

Maternal and perinatal Outcome with Vaginal Birth After Cesarean in Hebei Province of china: a cross-sectional study

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Abstract

Background In recent decades, cesarean section rate have increased significantly in China. The delivery mode of women with a previous cesarean delivery remains contentious. We conducted a study to analyze the maternal and perinatal outcome of vaginal birth after cesarean or repeat cesarean delivery, in a period the one-child policy convert to the universal two-child policy.

Methods We used the data from Maternal Near Miss Surveillance System of Hebei province between 2013 and 2017. In the analysis, we included women with singleton deliveries between 28 and 42 gestation weeks who had a single prior cesarean delivery. We used logistic regression with a robust variance estimator to examine trends in vaginal birth after cesarean. We also assessed the association between vaginal birth after cesarean and maternal and perinatal adverse outcomes.

Results 53,769 women with a previous caesarean section deliveries were included from 274,665 of total participants. There were 3,415 (6.4%) women delivered by vaginal birth after cesarean and 50,354 (93.6%) by repeat cesarean delivery. Between 2013 and 2016, the rate of vaginal birth after cesarean showed an upward trend, from 6.2% to 7.0%. But in 2017, it had declined to 5.2%. Compared to women with repeat cesarean delivery, women with vaginal birth after cesarean have lower absolute rates of severe maternal morbidity and mortality, especially significantly in incidence of blood transfusion, but have higher incidence of intrapartum stillbirth, newborns with low 5-minute Apgar score less than 7 and neonatal death.

Conclusions Most of maternal adverse outcomes risk of vaginal birth after cesarean was not higher than repeat cesarean delivery, but the risk of perinatal adverse outcomes has increased in vaginal birth after cesarean.

Background

As one of the main obstetrical operations, cesarean section is a remedial method for those who can not be delivered through vagina. With the improvement of surgical and anesthesia technology, the cesarean section has been considered a safe delivery and become a common mode of delivery in clinical practice^{1,2}.

The rates of cesarean section delivery was increasing worldwide, and there was some worry about this trend because of potential maternal and prenatal risks. The rates of caesarean section in China increased in the 1990s^{3,4}. A survey of Asian countries in 2010 showed that China had the highest caesarean section rates^{4,5,6}, which prompted the Chinese government to establish several policies to reduce it. With the universal two-child policy carried out since 2016, multiparous have increased, including those delivered with cesarean section in the first time^{7,8}.

It was not an absolute solution for all pregnant women with a history of cesarean section to have another repeat cesarean section. Studies have shown that caesarean section can save maternal, fetal and

neonatal life, but excessive use of caesarean section was a threat to a short-term and long-term maternal and child health, such as increased incidence of postpartum hemorrhage, organ damage^{9,10,11}. At the same time, in order to reduce the rates of cesarean section and maternal and prenatal adverse outcomes, the vaginal birth after cesarean section (VBAC) was promoted worldwide, with the risk of uterine rupture threaten to the safety of mothers and babies^{12,13}. whether the second delivery after cesarean section would be through vagina, this issue has been highly valued by obstetricians, but there is still a lack of large-scale research in this field. This study retrospectively analyzed the clinical data of 53,769 pregnant women who gave birth again after cesarean section in Hebei Province from January 2013 to December 2017. We compare the maternal and perinatal outcomes between VBAC and repeat caesarean delivery(RCD), to identify whether VBAC was a safe delivery mode.

Methods

Data sources

The data between January 2013 to December 2017 from Hebei Maternal Near Miss Surveillance System (HBMNMSS) was collected. There were 22 hospitals in 15 counties in Hebei province. The maternal deaths and near miss conditions were enumerated in women with severe complication of pregnancy or delivery, using the same approach suggested in the World Health Organization's global survey on maternal and perinatal health⁴. It covers different levels of hospitals (levels 1 to 3, based on the number of beds, categories of clinical departments, numbers of medical personnel, type and quantity of equipment and hospital funding, where level-1 consist of the smallest hospitals and level-3 the largest)¹⁴,with more than 1000 deliveries every year. In this study, we collected the deliveries information from the hospitals by the Survey Questionnaire form, which was designed by the China's National Maternal Near Miss Surveillance System. The information included Maternal age, Gestational age, Number of abortions, Education level, gravidity and parity, Hypertension, Diabetes mellitus, Length of hospital stay. Sampling strategy, data collection and reporting processes and quality control method of HBMNMSS have been detailed elsewhere, so as to avoid missed reports of hospitalized cases^{15,16}.

