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ORIGINAL ARTICLE

Influence of chorionicity in intra-partum management of twin deliveries

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Objective: **To analyze morbidity and mortality in twin pregnancies as a function of the type of delivery and chorionicity.** ***Design:*** **Retrospective cohort study.** ***Methods*****: Analysis of the type of delivery, intertwin time interval, and perinatal variables of >1000 twin deliveries during a 10-year period.** ***Main outcome measure*****: Influence of delivery type and chorionicity on perinatal outcome.** ***Results*****: The rate of cesarean sections was 42.4%. No differences were found as a function of chorionicity or as a function of presentation of the second twin. Cesarean sections were performed after vaginal delivery of the first twin in 1.8% of cases, being more common if the second baby was in a non-cephalic presentation (6.9% vs. 0.4%, $p < 0.05$). The average twin-to-twin delivery time interval was longer in the cases where the second had a cephalic presentation (8.26 ± 7.75 min vs. 6.81 ± 5.97 min, $p < 0.05$). The umbilical artery pH was lower the longer the interval between the birth of the twins, both in monochorionic and dichorionic.** ***Conclusions*****: According to the results, vaginal delivery is as safe as elective caesarean section in twin pregnancies where the first twin is in cephalic presentation and the intrapartum management should not vary due to chorionicity.**

Keywords: Delivery, Obstetric; Multiple, Pregnancy; Obstetric Labour; Pregnancy, Outcome; Twins; Twins, Dichorionic; Twins, Monochorionic

Introduction

Twin pregnancies have a perinatal mortality and morbidity rates 10-fold higher than single gestations. In addition, the intrapartum management has to deal with a higher prevalence of neonatal complications, mainly after the vaginal birth of the first twin. For this reason, the choice of the type of delivery, especially when the first twin is in a cephalic presentation but the second is not, remains controversial. Moreover, there is no consensus with regards to the optimum interval of time between the births of the twins [1,2].

However, it is well known that there is a higher rate of adverse perinatal outcomes in monochorionic pregnancies [3,4]. Nevertheless, there have been very few studies analyzing the influence of chorionicity on the time of delivery in normal twin pregnancies [5,6].

The objective of our study was to analyze perinatal morbidity and mortality in twin pregnancies as a function of the type of delivery, the presentation of the second twin and the chorionicity.

Material and methods

A retrospective cohort study was designed, based on 1 025 twin pregnancies attended in the Obstetrics and Gynaecology Unit of Cruces Hospital between 01/01/2000 and 31/12/2009. Patient information has been collected from the hospital perinatal database and medical histories. Twin pregnancies between 28 and 40 weeks of gestation were included. Chorionicity was determined by echography performed in the first trimester. As well as those women with gestation periods of less than 28 weeks (n = 36), two monoamniotic twin pregnancies and four pregnancies with known fetal malformations incompatible with life were excluded.

The following variables were analyzed with regard to management of birth, such as induction and/or stimulation of labor, the indication and method used for induction, the type of delivery, the indication for assisted delivery and the time interval between the births of the twins. In our hospital, elective cesarean section on maternal request is not offered to pregnant women. However, the protocol for assisted deliveries of twin pregnancies does consider the possibility of inducing labor. In fact, if labor has not initiated spontaneously at 40^{+0} week of gestation, the woman is programmed for induction. There is continuous intrapartum monitoring for both fetuses, epidural analgesia and the possibility of emergency cesarean section in less than 30 min. At least two obstetricians are present for the delivery, one being a consultant with experience in assisting breech deliveries. The following perinatal variables were analyzed: birth weight and the rate of low birth weight (<2500 g); umbilical artery pH; 1- and 5-min Apgar scores; admission to the neonatal unit; and antepartum, intrapartum and neonatal mortality and neonatal mortality in the first 28 days of life.

Statistical analysis was carried out using SPSS v.17 statistical software, with p values <0.05 being considered significant. The study was approved by the Clinical Research Ethics Committee of the hospital (CEIC E10/13).

