

Research Paper

## Umbilical Arterial Blood Gas and Perinatal Outcome in the Second Twin according to the Planned Mode of Delivery

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### Abstract

**Purpose:** To compare umbilical arterial gas parameters in the second twin of twin pregnancies according to the mode of delivery

**Methods:** We retrospectively analyzed the medical records of twin deliveries after 34 weeks of gestation for 3 years. Excluding the cases which underwent emergency cesarean delivery during trial of labor, a total of 79 twin gestations had umbilical arterial blood gas values available and were divided into cesarean delivery group (N=40) and vaginal delivery group (N=39). The mean differences of umbilical arterial blood parameters and the Apgar score between the first and second twin in each pregnancy were compared according to the mode of delivery.

**Results:** The differences of umbilical arterial gas parameters between twin siblings showed no significant difference according to the mode of delivery. With regard to the 1 minute and 5 minute Apgar scores, the differences between twin siblings are significantly increased in vaginal delivery group compared to cesarean delivery group ( $p=0.048$ , and  $p=0.038$ , respectively). In comparing the 28 cases delivered vaginally with an inter-twin delivery interval < 10 minutes and 40 cases delivered by cesarean section, no significant differences were observed in the umbilical arterial gas parameters and Apgar scores.

**Conclusion:** The inter-twin umbilical arterial blood gas parameters according to the mode of delivery showed no difference. For twin deliveries, it is relatively safe to plan for a vaginal delivery, but an effort should be made to reduce the inter-twin delivery interval time.

Key words: twin pregnancy, vaginal delivery, cesarean delivery, umbilical arterial gas parameters, inter-twin delivery interval

### Introduction

Twin pregnancies occur in approximately 1% of all pregnancies, but approximately 10% of perinatal complications occur in twin pregnancies [1,2]. Because the perinatal mortality rates are 3-6 times higher in twin pregnancies than singleton pregnancies, prenatal management and safe delivery of twin pregnancies are important issues in obstetrics. In particular, the

second twin may have a greater risk of adverse perinatal outcome than the first twin, because of difficulties in delivery due to uterine inertia and abnormal lie or high presentation after the vaginal delivery of the first twin, and increased risk of premature placental separation and cord prolapse [3,4]. Although some large-scale epidemiologic studies have reported that

there was no difference in the risk of perinatal complications according to birth order [5,6]; recent studies have shown that the risk of perinatal mortality and neonatal morbidity was higher in the second twin than the first twin [7,8], and the inter-twin delivery interval have been suggested as an important risk factor associated with the incidence of delivery-related complications in second twins [9].

Recently, in an effort to reduce complications in twin deliveries, the rate of planned cesarean delivery has been increased in multiple deliveries. However, the safe time limit of the inter-twin delivery interval has not been defined, and there are controversies regarding the optimal mode of delivery of twin gestations. Meta-analysis did not evidence significant increased adverse neonatal outcome of both twins after vaginal delivery in comparison with cesarean [8,9]. Conversely, some suggest systematic planned cesarean delivery for all twin gestations could protect second twins from increased neonatal mortality and morbidity [10,11]. Indeed, cesarean delivery may increase the prevalence of fetal and maternal complications [12]. Accordingly, additional research on the risk of hypoxia during labor in second twins, and determining whether or not cesarean section may reduce the risk of hypoxia is needed.

The current study was performed to investigate the perinatal outcomes of the second twin according to mode of delivery. In particular, to provide objective evidence of peripartum asphyxial insult and neonatal outcome, we focused on acid base status of the fetus as measured in umbilical arterial blood gas analysis just after delivery [13,14].

## Patients and methods

All the twin deliveries after 34 weeks of gestation at Seoul St. Mary Hospital of the Catholic University between 1 January 2006 and 31 December 2008 were reviewed retrospectively. The cases of emergency cesarean delivery due to failure to progress or fetal distress during labor, intrauterine death of either one of the twins before labor, discordant twins defined by the discrepancy of birth weight by more than 20%, and pregnancies complicated by preeclampsia, intrauterine growth restriction, twin-to-twin transfusion syndrome, and fetal anomalies were excluded. A total of 79 twin gestations in which the umbilical arterial blood gas values were available for both twins were selected.

The mode of delivery for twin gestation was determined according to following criteria. If the first twin was in the cephalic presentation, vaginal delivery was attempted for all women regardless of parity and the presentation of the second twin. Multiparas

whose first twin was in the breech presentation, were allowed a trial of labor. A cesarean delivery was performed if the pregnant woman had a history of cesarean delivery or uterine surgery or on maternal request. As a result, among the 79 cases in the current study, 40 pregnant women had cesarean deliveries and 39 women had vaginal deliveries.

