twin (appropriate for gestational age or small for gestational age; AGA or SGA).

Methods: We examined normally growth (AGA–AGA) and AGA-SGA monochorionic and dichorionic twin pregnancies with birth (or fetal) weight discordancel (6 AGA-AGA and 54 AGA-SAG monochorionic, and 16 AGA-AGA and 97 AGA-SGA dichorionic twin pregnancies). In addition, we examined normally growth (AGA–AGA) and AGA-SGA monochorionic and dichorionic twin pregnancies with birth (or fetal) weight concordance as control (97 AGA-AGA and 66 AGA-SAG monochorionic, and 359 AGA-AGA and 137 AGA-SGA dichorionic twin pregnancies).

Results: Growth discordance in the monochorionic and diamniotic twin pregnancies was associated with adverse outcomes only in the SGA twins of the discordant AGA-SGA twin pregnancies.

Conclusions: The presence of growth discordance or growth restriction may not be an independent risk factor for adverse perinatal outcomes in twin pregnancies.

Keywords: Growth discordance; Twin pregnancy; Small for gestational age; Perinatal outcome

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Introduction

Discordant twin growth of more than 20-25% may be an important contributor to the adverse perinatal outcomes especially in monochorionic twin pregnancies; however, this may be attributed to the actual weight of each twin (appropriate for gestational age or small for gestational age; AGA or SGA) rather than growth discordance [1, 2]. The aim of this study was to investigate the perinatal characteristics and outcomes in growth discordant monochorionic and dichorionic twin pregnancies concerning the difference of actual weight of each twin.

Methods

Medical charts of dichorionic and monochorionic diamniotic twin pregnancies who delivered at ≥ 22 weeks' gestation at Japanese Red Cross Katsushika Maternity Hospital between 2002 and 2010 were reviewed. The growth discordant twin pregnancy was defined by the presence of ≥ 20% growth discordance calculated as the birth weight difference between twins divided by the larger weight. In cases with chronic twin-twin transfusion syndrome (TTTS) receiving fetoscopic laser treatment and cases with fetal demise at least one twin, the estimated fetal weight was calculated based on the equation: 1.07 x biparietal diameter3 + 3.00 x 10-1 x abdominal circumference2 x femur length as reported previously in Japan (The Japan Society of Ultrasonics in Medicine, 2003). Thus, the percent discordancy between twins was defined by the following equation: % Discordancy = 100 x (birth or estimated fetal weight of larger twin - birth or estimated fetal weight of smaller twin) ÷ birth or estimated fetal weight of larger twin. Pregnancies were excluded if fetal demise at least one twin at < 22 weeks' gestation or fetal anomalies were diagnosed. Diagnosis of the placenta was made macroscopically and confirmed by placental pathology. The gestational age of the pregnancies was established by ultrasonographic examination of the fetal crown-rump length at 8 - 11 weeks' gestation. Birth (or estimated fetal) weight was classified as SGA if the weight was below the 10th percentile

Table 1. Perinatal Characteristics and Outcomes of Concordant Monochorionic Twin Pregnancies and Discordant Dichorionic Twins by Actual Birth (or Fetal) Weight