Results

Table I shows the characteristics of the 1025 twin pregnancies of which 166 were monochorionic (16.2%) and 859 dichorionic (83.8%). The mean age of the population studied was 34.05 ± 4.25 years. With regard to parity, 75.3% were nulliparous, while 21.4% and 3.3% of the women had already given birth 1 or ≥2 times previously, respectively. The median gestational age (in weeks) at birth was 36 (range 12) and 37 (range 12) for monochorionic and dichorionic pregnancies, respectively ($p > 0.05$). The rate

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of twin pregnancies after ART was 56.6%. The prematurity rate for monochorionic and dichorionic pregnancies was 51.1% and 49.1%, respectively ($p > 0.05$).

Of the 1025 twin pregnancies, 57.6% of the women delivered vaginally and 42.4% by cesarean section (including 11 cases of cesarean section of second twin) (Figure 1). As a function of chorionicity, we found that the rate of cesarean sections was 36.1% and 43.5% in monochorionic and dichorionic pregnancies, respectively ($p = 0.07$).

We did not detect any statistically significant differences in the type of delivery as a function of the presentation of the fetus ($p = 0.42$). Among those deliveries in which the first twin was in a cephalic presentation and the onset of labor was spontaneous, the most common indication for caesarean section was labor dystocia (21.1%).

There was a normal vaginal delivery for both twins in 243 (23.7%) cases, and in 177 cases both twins were born by instrumental delivery. Among the 169 cases in which vaginal delivery was attempted with the second twin in non-cephalic presentation, total breech extraction was performed in 121 cases (71.6%).

In 11 cases, cesarean section was carried out for the second twin after vaginal birth of the first one (1.8% of the total number of vaginal deliveries of the first one [11/601]). Among these, the rate of cesarean section was significantly higher if second twin had been in non-cephalic presentation (n = 9; seven transverse and two footling breech) compared to cephalic presentations (n = 2) (6.9% [9/130] vs. 0.4% [2/471], $p < 0.05$).

The median of time between the births of the twins was 5 min; with different range for deliveries with both twins in cephalic presentation (range 50), and cases in which the second twin was in a non-cephalic presentation (range 30) (Mann–Whitney test for independent samples, $p = 0.02$). Analyzing the relationship between the intertwin time and perinatal outcomes, we found a statistically significant correlation between this twin-to-twin delivery time interval and umbilical artery pH of the second twin after vaginal birth of first one, both for monochorionic (Pearson Correlation: r = −0.25, $p = 0.01$) and dichorionic pregnancies (Pearson Correlation: r = −0.29, $p < 0.01$). The regression line was "Umbilical artery pH = 7.26 [CI 95%: 7.24–7.29]–0.002 [CI 95%: 0.004–0.001] × (inter-twin interval in minutes)" for monochorionic and "Umbilical artery pH = 7.26 [CI 95%: 7.24–7.27]–0.005 [CI 95% 0.006–0.003] × (inter-twin interval in minutes)" for dichorionic. The coefficient of determination (R^2) was 0.062 in monochorionic and 0.083 in dichorionic. We can see the graphic representation (dispersion diagram) of the relationship between two variables in Figures 2 and 3. Indeed, we did not find any association between this twin-to-twin delivery time interval and the 1- and 5-min Apgar scores, the rate of admission into the neonatal unit or the intrapartum or neonatal mortality in the first 28 days of life.

We have analyzed the umbilical artery pH of the second twin after vaginal delivery of the first one (n = 601). There are no differences in the mean of umbilical artery pH based on the presentation of the second twin (cephalic 7.21 ± 0.1 vs. non cephalic 7.22 ± 0.1; $p = 0.39$) or based on the chorionicity (monochorionic 7.23 ± 0.1 vs. dichorionic 7.21 ± 0.1; $p = 0.08$). There are no differences in the rate of pH < 7 based on the presentation of the second twin (cephalic 18/471 vs. non cephalic 3/130 ($p = 0.44$) but yes when they are based on the chorionicity (monochorionic 0/108 vs. dichorionic 21/493; $p = 0.02$).

Table II lists the perinatal outcomes of the twins (first and second) as a function of the type of delivery. In the first twin, we did not find any significant differences between elective cesarean sections and attempted vaginal delivery (vaginal delivery and

Table I. Characteristics of twin pregnancies.

