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Analysis of high risk factors for complications in the trial of vaginal delivery due to uterine scarring in a subsequent pregnancy to a cesarean section.

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Key words: scarred uterus; pregnancy; vaginal trial delivery; complications; high-risk factors.

Abstract. The purpose of this work was to analyze the high-risk factors of complications in the trial of vaginal delivery of a subsequent pregnancy for scar uterus after a previous cesarean. 136 pregnant women with scar uterus with a history of cesarean who were admitted to our obstetrics department from February 2016 to March 2019 were selected and were divided into a successful group and a failed group according to the results of pregnancy and trial of labor vaginal delivery. General data of before, during, and after delivery were collected and the high-risk factors for failed vaginal delivery of scar uterine were analyzed by the logistic regression analysis. Among the 136 patients, 108 cases (79.41%) of vaginal trials were successful, and 28 cases (20.59%) of vaginal trials faired. The univariate analysis showed that the differences in gravidity, parity and the previous cesarean interval, vaginal birth history, prenatal BMI, uterine contraction, gestational age, infant weight, dilatation of the cervix, cervical Bishop score, the height of the fetal head, the thickness of the lower uterus, and whether the membranes were prematurely ruptured were statistically significant ($P<0.05$). Logistic regression analysis showed vaginal birth history, prenatal BMI $\geq$ 30 kg/m^2, parity $\geq$ 2 times, cesarean interval <2 times, dilatation of cervix $\geq$ 1 cm, the height of the fetal head $\geq$ -3, premature rupture of the membrane and the thickness of the lower uterus of 3.0 to 3.9 cm were the high-risk factors of complications in the vaginal trial delivery of pregnancy again for scar uterus ($P<0.05$). It is feasible for pregnant women with scar uterus to undergo vaginal delivery, but many related factors can affect the failure of trial of labor. It is necessary to pay attention to all aspects of clinical examination and choose applications strictly according to the indications.

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Análisis de factores de alto riesgo para complicaciones en el trabajo de parto vaginal debidas a cicatrización uterina en un embarazo posterior a una operación cesárea.

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Palabras clave: cicatriz uterina; embarazo; prueba de parto vaginal; complicaciones; factores de alto riesgo.

Resumen. El propósito del presente trabajo fue analizar los factores de alto riesgo de complicaciones por cicatriz uterina en la prueba de parto vaginal del siguiente embarazo después de una cesárea previa. 136 gestantes con cicatriz uterina fueron seleccionadas con antecedente de cesárea anterior que ingresaron a nuestro servicio de obstetricia de febrero 2016 a marzo 2019, y se dividieron en un grupo exitoso y un grupo fallido según los resultados de las pruebas de embarazo y parto vaginal. Los datos generales anteriores fueron recolectados, durante y después del parto y se analizaron los factores de alto riesgo para el parto vaginal fallido de la cicatriz uterina mediante el análisis de regresión logística. Entre las 136 pacientes, 108 casos (79,41%) de las pruebas vaginales fueron exitosas y 28 casos (20,59%) de las pruebas vaginales fracasaron. El análisis univariado mostró que las diferencias en la gravidez, la paridad y el intervalo de cesárea previa, la historia de parto vaginal, el IMC prenatal, la contracción uterina, la edad gestacional, el peso del lactante, la dilatación del cuello uterino, la puntuación cervical de Bishop, la altura de la cabeza fetal, el grosor del segmento uterino inferior, y si las membranas se habían roto prematuramente fueron estadísticamente significativas (P<0,05). El análisis de regresión logística mostró antecedente del parto vaginal, el IMC prenatal ≥ 30 kg/m2, la paridad ≥ 2 veces, el intervalo entre cesáreas < 2 veces, la dilatación del cuello uterino ≥ 1 cm, la altura de la cabeza fetal ≥ -3, la ruptura prematura de la membrana y el grosor del segmento uterino inferior de 3,0 a 3,9 cm fueron los factores de alto riesgo de complicaciones por cicatriz uterina en la prueba de parto vaginal de un siguiente embarazo (P<0,05). Sería posible que las gestantes con cicatriz uterina vuelvan a someterse a parto vaginal, pero existen muchos factores relacionados que inciden en el fracaso del trabajo de parto. Es necesario prestar atención a todos los aspectos de la exploración física y elegir las aplicaciones estrictamente de acuerdo con las indicaciones.

