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Risk Factor Analysis of Twin Pregnancy and its Relationship with Delivery Mode in 1,494 Clinical Cases: A Retrospective Study

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Abstract

Objective: To explore the relationship between the risk factors of twin pregnancy and delivery mode.

Methods: Clinical data of 1,494 women with twin pregnancies delivered in our hospital from June 2006 to October 2019 were retrospectively analyzed. According to the delivery mode, 1,355 cases were divided into the cesarean section group and 139 into the natural delivery group. The general prenatal conditions as well as maternal and neonatal outcomes were analyzed.

Results: Compared to the physiological delivery group, the age of pregnant women in the cesarean section group was generally higher, and the proportion of pregnant women with a history of uterine surgery significantly increased (P=0.001). 80.6% of pregnant women in the physiological delivery group were naturally conceived, significantly higher than those in the cesarean section group (P=0.001). In terms of chorionic properties, more than half of the pregnant women in the cesarean section group have a Single Chorionic Double Amniotic sac (MCDA), while the physiological section group has a Double Chorionic Double Amniotic sac (DCDA), which accounts for the majority. In terms of pregnancy complications and complications, the cesarean section rate of twin pregnant women with preeclampsia, placenta previa, and Intrahepatic Cholestasis of Pregnancy (ICP) significantly increased (P=0.000). Pregnant women with fetal position in the head position often choose to terminate their pregnancy through natural delivery (P=0.002, P=0.000). In terms of maternal and fetal outcomes, the proportion of premature birth in the cesarean section group was higher than that in the physiological section group, and the length of hospital stay was longer than that in the physiological section group (P=0.000, P=0.000); However, the rate of severe asphyxia in newborns was lower than that in the physiological delivery group (P<0.05). Logistic equation analysis was conducted on the relevant factors that may potentially affect the selection of delivery methods for twin pregnancies. The results showed that IVF-ET, gestational hypertension, placenta previa, scarred uterus, premature rupture of membranes, and fetal position were the main factors affecting the delivery methods for twin pregnancies.

Conclusion: Cesarean section reduces the prevalence of neonatal asphyxia and stillbirth in twin pregnancy, whilst the rate of postpartum hemorrhage and preterm birth increases, hence comprehensive evaluation should be conducted prior to determining the appropriate delivery mode. Taking these factors into consideration, improvements in assisted delivery intended to decrease the frequency of cesarean section should draw the attention of obstetricians.

Keywords: Twin pregnancy; Delivery mode; Pregnancy outcome; Risk factors.

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Introduction

The implementation of the two-child policy and advances in assisted reproductive technology in China has contributed to a stepwise increase in the incidence of twin pregnancies [1], which was approximately 3.69% in 2019. Twin pregnancies account for the highest proportion of multifetal pregnancies and are related to high-risk pregnancies. Maternal age, parity, and malpresentation are considered as risk factors in twin births [2]. Advanced maternal age is consistent with a history of fertility treatments and chronic diseases. Adverse maternal and neonatal outcomes, such as spontaneous abortion, hypertension, preterm birth, and low birthweight occur more frequently in twin compared with singleton pregnancies [3], causing higher risks of morbidity and mortality. In comparison to dichorionic pregnancies, monochorionic pregnancies are more prone to suffer from adverse outcomes involving specific syndromes, such as twin-twin transfusion syndrome and twin anemia polycythemia sequence [4]. Moreover, the second twin is more vulnerable to birth weight discordance, prolonged intertwin delivery interval, and birth asphyxia and respiratory distress syndrome in case of a planned vaginal delivery [5,6].