Weeks	Monochorionic (n = 166)	Dichorionic (n = 859)
28–32	19 (11.4%)	91 (10.6%)
33–36	67 (40.4%)	331 (38.5%)
37–40	80 (48.2%)	437 (50.9%)
Presentation	Fetus 1	Fetus 2
Cephalic	77.6% (n = 795)	66.8% (n = 685)
Breech	21.0% (n = 215)	27.4% (n = 281)
Transverse	1.5% (n = 15)	5.8% (n = 59)

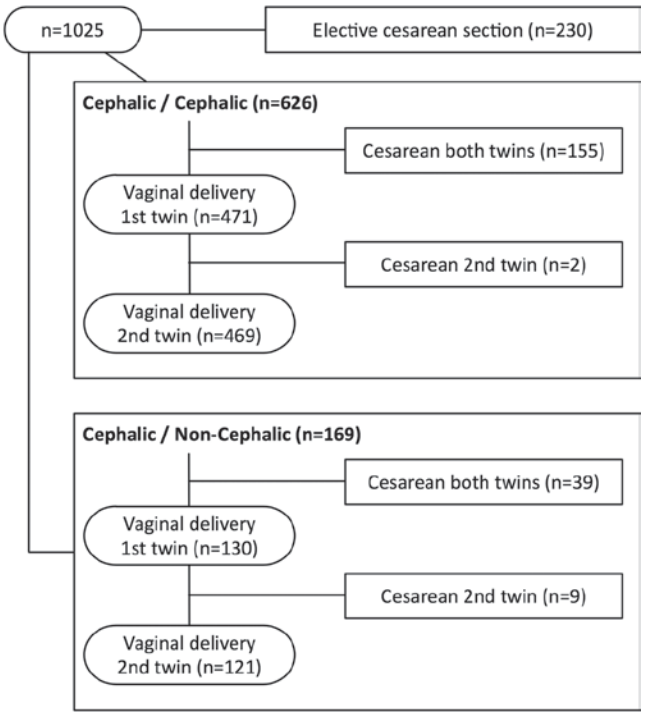

Figure 1. Type of deliveries of the cohort of twin pregnancies.

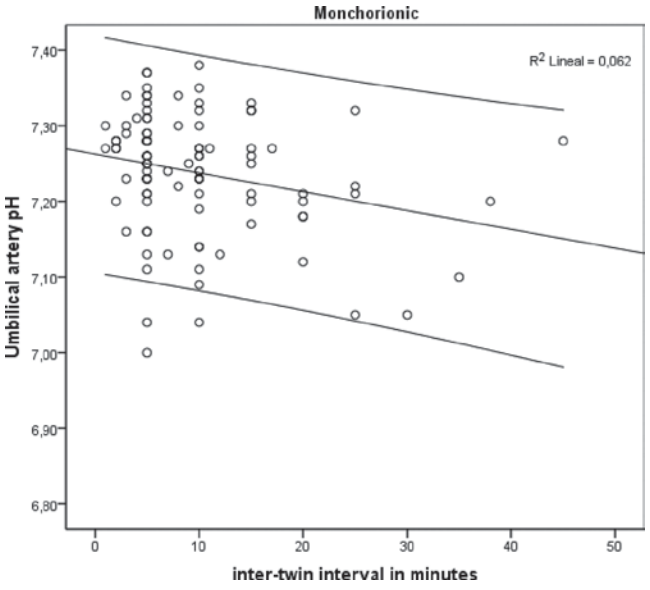

Figure 2. Dispersion diagram (umbilical artery pH of the second twin plotted [after vaginal delivery of the first twin] against the time interval between the births of the twins, in minutes) in monochorionic pregnancies.

emergency cesarean section). In the case of the second twin, we only found statistically significant differences with respect to the 1-min Apgar score below 7, which was 13% for elective cesarean sections and 30.7% for attempted vaginal deliveries.

We found significant differences as a function of the presentation of the second twin in the rate of neonatal admission (27.5% cephalic presentation of second twin vs. 39.6% non-cephalic presentation of second twin, $p < 0.01$) and 5-min Apgar score < 4 in the second twin (5.3% cephalic presentation vs. 9.5% non-cephalic presentation, $p = 0.04$). We did not find significant differences in 1-min Apgar score < 7.