	Concordant twin		Discordant twin	
	AGA-AGA	AGA-SGA	AGA-AGA	AGA-SGA
N	97	66	6	54
Maternal age (y)	30.3 ± 4.2	31.0 ± 4.0	30.2 ± 3.1	31.3 ± 4.0
Nulliparity	67 (69%)	34 (52%)	4 (67%)	32 (59%)
Smoking	7 (7.2%)	3 (4.5%)	0 (0%)	2 (3.7%)
History of infertility	5 (5.2%)	1 (1.5%)	0 (0%)	3 (5.6%)
IVF use	4 (4.1%)	1 (1.5%)	0 (0%)	1 (1.9%)
Maternal height (cm)	158 ± 6	159 ± 6	158 ± 3	159 ± 5
Maternal weight				
At pre-pregnancy	51 ± 6	51 ± 6	52 ± 4	51 ± 6
At delivery	66 ± 8	64 ± 6	61 ± 5	64 ± 6
Hypertensive disorders	25 (26%)	20 (30%)	0 (0%)	11 (20%)
Geatstional diabetes	2 (2.1%)	1 (1.5%)	0 (0%)	1 (1.9%)
TTTS	4 (4.1%)	3 (4.5%)	1 (17%)	5 (9.3%)
Gestational age at delivery				
Average (weeks)	35.5 ± 3.4	36.0 ± 2.4	34.5 ± 3.4	35.5 ± 3.4
< 28 weeks	4 (4.1%)	1 (1.5%)	0 (0%)	1 (1.9%)
< 33 weeks	9 (9.3%)	4 (6.1%)	1 (17%)	10 (19%)
Delivery mode				
Elective Cesarean	39 (40%)	20 (30%)	2 (33%)	16 (24%)
Emergency Cesarean	32 (33%)	29 (44%)	2 (33%)	20 (30%)
Neonatal birth weight				
Larger twin (g)	2402 ± 491	2233 ± 443	2454 ± 515	2163 ± 630
Smaller twin (g)	2336 ± 532	2067 ± 413*	2016 ± 484*	1515 ± 568*
Abnormal cord insertion				
Larger twin	18 (19%)	15 (23%)	1 (17%)	13 (20%)
Smaller twin	26 (27%)	31 (47%)	2 (33%)	29 (54%)*
Fetal demise at ≥ 22 weeks				
Larger twin	1 (1.0%)	1 (1.5%)	0 (0%)	1 (1.9%)
Smaller twin	2 (2.1%)	3 (4.5%)	0 (0%)	2 (3.7%)
Apgar score < 7 at 1min				
Larger twin	3 (3.1%)	4 (6.1%)	1 (17%)	3 (5.6%)
Smaller twin	2 (2.1%)	5 (7.6%)	1 (17%)	10 (19%)*
Apgar score < 7 at 5 min				
Larger twin	2 (2.1%)	2 (3.0%)	0 (0%)	1 (1.9%)
Smaller twin	1 (1.0%)	2 (3.0%)	0 (0%)	1 (1.9%)
Umbilical artery pH < 7.1				
Larger twin	1 (1.0%)	2 (3.0%)	0 (0%)	0 (0%)
Smaller twin	2 (2.1%)	4 (6.1%)	1 (17%)	2 (3.7%)

AGA, appropriate for gestational age; SGA: small for gestational age; IVF, in vitro fertilization; TTTS, twin-twin transfusion syndrome. *P < 0.05 vs. Concordant AGA-AGA twin pregnancies.

Table 2. Perinatal Characteristics and Outcomes of Concordant Dichorionic Twin Pregnancies and Discordant Dichorionic Twins by Actual Birth (or Fetal) Weight