Although a planned cesarean section may reduce these adverse outcomes, several studies found no difference compared with vaginal delivery. A retrospective cohort study reported lower risks in dichorionic twins with intended cesarean delivery [7]. Another retrospective study found that elective cesarean delivery might improve perinatal outcomes for the second twin [5]. On the contrary, a randomized trial of planned cesarean or vaginal delivery for twin pregnancies identified no significant differences in maternal and neonatal outcomes [8]. Likewise, a literature review showed evidence that a cesarean delivery did not improve neonatal complications, such as neonatal sepsis and fetal distress [6]. In addition, postpartum outcomes at 3 months, including incontinence, breastfeeding, depression, and fatigue, remained similar in both modes of delivery [9]. Conversely, cesarean delivery can increase the risk of uterine rupture, abnormal placentation, ectopic pregnancy, stillbirth, and preterm birth [10], as well as overweight and obesity in childhood [11]. Despite these risks, cesarean section rates have dramatically increased globally, partially due to maternal requests for cesarean sections [12]. Although there has been a reduced prevalence of urinary incontinence and pelvic organ prolapse in cesarean delivery [13-15], insufficient evidence of significant benefits, in addition to severe complications and unnecessary interventions for non-medical indications have resulted in a rising concern for the high prevalence of cesarean delivery. In contrast, vaginal delivery, regarded as a natural delivery mode, is still favored by a majority of women due to the rapid recovery and less adverse outcomes [16]. Therefore, trials on non-clinical interventions that can reduce unnecessary cesarean deliveries have been conducted and show that targeting healthcare professionals can be effective in safely reducing the cesarean section rate [17,18].

Previous research has shown that it is crucial to determine the appropriate delivery mode and adapt adequate antenatal care to reduce severe adverse outcomes. Hence, we retrospectively analyzed 1,494 women with twin pregnancies, who delivered in our hospital from June 2006 to October 2019, to investigate the risk factors of twin pregnancy and its relationship with the delivery mode.

Materials and methods

General information

This retrospective study comprised a total of 1,494 twin births at Jiangsu Province Hospital in China from June 2006 to October 2019. There were 583 dichorionic pregnancies and 901 monochorionic pregnancies confirmed by both sonographic determination and delivery of the placenta. Women with twin pregnancies were divided into the following two groups based on the mode of delivery; cesarean section group (n=1,355) and natural delivery group (n=139).

Outcomes

Patient information was obtained from electronic medical records. General prenatal conditions, pregnancy and medical complications, and neonatal outcomes of the two groups were compared. The general prenatal conditions included maternal age, parity, gestational age, mode of conception, uterine surgery procedures, amnionicity, and chorionicity. The items recorded as maternal complications included: gestational hypertension, Gestational Diabetes Mellitus (GDM), Preeclampsia (PE), Intrahepatic Cholestasis of Pregnancy (ICP), Acute Fatty Liver of Pregnancy (AFLP), chronic HBV infection, hypothyroidism, hyperthyroidism, anemia, hypoalbuminemia, Antiphospholipid Syndrome (APS), Premature Rupture of Membranes (PROM), placental abruption, placenta previa, polyhydramnios, oligohydramnios, malpresentation, preterm birth, and postpartum hemorrhage. Neonatal outcomes included low birthweight, neonatal asphyxia, and stillbirth.

Diagnostic criteria

Diagnosis of pregnancy was established by human Chorionic Gonadotropin (hCG) test and transvaginal sonography, which showed separate gestational sacs within the endometrial cavity. Gestational age was estimated from the date of the last menstrual period and confirmed by measurement of the crown-rump length utilizing nuchal translucency evaluation. Chorionicity was identified in the first trimester with sonography and reaffirmed after delivery of the placenta as Monochorionic Monoamniotic (MCMA), Monochorionic Diamniotic (MCDA), or Dichorionic Diamniotic (DCDA). Prior uterine surgeries included curettage, cesarean section, myomectomy, or other previous operative procedures. Indications for cesarean section were ICP, gestational hypertension with placenta previa, PROM, neonatal asphyxia, breech presentation of the first twin, other medical comorbidities and complications, as well as maternal request for cesarean delivery. A delivery was indicated in case of premature labor, obstetrical complications, and other circumstances unfavorable to expectant management. DCDA pregnancies without adverse outcomes could continue until 37 weeks and MCDA pregnancies until 38 weeks.

Inclusion criteria were patients who registered in the first trimester and delivered at our hospital. Exclusion criteria were miscarriage, induction, elective twin pregnancy reduction, fetal structural anomalies, coagulation disorders, monoamniotic twins, and other complicated twins.