There were 15 cases of antepartum mortality, 7 of which occurred in monochorionic pregnancies (7/166; 4.04%) and 8 in dichorionic pregnancies (8/859; 0.92%) ($p < 0.05$) (Table III).

For the first twin, there were three cases of intrapartum or neonatal mortality. Two of these occurred in elective caesarean sections: one in the first 24 hours of life due to severe intrauterine growth restriction, and the other at 30 weeks after premature birth. The third case occurred on day 7 of life due to septicemia caused by *E. coli* after vaginal delivery.

In the case of the second twin, there were four cases of intrapartum or neonatal mortality, two in vaginal deliveries (one in the first 24 hours of life associated with fetal intrapartum bradycardia, and one intrapartum due to umbilical cord prolapse). The other two cases occurred after an elective cesarean section. One of them was a 30-week premature baby who died at day 7 of life due to sepsis and the other was a case of hydramnios affecting the second twin with low birth weight and non-reassuring fetal heart rate.

Analyzing the data as a function of chorionicity, there were three cases of intrapartum or neonatal mortality in monochorionic (3/166; 1.80%) and four cases in dichorionic pregnancies (4/859; 0.46%) ($p = 0.08$). Thus in our cohort, to avoid a death related to the type of delivery, it would be necessary to perform at total of 295 cesarean sections (2 intrapartum deaths in 590 vaginal births). There were no cases of death of both twins in the same pregnancy.

In the overall population under study, there were 22 cases (22/2 050; 10.7‰) of mortality. This mortality was 30‰ (10/332) and 6.9‰ (12/1 718) in monochorionic and dichorionic pregnancies respectively ($p < 0.05$).

The rates of low birth weight (<2 500g) were 60.8% and 59% for monochorionic and dichorionic pregnancies, respectively ($p > 0.05$). In 24.1% of monochorionic and 22.0% of dichorionic pregnancies the difference in birth weight between the twins was more than 20% ($p > 0.05$). However, we did not find significant differences as a function of chorionicity in the rate of neonatal admission (30.5% monochorionic vs. 24.7% dichorionic), umbilical artery pH < 7 (1.8% monochorionic and 3.8% dichorionic, $p = 0.19$), or 5-min Apgar score <4 (2.4% monochorionic and 0.9% dichorionic, $p = 0.11$).

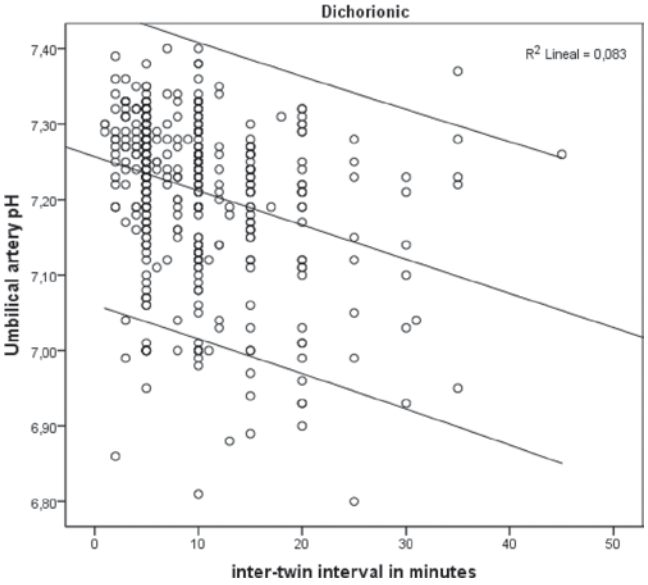

Figure 3. Dispersion diagram (umbilical artery pH of the second twin plotted [after vaginal delivery of the first twin] against the time interval between the births of the twins, in minutes) in dichorionic pregnancies.

Discussion

Epidemiological studies show that in twin pregnancies, which have reached term, perinatal mortality is higher the older the gestational age [7,8]. For this reason, in the absence of complications,

Table II. Perinatal outcomes of the first and the second twin. Comparative study: attempted vaginal birth vs. elective cesarean section.