To compare the perinatal complications between two groups, we investigated maternal age, parity, gestational age, birth weight, mode of delivery, and fetal sex from the delivery records of each case. If the 5-minute Apgar score was  $< 7$ , we determined the presence of neurologic complications in the neonate by using the medical records of the neonate. In addition, we checked the umbilical arterial blood pH, carbon dioxide tension, bicarbonate level, and base deficit from the records of umbilical arterial blood gas analysis.

Umbilical cord blood gas analysis was performed for the umbilical artery and vein in all deliveries apart from three twin gestation, in which umbilical arteries were too thin to collect a sufficient amount of blood. Umbilical cord blood was collected using a syringe flushed with heparin after the umbilical cord was ligated. The umbilical cord was ligated closer to the fetus with a Kelly clamp after delivery at a length of 5-10 cm and 10 cm from the fetus. About 3 cc amount of umbilical arterial and venous blood was sampled with the syringe, and gas analysis was performed within 60 minutes after delivery.

In the statistical comparison of the prognosis of second twins according the mode of delivery, the mean differences of umbilical arterial blood parameters and the Apgar score between the first and second twin in each pregnancy were compared between the vaginal delivery group and cesarean section groups using the Student *t*-test and chi-square test where appropriate. In addition, we selected twin gestations with an inter-twin delivery interval of less than around the mean interval of vaginal delivery, and then re-compared according to delivery mode using the Student *t*-test and chi-square test. In this study, we applied a cut off value of 10 minute.

The Statistical Package for Social Science software (version 12.0; SPSS, Inc., Chicago, IL, USA) was used, and statistical significance was considered if the *p*-value was  $< 0.05$ .

## Results

### I. Maternal and obstetric characteristics of study group

In the 79 twin deliveries, the mean maternal age was  $31.5 \pm 3.2$  years, and 53 gravidas (67.1%) were

nulliparas. The mean gestational age was  $37.0 \pm 1.7$  weeks and 29 cases (36.7 %) were delivered between 34 and 37 weeks. In comparing the maternal characteristics between the vaginal delivery and cesarean delivery groups, the mean maternal age was significantly older in cesarean delivery group than vaginal delivery group ( $P = 0.007$ ). The proportion of nulliparas was 77.5% in the cesarean delivery group and 56.4% in the vaginal delivery group ( $P = 0.046$ ). The mean inter-twin delivery interval was  $8.2 \pm 8.2$  minutes in twins delivered vaginally, which was significantly longer than in twins delivered by cesarean section ( $P = 0.021$ ). There were 11 twin deliveries (28.2%) in which the inter-twin delivery interval was  $\geq 10$  minutes and in 4 twin deliveries, the inter-twin delivery interval was  $> 15$  minutes (10.3%; Table 1).

## 2. Delivery outcomes and umbilical arterial blood gas analysis

The mean umbilical arterial blood pH, carbon dioxide tension, bicarbonate and base-deficit were  $7.28 \pm 0.09$ ,  $47.84 \pm 10.45$  mmHg,  $21.80 \pm 3.40$  mEq/L, and  $5.24 \pm 4.55$  mEq/L, respectively. The neonates with an umbilical arterial pH of  $< 7.2$  were 6 in first twins (7.6%) and 14 in second twins (17.7%). Severe fetal acidemia with a pH  $< 7.0$  occurred in 3 cases, all of which were from the vaginal delivery group. Three neonates had a 5-minute Apgar score of less than 7, but didn't show any neurologic morbidity. In a comparison of the first twins between the vaginal delivery and cesarean delivery groups, none of the umbilical arterial gas parameters showed statistically significant differences, and the 1- and 5-minute Apgar scores were not significantly different (Table 2).

## 3. Delivery and perinatal outcomes of the second twins according to the mode of delivery

The prognosis of the second twin in each pregnancy was assessed using inter-twin difference of the umbilical arterial gas parameters and Apgar scores between the first and the second twins (Table 3). The mean inter-twin differences of umbilical arterial pH are  $0.02 \pm 0.07$  in the vaginal delivery group and  $0.02 \pm 0.05$  in the cesarean delivery group, showing no significant difference according to the mode of delivery. With respect to the other umbilical arterial blood gas parameters, the differences between the first and second twins were not significantly different according to mode of delivery. In the analysis of Apgar scores, the difference in 1-minute Apgar scores of more than 2 occurred in 8 (20.5%) twin gestations in the vaginal delivery group, which is significantly more than difference in the cesarean delivery group (5.0 %) ( $P = 0.048$ ). In addition, the difference in 5-minute Apgar scores of more than 1 showed a significantly higher incidence in the vaginal delivery group than in the cesarean delivery group (38.5 % vs. 17.5 %;  $P = 0.038$ ).