Ethical approval and consent to participate

This study was authorized by the Ethics Board of the First Affiliated Hospital of Nanjing Medical University (Ethics Committee 2020-SR-256) and was exempt from informed consent requirements due to its retrospective nature.

Statistical methods

Statistical analysis was conducted using Statistical Package for Social Sciences (SPSS) version 20.0. Quantitative data were presented as mean ± standard deviation after being tested for normality using the Shapiro–Wilk test. Comparisons between the two groups were assessed by the independent t-test. Categorical variables were expressed as number (in percentage). Comparisons between the two groups were performed by the chi-square test. A value of P<0.05 was considered statistically significant.

Results

Between June 2006 and October 2019, a total of 1,494 twin births delivered in our hospital were included in the retrospective analysis after applying exclusion criteria. Of those, 1,355 terminated the pregnancy by cesarean section and 139 by vaginal delivery.

General prenatal conditions of women giving birth to twins

The cesarean section group had a higher mean maternal age compared with the natural delivery group 30.05±6.17 years vs. 27.65±7.82 years (P=0.000), respectively. Compared to the cesarean section group, 80.6% of pregnant women in the physiological section group were naturally conceived, significantly higher than those in the cesarean section group. In terms of chorionic properties, 62.4% of pregnant women in the cesarean section group had double chorionic and double amniotic sac (DCDA), significantly higher than those in the physiological section group. In addition, a total of 108 pregnant women with a previous history of uterine surgery underwent cesarean section (P=0.001). There were no statistically significant differences in the general conditions of pregnant women between the other two groups, including gestational age, parity, and BMI (P>0.05) (Table 1).

Table 1: General situation of pregnant women [N(%)].

Group		Cesarean section group (N=1355)	Physiological section group (N=139)	χ^2/U	P value
Maternal age (year)		30.05±6.17	27.65±7.82	7.662	0.000*
Gestation times	Number of pregnancies ≤ 3 times	1229(90.7)	129(92.8)	0.675	0.411
	Number of pregnancies >3 times	126(9.3)	10(7.2)	-	-
Parturition times 1	Number of births = 0	1154(85.2)	114(82.0)	0.975	0.323
	The number of births ≥ 1	201(14.8)	25(18.0)	-	-
Mode of conception 0.97526	Natural conception	913(67.4)	112(80.6)	10.192	0.001*
	After IVF-ET operation	442(32.6)	27(19.4)	-	-
BMI		26.6±3.1	26.9±3.0	-0.545	0.587
Gestational age (week)		34(30,36)	36(35,37)	-7.933	0.000*
Chorionic properties 32.6	DCDA	509(37.6)	74(53.2)	13.014	0.000*
	MCDA	846(62.4)	65(46.8)	-	-
Scar uterus		108(8)	2(0)	11.942	0.001*

Note: *P<0.05

Table 2: Comparison of pregnancy complications and complications between the two groups [N(%)].

Group		Cesarean section group (N=1355)	Physiological section group (N=139)	χ^2 value	P value
Hypertensive disorder complicating pregnancy		177(13.1)	6(4.3)	8.972	0.003*
Gestational diabetes mellitus		213(15.7)	17(12.2)	1.178	0.278
Intrahepatic cholestasis of pregnancy#		109(8.2)	4(2.9)	4.813	0.028*
Abnormal thyroid function during pregnancy		189(13.9)	14(10.1)	1.613	0.204
Anemia during pregnancy		85(6.3)	8(5.8)	0.058	0.810
Premature rupture of membranes		189(13.7)	64(46.0)	94.490	0.000*
Placental abruption		19(1.4)	3(2.2)	0.497	0.481
Placenta previa#		50(3.7)	0(0)	-	0.012*
Oligohydramnios#		8(0.6)	0(0)	-	1.000
Polyhydramnios		17(1.3)	3(2.2)	0.245	0.620
Umbilical cord around neck		149(11.0)	23(16.5)	3.812	0.051
Twin transfusion syndrome		11(0.8)	1(0.7)	0.014	0.907
Fetal position (head position)	First child	1249(92.2)	138(99.3)	9.567	0.002*
	Double head position	671(53.7)	96(69.1)	11.908	0.000*