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INTRODUCTION

A Cesarean section is an operation to open the abdominal wall and uterus to remove the fetus that is an important operation in the field of obstetrics. It plays an important role in solving dystocia and severe pregnancy complications; and reduces the morbidity and mortality of mothers and infants [1]. At present, as the indications for cesarean section surgery and the technology of cesarean section become more and more sophisticated, China's cesarean section rate has been above the global cesarean section

warning line. Although cesarean section can significantly reduce the incidence of dystocia and postnatal adverse reactions, it can significantly increase the number of pregnant women with scar uterus after cesarean section, increase the risk of patients with scar pregnancy, placental implantation, placenta previa, and other events, which pose a certain threat to the health of mothers and infants [2-3]. In recent years, with the full popularization of the national "second child" policy, the number of women who have had a vaginal delivery again after the cesarean section has significantly increased. Related data shows that [4], the risk of uterine rupture during the vaginal delivery of pregnant women with scar uterus is obviously increased, which easily leads to maternal and perinatal death. Reviewing relevant research findings at home and abroad [5], most of the references mainly discuss the factors related to the success of vaginal delivery in scar uterus re-pregnancy. There are fewer factors related to the complications of vaginal delivery in scar uterus re-pregnancy, this study aims to analyze risk factors of complications in vaginal trial delivery of a subsequent pregnancy for scar uterus after cesarean section.

MATERIAL AND METHODS

Research subjects

136 pregnant women with scarred uteri with a history of cesarean section who were admitted to the obstetrics department of our hospital from February 2016 to March 2019 were selected as the research subjects. This study was approved by the ethics committee of our hospital. Inclusion criteria: 1) those aged 22 to 40 years with 37 to 41 weeks gestation; 2) the time between the last cesarean operation and this pregnancy of all pregnant women was more than 2 years; 3)the uterine scar of the pregnant woman was located at the lower section of the uterus; 4) the fetal position was normal and without absolute pelvic pelvis; 5) the pelvic bones of pregnant women were normal; 6) the indication for the last cesarean section operation did not exist; 7) The patient and family members were informed and signed a consent form. Exclusion criteria: 1) those who had a history of two or more cesarean sections; 2) patients with intrauterine multiple births and non-term pregnancies; 3) patients with previous history of uterine rupture; 4) pregnant women with uterine tumor disease; 5) those who occur new cesarean section indications in this pregnancy; 6) those that had placenta attachment or poor continuity of muscle layer in the scar of the lower uterus. 7) products with estimated weights greater than 4000 grams were not considered. 136 pregnant women aged 22 to 40 years old, with an average age of (27.82 ± 3.84) years, 37 to 41 weeks of gestational age, an average of (39.15 ± 1.07) weeks, with two to five pregnancies, an average of (2.10 ± 1.03) times, and one to four times of parity, with an average of (1.18 ± 0.47) times, and the interval between cesarean sections was 24-168 months, with an average of (62.38 ± 25.47) months. According to the results of vaginal trial delivery, they were divided into the successful group and failed groups.

Delivery methods

After admission, pregnant women underwent detailed obstetric examinations and fetal ultrasound examinations to evaluate comprehensively their physical and pregnancy status. Pregnant women and their families chose the delivery method based on the actual situation. Continuous electronic ECG monitoring was given, and the midwife accompany the trial of pregnant women by the way of one-on-one monitoring the progress of the labor process closely. After the successful trial, it was checked whether the uterus was complete and whether the uterine scar had cracked. If the pregnant woman does not give birth within 12 hours after contraction, or if there are suspicious signs of uterine rupture and fetal distress, a cesarean section should be given immediately.