	Attempted vaginal birth first twin (n = 795)				
	Vaginal delivery (n = 601)	Emergency cesarean (n = 194)	Total (n = 795)	Elective cesarean section (n = 230)	*p*
Birth weight (g)	2378 ± 514	2446 ± 634	2395 ± 546	2386 ± 537	0.17
Umbilical artery pH < 7	2 (0.3%)	4 (2.1%)	6 (0.8%)	2 (0.9%)	0.89
1-min Apgar score < 7	55 (9.2%)	32 (16.5%)	87 (10.9%)	31 (13.5%)	0.28
5-min Apgar score < 4	1 (0.2%)	3 (1.5%)	4 (0.5%)	0 (0%)	0.28
Neonatal admission	177 (29.5%)	60 (30.8%)	230 (28.9%)	73 (31.6%)	0.41
Intrapartum and neonatal mortality	1 (1.6‰)	0 (0‰)	1 (1.2‰)	2 (8.6‰)	0.12
	Attempted vaginal birth second twin (n = 795)				
	Vaginal delivery (n = 590)	Emergency cesarean (n = 205)	Total (n = 795)	Elective cesarean section (n = 230)	*p*
Birth weight (g)	2350 ± 519	2352 ± 656	2351 ± 557	2281 ± 507	0.09
Umbilical artery pH < 7	20 (3.4%)	5 (2.4%)	25 (3.14%)	3 (1.3%)	0.16
1-min Apgar score < 7	185 (31.4%)	59 (28.8%)	244 (30.7%)	30 (13%)	<0.01
5-min Apgar score < 4	5 (0.8%)	2 (1%)	7 (0.9%)	1 (0.4%)	0.49
Neonatal admission	182 (30.8%)	66 (32.1%)	248 (31.2%)	77 (33.7%)	0.52
Intrapartum and neonatal mortality	2 (3.4‰)	0 (0‰)	2 (2.5‰)	2 (8.7‰)	0.22

Table III. Antepartum mortality by weeks of diagnosis of fetal demise and by chorionicity.

Weeks of gestation	28	29	30	31	32	33	34	35	36	37	38	39	40
Dichorionic	2	-	1	-	1	-	1	-	1	1	1	-	-
Monochorionic	-	1	1	-	2	2	-	1	-	-	-	-	-

it is recommended to induce labor between week 38^{+0} and 40^{+0} [9]. Moreover, the intrapartum management, especially after the vaginal delivery of the first twin, is associated with a higher prevalence of neonatal complications related to risk of anoxia in the second twin, generally due to mechanical problems, such as early rupture of the membranes, umbilical cord prolapse, or fetal bradycardia [10]. Most scientific societies [11–13] recommend vaginal delivery in twin pregnancies when both twins have a cephalic presentation (42% of the total), and elective cesarean section when the first twin is in a breech presentation (20%) due to the associated risk. However, what should be the delivery of choice when the first twin has a cephalic presentation and the second one has a breech presentation (38%) is still controversial. In a review of the American College of Obstetricians and Gynecologists, it was concluded that vaginal delivery may be acceptable if the babies weigh more than 1500 g, but that there is not sufficient evidence for babies under this weight. The Society of Obstetricians and Gynaecologists of Canada [13] also recommends vaginal delivery when the weight of the fetuses is between 1500 and 4000 g, but finds no evidence for recommending vaginal delivery in fetuses under 1500 g. Some population studies have suggested that elective cesarean section in all twin pregnancies may protect the second twin [14]. The Cochrane review analyzed the benefit of elective cesarean section in twins with non-cephalic presentation of the second fetus. The authors of this review and RCOG guideline did not identify improvement in neonatal outcome and it seems to be inappropriate to recommend elective cesarean section routinely [15,16].

Recently, a review of the evidence concludes that it is reasonable to accept vaginal delivery with the second twin in non-cephalic presentation and total breech extraction and resort to cesarean section if this cannot be achieved [17]. In addition, a cohort study concluded that vaginal delivery in twin pregnancies with the second twin in a non-cephalic presentation seems to have similar neonatal outcomes to delivery by cesarean section and that active management of the second stage of labor is associated with good neonatal outcomes and a lower risk of combined delivery vaginal-cesarean section [18].