Note: *P<0.05; #Fisher test

Analysis of pregnancy and medical complications

The proportion of preeclampsia, ICP, and placenta previa in the cesarean section group was significantly higher than that in the physiological section group, with statistical significance (P=0.003, P=0.028, P=0.012). However, the proportion of premature rupture of membranes and head position (first and second fetuses) was significantly lower than that of the physiological birth group (P=0.000, P=0.002, P=0.000). There was no statistical difference (P>0.05) in other pregnancy complications and complications, as shown in Table 2.

Analysis of delivery complications and neonatal outcomes

The incidence of postpartum bleeding and the proportion of premature infants (under term delivery) in the cesarean section group were significantly higher than those in the physiological section group (P=0.000, P=0.000). In addition, the asphyxia rate of the second fetus in the cesarean section group was significantly lower than that in the physiological section group (P=0.000), and the difference was statistically significant. There was no statistical difference (P>0.05) between the cesarean section group and the physiological section group in the probability of asphyxia and death in the first fetus, as shown in Table 3.

Table 3: Comparison of maternal and fetal outcomes between the two groups of pregnant women.

Maternal and fetal outcome	Cesarean section group (N=1376)	Physiological section group (N=709)	χ^2/U value	P value
Postpartum hemorrhage	220	24	0.098	0.754
Hospitalization days	8(6,10)	5(3,8)	-9.120	0.000*
Preterm delivery	903(66.6)	40(28.8)	77.646	0.000*
Low birth weight of newborn	15(1.1)	1(0.7)	0.179	0.672
Asphyxia neonatorum	42(3.1)	16(11.5)	23.902	0.000*

Note: *P<0.05

Table 4: Potential factors affecting the delivery mode of twin pregnancy.

	β	SE	Wald X^2	OR(95%CI)	P
HDCP	1.061	0.434	5.97	2.888(1.233, 6.762)	0.015*
IVF-ET operation	0.752	0.232	6.919	1.841(1.169, 2.900)	0.009*
ICP	0.929	0.53	3.07	2.531(0.896, 7.153)	0.080
Premature rupture of membranes	-1.660	0.195	72.577	0.190(0.130, 0.279)	0.000*
Chorionic properties	-0.316	0.223	2.01	0.729(0.471, 1.128)	0.156
Scar uterus	1.79	0.732	5.979	5.991(1.427, 25.163)	0.014*
Fetal position((first child)	2.767	1.015	7.434	15.916(2.177,116.353)	0.001*
Fetal position (second child)	0.68	0.202	11.33	1.974(1.329, 2.934)	0.000*

Multifactor analysis on the selection of delivery methods for twin pregnancy

This study conducted a multivariate logistic regression analysis to further control the impact of confounding factors. The results showed that Hypertensive Disorder Complicating Pregnancy (HDCP) and IVF-ET surgery, as potential factors affecting the delivery mode of twin pregnancies, were positively correlated with the cesarean section method (OR=2.888, 95% Cl 1.233 to 6.762; OR=1.841, 95% Cl 1.169, 2.900), while premature rupture of membranes, the fetal position (first and second fetuses) was positively correlated with vaginal delivery (OR=0.190, 95% Cl 0.130, 0.279; OR=15.916, 95% Cl 2.177116.353; OR=1.974, 95% Cl 1.329, 2.934), and the differences were statistically significant (P<0.05). ICP and chorionic properties (MCDA), as potential factors affecting twin delivery, are positively correlated with cesarean section, but the differences are not statistically significant (P>0.05) Table 4.

Discussion

The incidence of twin pregnancies has risen gradually due to assisted reproductive technology [19]. Risk factors of twin pregnancies are associated with ethnicity, maternal age, parity, heredity, nutritional factors, pituitary gonadotropins, and infertility therapy.

