

Effect of China's Universal Two-child Policy on the Rate of Cesarean Delivery: A Case Study of a Big Childbirth Center in China*

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Summary: China's universal two-child policy was released in October of 2015. How would this new policy influence the rate of overall cesarean delivery (CD) in China? The objective of this paper is to investigate the trend of overall CD rate with the increase of number of multiparous women based on a big childbirth center of China (a tertiary hospital) in 2016. In this study, 22 530 cases from the medical record department of a big childbirth center of China from January 1 to December 31 in 2016 were enrolled as research objects. Electronic health records of these selected objects were retrieved. According to the history of childbirth, the selected cases were divided into primiparous group containing 16 340 cases and multiparous group containing 6190 cases. Chi-square test was carried out to compare the rate of CD, neuraxial labor analgesia, maternity insurance between the two groups; *t*-test was performed to compare the in-hospital days and gestational age at birth between the two groups. Pearson correlation coefficient was used to evaluate the relationship among observed monthly rate of multiparas, overall CD rate, and Elective Repeat Cesarean Delivery (ERCD) rate. The results showed that the CD rate in multiparous group was 55.46%, which was higher than that in primiparous group (34.66%, $P < 0.05$). The rate of neuraxial labor analgesia in multiparas group was 9.29%, which was lower than that in primiparas group (35.94%, $P < 0.05$). However, the rate of maternity insurance was higher in multiparas group (57.00%) than that in primiparas group (41.08%, $P < 0.05$). The hospital cost and in-hospital days in multiparas group were higher, and the gestational age at birth in multiparas group was lower than in primiparas group ($P < 0.05$). The overall CD rate slightly dropped in the first 4 months of the year ($P < 0.05$), then increased from 36.27% (April) to 43.21% (December) ($P < 0.05$). The rate of multiparas women and ERCD had the same trend ($P < 0.05$). There were linear correlations among the rate of overall CD, the rate of multiparas women and the rate of ERCD rate ($P < 0.05$). With the opening of China's two-child policy, the increasing rate of overall CD is directly related with the high rate of ERCD. Trials of Labor After Cesarean Section (TOLAC) in safe mode to reduce overall CD rate are warranted in the future.

Key words: cesarean delivery; elective repeat cesarean delivery; Trial of Labor After Cesarean Section (TOLAC)

Pregnancy is a normal state for most women, although it carries certain risk of death and disability^[1,2]. Cesarean delivery (CD), as an important and common obstetric operative procedure, has become one of main delivery methods to resolve dystocia, address certain obstetric complications, and save maternal

and fetal lives^[3,4]. However, the overuse of CD leads to higher rate of various complications, such as blood transfusion, anesthesia complications, internal organ injury, infection, thromboembolic disease, neonatal respiratory distress, and iatrogenic prematurity^[5-7]. In addition, women who conceive again suffer a higher risk of placenta previa, placenta accreta, uterine scar rupture^[8-10]. In 1985, the World Health Organization (WHO) stated that the "ideal" CD rate is considered to be 15%^[11]. However, most countries have experienced a steep increase of CD rate in the last three decades. WHO Asian survey reported that the overall CD rate in China was 46.5% in 2007-2008^[12]. A cross-

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sectional hospital-based study involving 112 138 women revealed that the rate of overall CD was 54.5% in 2011 in China^[13]. The overuse of CD has become a significant public health issue in China, which is caused by various reasons including non-evidence-based indications, professional convenience, maternal request, and over-medicalization of childbirth^[14]. The rapid growth in the number of CD cases requires Chinese government to take measures to reduce the rate of CD, especially the rate of Maternal Request Cesarean Delivery (MRCD)^[15-17]. In October, 2015, China announced the release of universal two-child policy, which fully replaced the iconic one-child policy^[18]. More and more women who have had CD previously will have their second babies. They may choose Elective Repeat Cesarean Delivery (ERCD) or Trial of Labor After Cesarean Section (TOLAC)^[19, 20].

How would this policy of two-child affect the overall CD rate in China? In this study, 22 530 cases collected from our hospital, a tertiary hospital in Hubei province & a big childbirth center of China from January 1 to December 31, 2016, were selected as research objects. The monthly overall CD rate, monthly rate of multiparas, and monthly ERCD rate were compared based on these selected cases, in order to find the reasons and provide reliable evidence to control high overall CD rate with the opening of two-child policy in China.

1 MATERIALS AND METHODS

1.1 Ethics Approval and Consent to Participate

The study protocol was approved by the Ethics Committee of Maternal and Child Health Hospital of Hubei Province (2015-78). The study was a retrospective study, and therefore consent to participate for the use of their medical records was waived by the Ethics Committee.

1.2 Data Collection

The study was a retrospective study involving 23 298 cases collected from our hospital, a tertiary hospital in Hubei province & a big childbirth center of China, from January 1, to December 31, 2016. The data of parturient cases were obtained from the electronic-based medical records of our hospital. Of all 23 298 cases, there were 44 cases with incomplete information, 24 cases having abortion before 28 weeks' gestation, 655 cases having labor induction due to fetal malformations, and 45 cases having intrauterine fetal death. Therefore, 22 530 cases finally included (accounting for 96.70% of all cases) consisted of 16 340 primiparous women (accounting for 72.53%) and 6190 multiparous women (accounting for 27.47%). The selected women were all delivered in our birth center and mainly lived in the urban areas of Wuhan, which is the largest city in Hubei Province in central China.