However, there is no consensus with regard to the optimal time between twin births. A retrospective cohort study concluded that when twin-to-twin delivery time interval was more than 30 min, the 5-min Apgar score was significantly lower [1]. In line with this, a prospective study of 4110 twin pregnancies, found an association between the intertwin time interval and both fetal acidosis and the 5-min Apgar score < 7 [2]. For this reason, these authors considered the twin-to-twin delivery time interval to be an independent risk factor for the neonatal outcomes of the second twin.

It is well known that there is a higher rate of adverse perinatal outcomes in monochorionic pregnancies [3,4], due to the occurrence of placental vascular anastomoses, responsible for the twin-to-twin transfusion syndrome, and the twin reversed arterial perfusion sequence, among other complications. A prospective study of 378 dichorionic and 125 monochorionic pregnancies concluded that monochorionic twins have a greater risk of preterm labor between 30 and 34 weeks of gestation, as well as higher rates of low birth weights, large weight differences and admission to the neonatal unit [5]. Another study with 1107 dichorionic and 198 monochorionic pregnancies concluded that monochorionic twins have higher rates of perinatal mortality (11.6% vs. 5.0%) as well as lower gestational age at birth, higher rates of low birth weight, higher neurological morbidity, and a higher rate of admission to the neonatal unit [6]. However, there are very few reports in the literature of studies that analyze the influence of chorionicity on the delivery of non-complicated twin pregnancies.

In our study, we did not detect any significant differences in the perinatal outcomes in twin pregnancies as a function of the type of delivery. All of them were at university hospital with at least two obstetricians, one with experience in assisting breech deliveries. In our hospital, single breech presentation is delivered vaginally, with a 75% rate of cesarean section. The results of the study must be interpreted based on its retrospective design, unicentric study and the low frequency of any adverse outcome (11 cesarean sections of second twin or perinatal mortality).

The interval between the births of the twins is significantly longer when the second twin is in cephalic presentation. There is also a statistically significant relationship between intertwin time interval and the umbilical artery pH of the second twin after vaginal birth of the first one, in both monochorionic and dichorionic pregnancies. But the degree of correlation is very low. The coefficient of determination (R^2) showed that only 6.2% of umbilical artery pH in monochorionic and 8.3% in dichorionic were explained by the time between births. Therefore, we believe that although there is a statistical correlation, it has a little clinical significance. We did not find differences in the mean of pH of the second twin after vaginal birth of the first one but yes in the rate of pH < 7 based on the chorionicity, probably for the differences of the number of cases.

We also found a higher rate of perinatal mortality in monochorionic compared to dichorionic pregnancies. This is due to a significantly higher risk of antepartum mortality; but intrapartum and neonatal mortality in the first 28 days of life do not vary as a function of chorionicity. As in our cohort, a retrospective study found higher perinatal mortality in monochorionic (20‰) compared to dichorionic pregnancies (0‰), although only full-term pregnancies were analyzed [19].

Some scientific societies recommend elective induction at 37–38 weeks in twin pregnancies to decrease the antepartum mortality associated to advanced pregnancy [11,13,16] but others do not have this recommendation based on the quality scientific evidence available [12]. In our cohort, we should have induced 517 gestations at 37^{+0} week (50.4% of the total cohort) to avoid two cases of antepartum mortality (NNT = 258, CI 95% 108.47–674.50), both in dichorionic pregnancies. The obstetricians need prospective randomized well-designed studies to clarify this situation.

In short, according to our findings, vaginal delivery is as safe as elective cesarean section for twin delivery when the first twin is in cephalic presentation. The unexpected intrauterine death rate in uncomplicated monochorionic twin pregnancies is higher than in dichorionic. Applying a strategy of close fetal surveillance, perinatal morbidity can be minimized by allowing uncomplicated monochorionic pregnancies continue until term and elective preterm delivery warrants evaluation. The intrapartum management of these deliveries should not vary as a function of chorionicity.

Declaration of Interest: We, the authors, verify that the material submitted has not been published and is not currently submitted for publication elsewhere and it has been submitted with the full knowledge and approval of the institution given as the affiliation of the author(s). We confirm that we have no conflicts of interest in relation to this work.

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