Data collection

The general information on prenatal, perinatal, and postpartum for all pregnant women was collected, including age, education, pregnancy, parity, previous cesarean sections interval, vaginal birth history, prenatal BMI, use of uterine contractions, gestational age, infant weight, admission uterine dilation of the cervix, cervical Bishop score, the height of the fetal head, lower uterine segment thickness, premature rupture of membranes, regular birth checkup, etc., and the record content was checked.

Statistical methods

All the count data in this study are expressed in [n (%)]. The comparison between the two groups was performed using the χ^2 test. Logistic regression analysis was used to analyze the high-risk factors for failed vaginal delivery of scar uterine pregnancy. $P<0.05$ was considered statistically significant. The research data were analyzed using the SPSS21.0 software package.

RESULTS

Analysis of maternal delivery results

Among the 136 patients, 108 cases (79.41%) of successful vaginal trials were in the successful group, 28 cases (20.59%) of failed vaginal trials were in the failed group, and the reasons for 28 cases of pregnant women who failed vaginal trials and were changed to cesarean section, are shown in Table 1.

Table 1
Reasons for pregnant women who have failed vaginal trials were changed to cesarean section.

Reasons	Cases
Fetal distress	12 (42.86)
Secondary tocolytic weakness	1 (3.57)
Abnormal labor	7 (25.00)
Intrauterine infection	1 (3.57)
Other factors	7 (25.00)

Univariate analysis of factors related to failed vaginal trial delivery of scar uterine pregnancy

The univariate analysis showed that there were statistically significant differences in gravidity, parity, previous cesarean sections interval, vaginal birth history, prenatal BMI, use of uterine contraction, gestational age, infant weight, admission dilation of the cervix, cervical Bishop score, the height of the fetal head, the thickness of the lower uterus, and whether the membranes were prematurely ruptured ($P<0.05$). See Table 2.

Influencing factors and assignments

The high-risk factors and assignments of failed vaginal trial delivery in scar uterine pregnancy, are expressed in Table 3.

Logistic regression analysis of high-risk factors for failed vaginal trial delivery in scar uterus pregnancy

Taking the failed vaginal trial delivery as the dependent variable, the statistically significant indicators in Table 2 were used as the dependent variables for evaluation (see Table 3) and were included in the logistic regression analysis model. The results showed that there was no history of vaginal delivery, BMI ≥ 30 kg/m^2, parity ≥ 2 times, cesarean section interval < 2 times, admission dilation of cervix ≥ 1 cm, the height of fetal head ≥ -3, premature rupture of membranes, and 3.0-3.9cm of the thickness of the lower uterus are high-risk factors for complications in vaginal trial delivery in scar uterus pregnancy ($P<0.05$) (see Table 4).

DISCUSSION

With the continuous increase in cesarean section rate in the world and the widespread application of laparoscopic myomectomy in women of childbearing age, the problem of subsequent pregnancies for scarred uterus is inevitable [6]. With the gradual increase in cesarean section rate, the scarred uterus appears in large numbers. There are two methods of deliv-

Table 2
Univariate analysis of factors related to failed vaginal delivery of scar uterine pregnancy.