	Concordant twin		Discordant twin	
	AGA-AGA	AGA-SGA	AGA-AGA	AGA-SGA
N	359	137	16	97
Maternal age (y)	32 ± 4	32 ± 4	31 ± 4	32 ± 4
Nulliparity	247 (69%)	77 (56%)	12 (75%)	70 (72%)
Smoking	9 (2.5%)	6 (4.4%)	0 (0%)	9 (9.3%)*
History of infertility	176 (49%)	51 (37%)	11 (66%)	47 (48%)
IVF use	136 (38%)	27 (20%)	5 (31%)	35 (36%)
Maternal height (cm)	159 ± 5	158 ± 5	160 ± 5	158 ± 6
Maternal weight				
At pre-pregnancy	54 ± 9	53 ± 9	53 ± 5	53 ± 9
At delivery	67 ± 9	65 ± 10	67 ± 8	66 ± 8
Hypertensive disorders	32 (8.9%)	7 (5.1%)	5 (31%)	25 (26%)*
Geatstional diabetes	7 (1.9%)	2 (1.5%)	0 (0%)	2 (2.1%)
Gestational age at delivery				
Average (weeks)	36.1 ± 2.0	36.1 ± 3.0	36.0 ± 1.5	36.1 ± 2.2
< 28 weeks	7 (1.9%)	2 (1.5%)	0 (0%)	1 (1.0%)
< 33 weeks	21 (5.8%)	10 (7.3%)	1 (6.3%)	4 (4.1%)
Delivery mode				
Elective Cesarean	136 (38%)	39 (28%)	5 (31%)	36 (37%)
Emergency Cesarean	118 (33%)	40 (29%)	5 (31%)	19 (20%)
Neonatal birth weight				
Larger twin (g)	2492 ± 462	2356 ± 519	2748 ± 265	2543 ± 459
Smaller twin (g)	2326 ± 451	2209 ± 475	2080 ± 234	1807 ± 410*
Abnormal cord insertion				
Larger twin	56 (16%)	25 (18%)	3 (18%)	12 (12%)
Smaller twin	55 (15%)	31 (23%)	4 (25%)	25 (26%)*
Fetal demise at ≥ 22 weeks				
Larger twin	2 (0.6%)	2 (1.5%)	1 (6.3%)	0 (0%)
Smaller twin	2 (0.6%)	2 (1.5%)	0 (0%)	2 (2.1%)
Apgar score < 7 at 1min				
Larger twin	15 (4.2%)	3 (2.2%)	0 (0%)	5 (5.2%)
Smaller twin	18 (5.0%)	5 (3.6%)	1 (6.3%)	5 (5.2%)
Apgar score < 7 at 5 min				
Larger twin	3 (0.8%)	0 (0%)	0 (0%)	0 (0%)
Smaller twin	4 (1.1%)	2 (1.5%)	0 (0%)	0 (0%)
Umbilical artery pH < 7.1				
Larger twin	4 (1.1%)	0 (0%)	0 (0%)	1 (1.0%)
Smaller twin	5 (1.4%)	3 (2.2%)	0 (0%)	5 (5.2%)*

AGA, appropriate for gestational age; SGA: small for gestational age; IVF, in vitro fertilization. *P < 0.05 vs. Concordant AGA-AGA twin pregnancies.

and as AGA if it was at or above the 10th percentile in accordance with Japanese singleton norms (Acta Neonatol Jpn from Japan Society of Neonatology, 1998).

In this study, we examined adverse perinatal outcomes of discordant dichorionic twin pregnancies in relation to the actual birth (or fetal) weight as follows: (1) fetal demise at least one twin at ≥ 22 weeks' gestation, (2) premature delivery at < 28 or 33 weeks' gestation, (3) neonatal Apgar score at 1 or 5 min < 7 and umbilical artery pH < 7.1, and (4) monochorionic twins complicated by chronic twin-twin transfusion syndrome (TTTS; twin oligo-polyhydramnios sequence).

Cases were compared by means of Student's t-test for continuous variables, and x^2 or Fisher's exact test for categorical variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were also calculated. Differences with P < 0.05 were considered significant.

In this study, we examined normally growth (AGA-AGA) and AGA-SGA monochorionic and dichorionic twin pregnancies with birth (or fetal) weight discordancel (6 AGA-AGA and 54 AGA-SAG monochorionic, and 16 AGA-AGA and 97 AGA-SGA dichorionic twin pregnancies). In addition, we examined normally growth (AGA-AGA) and AGA-SGA monochorionic and dichorionic twin pregnancies with birth (or fetal) weight concordance as control (97 AGA-AGA and 66 AGA-SAG monochorionic, and 359 AGA-AGA and 137 AGA-SGA dichorionic twin pregnancies).

Results

Table 1 shows the perinatal characteristics and outcomes of concordant and discordant monochorionic twins by actual birth (or fetal) weight. The incidence of velamentous/marginal cord insertion of the placenta in the SGA twins of discordant twin pregnancies was significantly higher in the discordant twin pregnancies than that in the normally growth concordant twin pregnancies (OR 3.17, 95% CI 1.6 - 6.4, P < 0.01). The incidence of TTTS in the normally growth concordant twins was similar among these 4 pregnancy groups in Table 1. Growth discordance in the monochorionic twin pregnancies was associated with adverse outcomes only in the SGA twins of the discordant AGA-SGA twin pregnancies. The SGA twins in monochorionic discordant AGA-SGA twin pregnancies had a higher risk of Apgar score < 7 at 1 minute (OR 10.8, 95% CI 2.3 - 51, P < 0.01).