We included only singleton pregnant women with one previous caesarean section and who delivered at 28 completed weeks of gestation or above. We excluded twin pregnancy. We classified maternal age into five subgroups, and common definitions for marital status and education as detailed elsewhere¹⁷. We extracted the day of the week from the date of delivery.

Statistical analyses

We used χ^2 test to assess the trends in vaginal delivery after caesarean section by maternal age and hospital level. We also calculated the trends in the weighted rates of vaginal delivery after caesarean section in each subgroup. To examine the association between year and the rates of vaginal delivery after

caesarean section, we used Logistic regression with a robust variance estimator, analyzing rare events, and binomial data on individuals. We used SPSS version 19.0 for our analyses, investigated both multicollinearity and model goodness-of-fit to identify the most robust and stable model.

We used a likelihood ratio test to obtain the *P*-value for the interaction among the variables by comparing models with and without interaction variables. Lastly, we compared the proportions of maternal and neonatal outcomes between vaginal delivery after caesarean section and RCD. We calculated the cRR and aRR for the following maternal outcomes: uterine rupture, blood transfusion, hysterectomy, intensive care unit admission, puerperal infection and mortality before discharge; and perinatal outcomes: intrapartum stillbirths, 5-minute Apgar score lower than 7 and neonatal death before discharge. We restricted the sample to deliveries without antepartum stillbirths for intrapartum stillbirths, to live births for 5-minute Apgar score lower than 7, and neonatal deaths before discharge. We defined uterine rupture as uterine or Lower uterine segment dehiscence in late pregnancy or during delivery, including complete and incomplete rupture.

Results

There were 274,665 women included in this study, aged 15 to 49 years, between 2013 and 2017. There were 53,769 women with previous cesarean delivery once, and who had a singleton delivery at 28 to 42 weeks gestation in the current pregnancy (Fig. 1).

Of these women, 22,268 (41.4%) were 25 to 29 years of age, 2,858(5.3%) had hypertension, 2,826(5.3%) had diabetes mellitus. Women who had a RCD were older, and had higher rates of hypertension and diabetes mellitus than women who delivered after an VBAC (Table 1). The VBAC rates was 6.2% (454/7,298) in 2013, increased to 7.0% (993/14,227) in 2016, decreased to 5.3% (766/14,389) in 2017. The proportion of women who delivered in level-2 hospitals were stable over the study period and the rates were about 71.2%. And it was consistent with an increase in vaginal delivery rates, from 5.5% in 2013 to 7.1% in 2016, decreased to 5.8% in 2017, (Table 2). Table 3 shows rates of severe maternal morbidity and mortality after RCD and VBAC in the study population. Women who had an VBAC had significantly higher rates of intrapartum stillbirths, newborns with a 5-minute Apgar score less than 7 and neonatal death compared to women who had an RCD.

Table 1
Maternal characteristics and mode of delivery^a n(%)

	VBAC N = 3,415	RCD N = 50,354	P-value
Maternal age, † (years)			
< 20	16(0.5)	82(0.3)	∞0.001
20–24	331(9.7)	3,356(6.7)	
25–29	1,481(43.4)	20,782(41.3)	
30–34	1,089(32.2)	18,017(35.8)	
≥ 35	489(14.3)	8,112(16.1)	
Gestational age(weeks)	37.97 ± 2.78	38.40 ± 1.38	∞0.001
Number of abortions			
∞3	3,281(96.2)	48,247(95.9)	0.34
≥ 3	129(3.8)	2,073(4.1)	
Education level			
Primary	1,587(46.5)	21,024(41.8)	∞0.001
Medium	1,042(30.5)	17,067(33.9)	
High	786(23.0)	12,263(24.4)	
Hypertension	157(4.6)	2,701(5.7)	0.05
Diabetes mellitus	145(4.2)	2,681(5.3)	
Length of hospital stay	4.94 ± 2.64	6.25 ± 2.60	∞0.001
Note: VBAC = vaginal birth after cesarean; RCD = repeat cesarean delivery.			
^a We obtained data from 22 hospitals. Our study was restricted to women with a parity of 1 who had a previous cesarean delivery and who delivered a singleton at 28 to 42 weeks gestation in the current pregnancy in Hebei provinces (excluding Langfang) from 2013 to 2017. Participants with missing values were excluded.			
†For maternal age, the denominators used were 53,769 (no. of participants with a previous cesarean delivery), 50,354(no. of participants with an repeat cesarean) and 3,415 (no. of participants with an VBAC).			