Relative factors		Successful group (n=108) (%)*	Failed group (n=28) (%)*	F	p-value**
Age	<35 years	99(91.67)	27(96.43)	0.740	0.390
	≥35 years	9(8.33)	1(3.57)		
Education	Under the high school	85(78.70)	21(75.00)	0.177	0.674
	High school or above	23(21.30)	7(25.00)		
Gravidity	<3 times	33(30.56)	12(42.56)	1.520	0.218
	≥3 times	75(69.44)	16(57.14)		
Parity	<2 times	83(76.85)	27(96.43)	5.511	0.019
	≥2 times	25(23.15)	1(3.57)		
Previous cesarean sections interval	24~36 months	55(50.93)	21(75.00)	5.227	0.022
	>36 months	53(49.07)	7(25.00)		
Vaginal birth history	Yes	67(62.04)	3(10.71)	11.825	0.001
	No	41(37.96)	25(89.29)		
Prenatal BMI	<30 kg/m2	78(72.22)	14(50.00)	5.017	0.025
	≥30 kg/m2	30(27.78)	14(50.00)		
Use of uterine contraction	Yes	55(50.93)	8(28.57)	7.281	0.007
	No	53(49.07)	20(71.43)		
Gestational age	<40 weeks	82(75.93)	16(57.14)	3.896	0.048
	≥40 weeks	26(24.07)	12(42.56)		
Infant weight	<3.5kg	72(66.67)	12(42.56)	5.338	0.021
	≥3.5kg	36(33.33)	16(57.14)		
Dilation of cervix	<1cm	44(40.74)	22(78.57)	12.740	<0.001
	≥1cm	64(59.26)	6(21.43)		
Cervical Bishop score	<3 scores	4(3.70)	4(14.29)	4.497	0.034
	≥3 scores	104(96.30)	24(85.71)		
Height of the fetal head	<-3	4(3.70)	4(14.29)	4.497	0.034
	≥-3	104(96.30)	24(85.71)		
The thickness of the lower uterus	3.0~3.9cm	32(29.63)	16(57.14)	7.370	0.007
	≥4.0cm	76(70.37)	12(42.56)		
Whether the membranes were prematurely ruptured	Yes	16(14.81)	10(35.71)	6.281	0.012
	No	92(85.19)	18(64.29)		
Regular birth checkup	Yes	75(69.44)	16(57.14)	1.520	0.218
	No	33(30.56)	12(42.86)		

* n= number, % (percent).
**P-value based on univariate analysis (linear regression).

Table 3
High-risk factors and assignments of failed vaginal trial delivery in scar uterine pregnancy.

Code	Variate	Assignments
X1	Gender	1=male, 2=female
X2	Education	1= under the high school, 2= high school or above
X3	Gravidity	1=<3 times, 2=≥3 times
X4	Parity	1=<2 times, 2=≥2 times
X5	Previous cesarean sections interval	1=24~36 months, 2>36 months
X6	Vaginal birth history	1=yes, 2=no
X7	Prenatal BMI	1=<30 kg/m2, 2=≥30 kg/m2
X8*	Use of uterine contraction	1=yes, 2=no
X9	Gestational age	1=<40 weeks, 2=≥40 weeks
X10**	Infant weight	1=<3.5kg, 2=≥3.5kg
X11	Dilation of cervix	1=<1cm, 2=≥1cm
X12	Cervical Bishop score	1=<3 scores, 2=≥3 scores
X13	Height of the fetal head	1=<-3, 2=≥-3
X14	The thickness of the lower uterus	1=3.0~3.9cm, 2=≥4.0cm
X15	Whether the membranes were prematurely ruptured	1=yes, 2=no
X16	Regular birth checkup	1=yes, 2=no
Y	Vaginal trial delivery results	1=successful, 2=failed

* Oxytocic medications were used.
** The cut-off point of 3500 grams was taken intentionally.

Table 4
Logistic regression analysis of high-risk factors for failed vaginal delivery of scar uterine pregnancy.