## 4. Comparison of the prognosis of second twins between the vaginal delivery and Cesarean section groups in case the inter-twin delivery interval was $< 10$ minutes

Excluding 11 twin gestations with an inter-twin delivery interval of more than 10 minutes we compared 28 cases of vaginal deliveries with the 40 cases of cesarean sections. No significant differences were noted in the umbilical arterial blood gas factors and Apgar scores between the two groups (Table 4).

**Table 1.** Maternal and obstetric characteristics of the study group according to mode of delivery.

	Vaginal delivery (N=39)	Cesarean delivery (N=40)	P value
Maternal age	$30.5 \pm 3.2$	$32.5 \pm 3.0$	0.007
Parity (nulliparous women)	22 (56.4%)	31 (77.5%)	0.046
G - age* at delivery (weeks)	$37.0 \pm 2.1$	$36.9 \pm 1.4$	0.751
Birth weight at delivery (g)			
First /second twins	$2517.2 \pm 344.6 / 2507.2 \pm 338.3$	$2647.3 \pm 385.4 / 2545.1 \pm 359.3$	0.451
Twin-to twin delivery time interval (min)			
Mean (min)	$8.2 \pm 8.2$	$1.6 \pm 0.6$	$< 0.001$
$> 10$ min	11 (28.2%)	0 (0%)	$< 0.001$
Sex (male) first /second twins	19(48.7%) / 20 (51.3%)	18 (45.0%) / 22 (55.0%)	0.799

\*Gestational age

Values are presented as mean  $\pm$  standard deviation or number of patients (%)

P values were derived from student t test and Chi-square test

**Table 2.** Mean values of umbilical artery blood gas parameters and Apgar scores of newborns according to the type of delivery mood.

	Vaginal delivery (N=39)		Cesarean delivery (N=40)	
	First twins	Second twins	First twins	Second twins
<b>Umbilical artery blood gas</b>				
pH	7.28±0.10	7.25±0.10	7.30±0.06	7.28±0.07
pH < 7.20	5 (12.8%)	8 (20.5%)	1 (2.5%)	6 (15.0%)
pCO <sub>2</sub> (mmHg)	46.58±50.93	60.08±9.26	45.65±9.03	48.24±9.42
HCO <sub>3</sub> (mEq/L)	21.39±21.88	22.26±3.33	21.87±3.59	22.09±3.43
Base deficit (mEq/L)	5.63±5.83	5.23±2.73	4.74±3.71	4.79±3.45
<b>Apgar score</b>				
1 min < 7	6 (15.4%)	6 (15.4%)	7 (17.5%)	8 (20.0%)
5 min < 7	2 (5.1%)	4 (10.3%)	1 (2.5%)	1 (2.5%)

Values are presented as mean ± standard deviation or number of patients (%)

**Table 3.** Inter-twin differences of umbilical arterial blood gas parameters and Apgar scores according to the delivery mode.

	Vaginal delivery (N=39)	Cesarean delivery (N=40)	P values
<b>Umbilical artery blood gas</b>			
pH	0.02 ± 0.07	0.02 ± 0.05	0.762
Decrease of pH value >0.005	13 (33.3%)	10 (25.0%)	0.415
pCO <sub>2</sub> (mmHg)	-3.35 ± 8.56	-2.58 ± 9.25	0.707
HCO <sub>3</sub> (mEq/L)	-0.46 ± 2.34	-0.22±2.98	0.697
Base deficit (mEq/L)	0.01±2.20	-0.16±2.80	0.772
<b>Apgar score</b>			
Difference at 1 min ≥ 2	8 (20.5%)	2 (5.0%)	0.048
Difference at 5 min ≥ 1	15 (38.5%)	7 (17.5%)	0.038

All values are the differences between first and second twins

Values are presented as mean ± standard deviation or number of patients (%)

P values were derived from student t test, Chi-square test and Fisher's exact test

**Table 4.** Inter-twin differences of umbilical arterial blood gas parameters and Apgar scores in cases which inter-twin delivery interval was less than 10 min.