Table 2

Weighted rates of vaginal delivery after caesarean section, by maternal age and hospital level in Hebei, 2013–2017

	VBAC n(%) ^a				
	2013	2014	2015	2016	2017
All deliveries	454(6.2)	693(6.7)	509(6.8)	993(7.0)	766(5.3)
Maternal age, †(years)					
< 20	2(14.3)	4(22.2)	2(10.0)	5(20.8)	3(13.6)
20–24	61(9.2)	88(10.9)	59(9.4)	76(9.1)	47(6.2)
25–29	211(6.4)	318(6.6)	216(7.0)	423(7.2)	313(5.9)
30–34	127(5.1)	195(5.5)	161(6.4)	345(6.6)	270(5.1)
≥ 35	53(6.1)	88(7.23)	71(5.8)	144(6.3)	133(4.4)
Hospital level					
Level 1	31(5.7)	29(4.3)	16(3.5)	41(4.0)	24(2.7)
Level 2	285(5.5)	476(6.2)	344(6.5)	698(7.1)	584(5.8)
Level 3	138(8.9)	188(9.1)	149(8.8)	254(7.6)	158(4.7)
† We used χ^2 -test to examine the distribution differences.					
Notes: We obtained data from 22 hospitals. Our study was restricted to women with a parity of 1 who had a previous cesarean delivery and who delivered a singleton at 28 to 42 weeks gestation in the current pregnancy in Hebei provinces (excluding Langfang) from 2013 to 2017. Participants with missing values were excluded. Level-1 hospitals are the smallest hospitals, while level-3 hospitals are the largest.					
Inconsistencies arise in some values due to rounding.					

Table 3

Comparison of maternal and perinatal outcome between vaginal birth after caesarean section and repeat caesarean delivery in Hebei, 2013–2017

	Weighted rates (no. of births) ^a		cRR (95% CI) ^d	aRR (95% CI) ^e
	VBAC ^b n(‰)	RCD ^c n(‰)		
Maternal Outcome				
Uterine ruptures	4(1.2)	39(0.8)	1.55(0.55–4.35)	1.08(0.37–3.21)
Blood transfusion	31(9.1)	670(13.3)	0.68(0.47–0.98)	0.36(0.25–0.54)
Hysterectomies	1(0.3)	24(0.5)	0.61(0.08–4.54)	0.18(0.02–1.48)
ICU admissions	2(0.6)	25(0.5)	1.18(0.28–4.98)	0.51(0.11–2.31)
Puerperal infection	1(0.3)	7(0.1)	2.11(0.26–17.13)	1.49(0.17–12.37)
Maternal mortality before discharge	1(29.3)	1(2.0)	0.07(0.00–1.08)	0.18(0.01–5.00)
Perinatal Outcome				
Intrapartum stillbirths	44(12.9)	29(0.6)	23.76(14.85–38.02)	9.83(5.48–17.64)
5-minute Apgar scores < 7	22(6.4)	97(1.9)	3.65(2.29–5.81)	2.19(1.31–3.67)
Neonatal deaths before discharge	11(3.2)	43(0.9)	0.25(0.12–0.50)	0.45(0.21–0.98)
aRR: adjusted relative ratio; CI: confidence interval; cRR: crude relative ratio; ICU: intensive care unit; VBAC: vaginal birth after caesarean; RCD :repeat caesarean delivery.				
n(‰) = number per 1,000 births(proportion, ‰)				
^a No. of births represents all births if not indicated live births.				
^b The sample for vaginal birth after caesarean section were 3,415 births and 3,198 live births.				
^c The sample for repeat caesarean delivery were 50,354 births and 50,197 live births.				