Table 2 shows the perinatal characteristics and outcomes of concordant dichorionic twin pregnancies and discordant dichorionic twins by actual birth (or fetal) weight. Compared with the normally growth concordant twin pregnancies, the rate of maternal smoking and hypertensive disorders in discordant AGA-SGA dichorionic twin pregnancies were significantly higher (Smoking: OR 3.98, 95% CI 1.5 - 10, P < 0.01; hypertensive disorders: OR 3.55, 95% CI 2.0 - 6.4, P < 0.01). In addition, the incidence of velamentous/marginal cord insertion of the placenta in the SGA twins was significantly higher in the discordant twin pregnancies (OR 1.92, 95% CI 1.1 - 3.3, P = 0.02). Growth discordance in the dichorionic twin pregnancies was associated with adverse outcomes only in SGA twins of discordant AGA-SGA twin pregnancies. The SGA twins in dichorionic discordant AGA-SGA twin pregnancies had a higher risk of umbilical artery pH < 7.1 (OR 3.85, 95% CI 1.1 - 14, P = 0.02).

Discussion

The current results indicated that discordant twin growth of more than 20% seemed to be an important contributor to the adverse perinatal outcomes in SGA twins; however the normally growth twin pregnancies with growth discordance are not associated with adverse perinatal outcomes in monochorionic or dichorionic twin pregnancies. Although the sample size of the current study is small, these results may support some previous studies that discordant growth is not an independent risk factor for adverse perinatal outcomes in twin pregnancies [1, 2]. In addition, the presence of growth restriction may not be a risk factor for adverse perinatal outcomes if the growth difference between the twins is concordant.

In this study, smoking and hypertensive disorders were risk factors for SGA newborns in discordant dichorionic twin pregnancies. These results seemed to be similar to our previous study [3]. Compared with singleton pregnancies, 2 fetuses can cause a severe increase in intrauterine pressure, and then maternal blood pressure increases homeostatically as a substitute for the decline in uteroplacental perfusion [4]. Elevated maternal blood pressure in twin pregnancies reflects an additional demand for blood supply to the uterus. If the limit for intrauterine capacity to adapt to decreased uteroplacental perfusion is exceeded, it would be restricted because of morbid placental ischemic damage. In addition, harmful effects of smoking during pregnancy are also well known [5, 6]. For example, Salihu et al [6] reported that twins born to smokers weighed an average of 182 g less than those born to non-smokers and the risk for SGA was higher among twins born to smokers.

Abnormal cord insertion such as velamentous/marginal cord insertion of the placenta has been also reported to be an important risk factor for growth discordance and/or growth restriction in twin pregnancies; this has been also observed to contribute to the adverse perinatal outcomes [7-10]. Although normally grown monochorionic and dichorionic twins with growth discordance are not associated with the adverse perinatal outcomes compared with normally grown concordant twins, the current results may also support these previous studies [7-10].

Based on the current findings, the presence of growth discordance or growth restriction is not an independent risk factor for adverse perinatal outcomes in monochorionic or dichorionic twin pregnancies. One reason could be the small sample in this study, because the power was only 6 cases of discordant AGA-AGA monochorionic twin pregnancies. Other possible reason is that the pathophysiologic significance in SGA in twin pregnancies with weight discordance is different from that in growth concordance. Because the average birth weights in the SGA in twin pregnancies with weight discordance is significantly lower than those in growth concordance (monochorionic twins: 1515 vs. 2067 g, $P < 0.01$; dichorionic twins: 1807 vs. 2209 g, $P < 0.01$). Therefore, the pathophysiologic changes in SGA twins may be significantly larger in pregnancies with growth discordance than those with growth concordance. Otherwise, the diagnostic criteria of SGA in twin pregnancies should be different from that in singleton pregnancies.

Conclusion

The presence of growth discordance or growth restriction may not be an independent risk factor for adverse perinatal outcomes in twin pregnancies.

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