Influencing factors	β	SE	Wald	p	OR	95%CI
No history of vaginal delivery	0.839	0.175	20.135	0.001	2.319	1.614~3.253
Prenatal BMI≥30 kg/m2	0.078	0.021	19.561	0.001	1.120	1.041~1.132
Parity≥2 times	0.737	0.245	8.426	0.002	2.142	1.031~4.173
Cesarean section interval <2 times	0.086	0.021	4.167	0.012	1.169	1.022~2.637
dilation of cervix≥1cm	0.026	0.017	4.865	0.014	1.038	1.004~1.071
height of fetal head≥-3	0.802	0.232	11.028	0.001	2.146	1.210~4.281
premature rupture of membranes	0.364	0.175	4.010	0.039	1.337	1.002~2.112
3.0-3.9cm of the thickness of the lower uterus	0.428	0.125	5.814	0.014	1.546	1.027~2.587

eries for scarred uterus in subsequent pregnancies, including cesarean section and vaginal delivery. A second cesarean section can reduce certain maternal and infant complications and newborn death rates, but it can increase the incidence of pain, pelvic adhesions, and surgical injuries in patients. The guided delivery in a subsequent pregnancy for scarred uterus is more economical than a second cesarean delivery, with less postpartum pain, and can reduce placental implantation and risk of placenta placement [7-8]. In recent years, the concept of vaginal trial delivery of a subsequent pregnancy for scarred uterus after the cesarean section has been accepted by obstetricians. Some scholars have found that the success rate of vaginal delivery after scar uterus for a previous cesarean section can reach 82.61%. However, there is currently no clear assessment of risk factors for vaginal trials in China, and most pregnant women have a certain degree of rejection of vaginal trials [9-10]. The results of this study showed that in 136 patients, 108 cases of vaginal trials were successful (79.41%), and 28 cases of vaginal trials failed (20.59%), which suggested that the scarred uterus has certain feasibility. The associated risk factors for pregnant women who have failed delivery were analyzed in this study.

Logistic regression analysis showed no history of vaginal birth, prenatal BMI ≥ 30 kg/m^2, parity ≥ 2 times, cesarean delivery interval <2 times, admission dilation of cervix≥ 1 cm, the height of fetal head ≥-3, premature rupture of membranes and a thickness of 3.0 - 3.9cm at the lower uterus are the high-risk factors for complications in the vaginal trial of scar uterine pregnancy (P <0.05). Increased prenatal BMI can increase the risk of adverse pregnancy outcomes such as hypertension and diabetes during pregnancy. Some scholars have found that pregnant women with high prenatal BMI values have a relatively slow expansion of the cervix during vaginal delivery, increasing the risk of vaginal trial failure [11]. Relevant data show that the shorter the interval from the last cesarean section, the higher the risk of uterine rupture in pregnant women [12]. First fetal head exposure refers to the part of the fetus that first enters the pelvic entrance. Pregnant women with high first fetal head exposure have a higher incidence of dystocia [13]. Premature rupture of membranes is a common perinatal complication, which refers to the natural rupture of membranes before labor, which can lead to an increase in perinatal mortality. Relevant data [14] show that the incidence of neonatal asphyxia after cesarean delivery in pregnant women with fetal head height and premature rupture of membranes has significantly increased. The thickness of the lower part of the uterus is a predictive indicator of uterine threatened rupture. When the thickness of the lower part of the uterus is low, it can increase the scar tension during labor and prone to complications such as uterine rupture [15].

In summary, no history of vaginal birth, prenatal BMI ≥ 30 kg/m^2, parity ≥ 2 times, cesarean section interval <2 times, admission dilation of cervix≥ 1 cm, the height of fetal head ≥- 3, premature rupture of membranes and a thickness of 3.0 - 3.9 cm at the lower uterus are the high-risk factors for complications in the vaginal trial of scar uterine pregnancy. Therefore, a vaginal trial for pregnant women with a scarred uterus is feasible. However, there are many relevant factors affecting the failure of trial of labor, and more attention should be paid to all aspects of inspection, and choose the application strictly according to the indication.

Authors' Contribution

- Ren Ye and Weixia Wang collected the samples.
- Ren Ye and Weixia Wang analyzed the data.
- Ren Ye and Jie Li conducted the experiments and analyzed the results.

All authors discussed the results and wrote the manuscript.

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Conflict of interests

The authors declare no conflict of interests.

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