The results of this study have shown that women in the cesarean section group tended to be older, were more likely to conceive spontaneously, and underwent more uterine surgeries. Older pregnant women with degenerative myometrium are more vulnerable to uterine atony, which is an indication for cesarean delivery. Furthermore, too much emphasis on the health of babies and themselves can contribute to maternal request for cesarean delivery. Prior uterine procedures, such as curettage, cesarean section, and myomectomy, can impair the strength of the uterine stretch and contraction leading to an increase in the risks of uterine rupture and placenta accrete when pregnancy recurs. Moreover, twin pregnancies characterized by uterine overdistention, and excessive intrauterine pressure are more susceptible to uterine rupture. Accordingly, in these circumstances cesarean section is the preferred choice to avoid the above adverse consequences.

The finding that spontaneous conception was more common in the cesarean section group than in the natural delivery group has been inconsistent with earlier studies. Stern J.E. found a higher cesarean section rate in women with infertility-related diagnoses compared to fertile women [20]. Deltombe-Bodart S. noted no difference between the rate of cesarean sections in patients with spontaneous conception and infertility treatments [21]. Improved compliance with routine obstetrical care, the popularity of pregnancy health knowledge, and eligibility

for vaginal delivery may partially explain the discordance, which is pending further study.

In regard to chronicity, women with MCDA and DCDA twin gestations preferred cesarean delivery over vaginal delivery, partially due to medical intervention. Vessel anastomosis can be found on the chorionic surface of the placenta in 80 to 100 percent of monochorionic twin placentas [22], followed by a shunt developing between fetuses. The chronic twin-twin transfusion may result in serious complications or even fetal loss, indicating the importance of timing the delivery [23]. A meta-analysis by Cheong-See F. recommended 37 weeks' gestation for dichorionic twin pregnancies and 36 weeks for monochorionic pregnancies.

Our findings of medical complications in pregnancy is in accord with several prior studies which also reported high rates of PE in cesarean delivery [24]. Higher maternal plasma hCG levels in twin pregnancy may be related to activation of the renin-angiotensin system, thereby inducing PE. Ultimately, placental hypoperfusion and insufficiency contributes to fetal growth restriction. Therefore, cesarean section has become the preferred method of delivery in women with PE. In addition, parturients carrying twins are susceptible to stress, which is accompanied by elevated risks of PE. In contrast, no significant differences in chronic diseases were found between both groups, which is inconsistent with Emily's study [25]. They reported that cesarean deliveries were more common in women with chronic diseases. Analysis of the gestational age indicated that preterm birth was the most common obstetrical complication, with an incidence of 62.7% in the cesarean section group and 40.5% in the natural delivery group. The incidence of preterm birth differs in literature and is affected by geographical area and sample size. Women with twin gestations are predisposed to preterm cervical dilatation which induces rhythmic uterine contractions and premature rupture of the membrane, leading to preterm labour. Indicated cesarean section in the case of serious adverse maternal and infant outcomes may account for the high frequency of preterm delivery. Therefore, a great increase in the incidence of neonatal asphyxia and stillbirth has occurred.

The substantially higher rate of postpartum hemorrhage in the cesarean section group, relative to that of the vaginal delivery group, was identical to the results of a study by Wenckus D.J. [26]. During natural labor, if insufficiency of placental blood flow, attributed by the delivery of the first twin, occurs in combination with intrauterine hypoxia caused by a prolapsed cord, it can result in neonatal asphyxia or even mortality of the second twin in case of prolonged second-stage labor. Shortened duration of labor benefiting from cesarean section mitigates adverse outcomes caused by the change in blood flow due to uterine contractions. Therefore, prenatal assessment of the presentation and the position of the twins with respect to the birth canal is essential to ensure normal labor. Hastened labor duration and the availability of resuscitation are especially necessary for the second twin; otherwise, cesarean section should be the first choice in malpresentation.

Conclusion

Although cesarean section reduces the prevalence of neonatal asphyxia and stillbirth in twin pregnancy, it increases the rate of postpartum hemorrhage and preterm birth. Hence, comprehensive evaluation should be conducted before determining the appropriate delivery mode. Taking these factors into consideration, improvements in assisted delivery intended to decrease the frequency of cesarean sections should draw the attention of obstetricians.

Declarations

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