	Weighted rates (no. of births) ^a		cRR (95% CI) ^d	aRR (95% CI) ^e
	VBAC ^b n(‰)	RCD ^c n(‰)		
^d We weighted the rates for sampling distribution of population and adjustment for clustering of births within hospitals.				
^e We adjusted the cRR for year, hospital level, level of education, maternal age, diabetes mellitus, hypertension, gestational age and birth weight.				
^f Information about perinatal outcome was missing from 369 (0.69%) births. We excluded 14 (0.03%) antepartum stillbirths from the total number of births.				
^g We restricted the analysis to live births.				

Discussion

Our study showed that the rates of VBAC rates increased during the relaxation of the one-child policy. We found increasing trends for women older than 25 years, for women with one previous caesarean section and in level-2 hospitals. The absolute rates of severe maternal morbidity and mortality were low among women who had a VBAC and those who had a RCD. However, relative rates of serious neonatal morbidity and mortality were substantially higher in VBAC. Between 2013 and 2016, the proportion of pregnant women with a previous caesarean section in Hebei province increased from 13.8%(7,333/52,968) to 22.5%(14245/63218), and reached 26.3% (14,416/54,715) by 2017, which was higher than the average level of China¹⁸. This could be explained by the large number of women with a previous caesarean section and the increase in number of women wanting to have a second child after universal two-child policy¹⁸. In 2017, 54.7% (29,945/54,715) of participants were multiparas. It suggested that the RCD rates would increase in China after years of high cesarean section rate, if VBAC were not taken. Studies from several countries also have shown that VBAC is an elective measure for reducing RCD rates^{19,20,21}. Despite the debate in China whether to support VBAC as a measure to reduce the caesarean section rates^{22,23,24}, some hospitals have encouraged trial of labour after caesarean section since 2010^{17,25}. This promotion of VBAC has been done to achieve reduction in the caesarean section rates and to act as maternal requirements with a prior caesarean section. Surprisingly, we found that the rate of VABC in level-2 hospitals was higher than that in level-3 hospitals. Considered that it may be related to referral of pregnant and lying-in women with complications in lower-level hospitals. The change of population policy to universal two-child policy shows an opportunity to promote VBAC in China. But to ensure the safety of mothers and their newborns, we mostly choose to have another cesarean section. So it's clear that the VBAC rates in level-2 hospitals increased from 5.5–7.1%, but declined to 5.8% by 2017. Compared with developed country, the VBAC rates in China seems to have a potential to further increase^{26,27,28}.

However, women in China with a previous caesarean section still have limited choices for a preferred delivery mode. In general, it appears that clinicians easily opt for repeat CS. Most obstetricians worried about been sued for adverse outcomes and bear the loss of income, so they may be reluctant to implement VBAC in their wards^{29,30}, with the risk of uterine rupture, operative injury, fetal or neonatal death^{31,32}. In our study, the maternal morbidity and mortality of VBAC was very low, such as 1.2‰ of uterine rupture, which was in contrast to other studies(16.8‰)³³. It suggested that VBAC was a safe mode of delivery, if master the indications and observe closely.

A cohort study in the UK also confirmed that the complications was reduced by vaginal compression of the fetus, such as wet lung and respiratory distress syndrome that caused by excessive retention of pulmonary fluid, and long-term asthma of newborns delivered by elective cesarean section was significantly increased (HR: 1.24, 95% CI: 1.09–1.42)³⁴. Therefore, it is very necessary to have a trial of labor after cesarean(TOLAC), as Young³¹. There were higher rates of perinatal adverse outcomes in women with VBAC than who with RCD. We found a significant increase in the rate of intrapartum stillbirths among the infants of women who underwent VBAC(12.9‰) as compared with infants born after RCD(0.6‰). It was necessary that neonatologists involve to the process of trial of labour after caesarean section, to ensure the timely treatment for perinatal adverse outcomes¹⁴.

Strengths and limitations: The HBMNMSS was a well established surveillance system with rigorous quality controls, involved 22 hospitals, covering a large sample, the results still have value for the choice of delivery mode. But we could not obtain the information of women undergoing TOLAC and failed, no information of VBAC after elective cesarean section or emergency cesarean section, it might be a bias in outcomes of VBAC.