	Vaginal delivery (N=27)	Cesarean delivery (N=40)	P values
<b>Umbilical artery blood gas</b>			
pH	0.01 ± 0.68	0.02 ± 0.06	0.599
Decrease of pH value >0.005	13 (33.3%)	10 (25.0%)	0.870
pCO <sub>2</sub> (mmHg)	-2.22 ± 8.56	-2.59 ± 9.26	0.870
HCO <sub>3</sub> (mEq/L)	-0.73 ± 2.53	-0.22±2.98	0.475
Base deficit (mEq/L)	-0.58±1.86	-0.16±2.86	0.493
<b>Apgar score</b>			
Difference at 1 min ≥ 2	2 (7.4%)	2 (5.0%)	1.000
Difference at 5 min ≥ 1	9 (33.3%)	7 (17.5%)	0.136

All values are the differences between first and second twins

Values are presented as mean ± standard deviation or number of patients (%)

P values were derived from student t test, Chi-square test and Fisher's exact test

## Discussion

The vaginal delivery of twin gestation is a challenge for obstetricians. The delivery of the second twin is complicated by uterine inertia following the delivery of the first twin, and the abnormal fetal lie or high presentation of the second twin [3,4]. Moreover, placental abruption and cord prolapse can increase the mortality rate of fetuses [3,4]. For these reasons, many studies have been conducted on safe modes of deliveries for second twins, but the conclusions were not consistent. Several retrospective analyses and meta-analyses have reported that the prognosis of twins was not different according to delivery mode [5,6,15], but population-based studies reported that the mortality rate of second twins is higher in vaginal deliveries [7,8].

This study shows that the risk of intrauterine fetal hypoxia in second twins was not different between vaginal deliveries and cesarean deliveries. Although the 1- and 5-minute Apgar scores were significantly lower in second twins delivered vaginally than second twins delivered by cesarean section, inter-twin difference of umbilical arterial pH value was not different according to mode of delivery. In particular, compared to previous studies in which the mean values of the second twin group were compared with the mean values of the first twin groups, our analysis may be more accurate as the difference between the first and second twin was analyzed in each delivery.

For the mode of delivery of twins, the American College of Obstetricians and Gynecologists (ACOG) recommended vaginal delivery in the case of twins in cephalic-cephalic presentation, [16]. However, some have argued for planned cesarean delivery for all twin gestations [10,11]. Because controversies still exist over the optimal mode of delivery for twin gestation, it is unreasonable to apply the mode of delivery uniformly. Moreover, cesarean deliveries can cause other pregnancy complications, including early delivery, low birth weight, and increased risk of placenta previa, placenta accreta, emergency cesarean section, and premature delivery in the next pregnancy [17].

An important difference between second twins according to the mode of delivery is the inter-twin delivery interval time. As shown in the current study, the inter-twin delivery interval time was significantly longer in vaginal delivery group ( $8.2 \pm 8.2$  minutes) than in cesarean delivery group ( $< 2$  minutes); 28.2% of twin gestations delivered vaginally had inter-twin delivery interval time  $\geq 10$  minutes. Some previous studies which concluded that the umbilical arterial blood gas of the second twin is worse in the vaginal

delivery group [18,19], reported the mean inter-twin delivery interval times were 16-18 minutes, which were rather longer compared to the mean time in the current study (8.2 minutes). According to Schmitz et al. [20] who argued that perinatal outcomes were not different according to the mode of delivery, the mean inter-twin delivery interval time was 4.9 minutes, which was much shorter than previous reports [18,19]. Therefore the difference in the inter-twin delivery interval may be the most important factor to causing the inconsistent prognosis of the second twins. In particular, when we compared the differences of umbilical arterial blood gas in twin sibling between vaginal delivery group in which inter-twin delivery interval time was less than 10 minutes and cesarean delivery group, the umbilical arterial blood gas were not significantly different. For twin deliveries, it is necessary to make an effort to reduce the inter-twin interval time and to establish stricter indications for trial of labor not to take inter-twin delivery interval time more than about 10 minutes rather than apply elective cesarean delivery uniformly to all twin gestations.

The results of this retrospective study must be interpreted with caution. A limitation of our study was the small number of women investigated, preventing any formal conclusion from being drawing. However, our study provides data to support the planned vaginal delivery in selected women. In conclusion, the results of this study showed that there was no difference in umbilical arterial blood gas parameters and the neonatal morbidity according to the mode of delivery. Accordingly, for twin deliveries, it is relatively safe to plan for a vaginal delivery as long as the other obstetric conditions are available for vaginal delivery, but an effort should be made to reduce the inter-twin delivery interval time.

## Conflict of Interest

The authors have declared that no conflict of interest exists.

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