Conclusion

Most of maternal adverse outcomes risk of VBAC was not higher than RCD, but the risk of perinatal adverse outcomes has increased in VBAC. Strategies must take to reduce the perinatal risk, and to reduce primary caesarean section. At the same time, health care providers need to help women to understand delivery mode better, so they can make personalized decisions.

Declarations

Abbreviations

TOLAC: Trial of labor after cesarean; VBAC: Vaginal birth after cesarean; RCD: repeat caesarean delivery; WHO: World health organization; ICU: Intensive Care Unit; HBMNMSS: Hebei Maternal Near Miss Surveillance System.

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Availability of data and materials

The datasets used and analyzed in the current study are available from the corresponding author on reasonable request.

Authors' contributions

All authors have contributed to the design of this study. YKZ were responsible for data gathering, and data analysis was performed by XXW. Manuscript was drafted by XXW. XXW, YY, LJ and LW contributed in the study design, reviewing the data and writing the manuscript. All authors have contributed in the revision of the study and gave approval of the final version of the manuscript.

Ethics approval and consent to participate

Ethical clearance was obtained from Hebei Women and Children's Health Center (20171029-1). Participants were verbally consented to be interviewed and recorded. Written consent was waived by the Ethics Committee given the low-risk nature of the research and anonymity of all interviews.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures

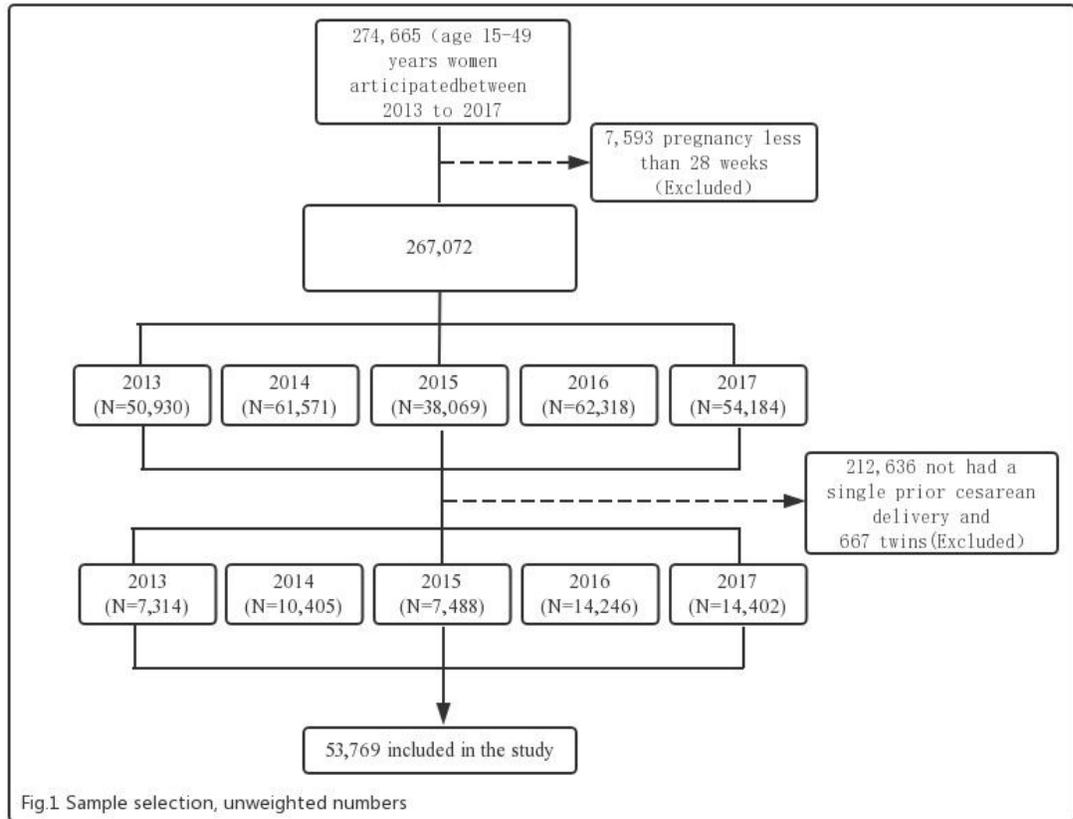


Figure 1

Sample selection, unweighted numbers

Supplementary Files

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