The maternal age of selected women ranged from 16 to 53 years old and the gestational age from 28 to 42 weeks. The information on the cases was collected from the electronic medical records, including general condition, previous pregnancy history, medical and surgical complications, delivery mode, and maternal and neonatal outcomes. In the delivery room of our hospital, treatments including 24-h obstetric anesthesia for neuraxial analgesia during labor, one-to-one midwife for both primiparous and multiparous women, and 5-min crash CD were provided. All standards were in accordance with training contents of the nongovernment project of No Pain Labor&Delivery (NPLD), a project advocated by an anesthesiologist named Ling-qun HU and developed at the Northwestern University Feinberg School of Medicine^[21].

MRCD is defined as the CD based solely on maternal request without any maternal/fetal medical indications^[22, 23]. Multiparous women who had had CD previously could choose TOLAC or ERCD. If TOLAC was successful, it was called vaginal birth after cesarean (VBAC)^[19, 20]. The overall CD rate was defined as the number of all CD cases / the number of all delivery cases $\times 100\%$. The multipara rate was defined as the number of multiparous cases / the number of total delivery cases $\times 100\%$. The ERCD rate was defined as the number of ERCD cases / the number of total delivery cases $\times 100\%$.

1.3 Statistics Analysis

All data were input into Statistical Package of Social Sciences software (v.19.0, SPSS Inc, Chicago, IL, USA) for statistical analysis. The values and variables were reported in the form of mean \pm standard deviation. Student's *t* test was performed to compare the variables in Gaussian distribution. Data were expressed in percentages. The effect of categorical variables on the rates was evaluated by chi-squared test. The Pearson correlation coefficient was used to evaluate the relationship among observed monthly rate of overall CD rate, multiparas and ERCD rate. Cochran-Armitage test for trend was carried out to evaluate the observed monthly rates during 2016. All statistical tests were performed with 2-sided *P* values. If *P* value <0.05 , the difference was considered to be statistically significant.

2 RESULTS

2.1 Demographic Data of Primiparas Group and Multiparas Group

The difference in marital status was not statistically significant between multiparas group and primiparas group (*P* >0.05). There was higher CD rate, lower rate of neuraxial labor analgesia, older maternal age (average old 4.2 years), longer in-hospital days, higher expensive cost, shorter gestational weeks at birth and

greater number of abortion history in multiparas group than in primiparas group ($P<0.05$). The demographic data of the two groups are listed in table 1. The rate of MRCD in primiparas group was 3.3% (537/16340) in 2016.

2.2 The Monthly CD Rate in Primiparas Group and Multiparas Group in 2016

In 2016, the CD rate was 34.66% (5663/16340) in primiparas women, and it was 55.46% (3433/6190) in multiparas women. With the extending of time during 2016, the CD rate in both primiparas and multiparas women remained unchanged ($P>0.05$) (fig. 1, table 2).

2.3 The Monthly Overall CD Rate, Multiparas Rate, ERCD Rate

The overall CD rate slightly dropped in the first 4 months of the year ($P<0.05$), then it increased from 36.27% (April) to 43.21% (December) ($P<0.05$). In the first 4 months, the rates of multiparas were 26.35%, 20.29%, 24.56%, 19.08% ($P<0.05$), and they increased monthly from 19.08% (April) to 33.23% (December) ($P<0.05$) (table 2). The rate of ERCD was also slightly decreased in the first 4 months (11.17%, 9.10%, 16.60%, 8.38%) ($P<0.05$), and then it increased monthly from 8.38% (April) to 15.48% (December) ($P<0.05$) (fig.

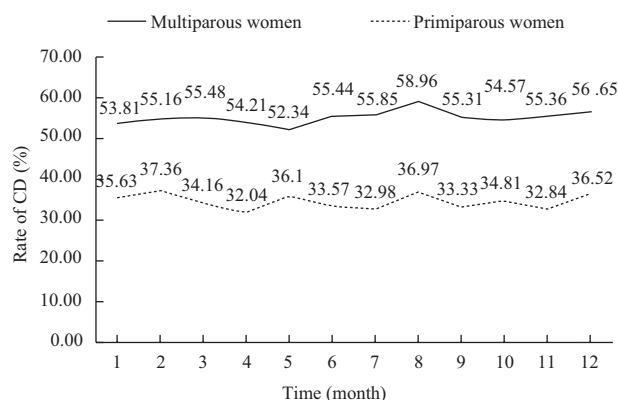


Fig. 1 Rate of CD in multiparous and primiparous women

2, table 3). There were positive correlations among three monthly rates of the overall CD, multiparas, and ERCD (table 3).

2.4 The VBAC Rate in 2016

There were 49 cases of VBAC, and none of them were complicated with uterine rupture. The VBAC was performed when the labor was progressing normally. There was no time to choose ERCD and no one chose neuraxial labor analgesia during the labor. Among

Table 1 Comparison of demographic data between primiparous group and multiparous group

Demographic characteristic	Primiparous Group (n=16340)	Multiparous Group (n=6190)	t or χ^2	P value
Maternal age (year, mean±SD)	28.0±3.1	32.2±4.1	-83.273	<0.001
Rate of CD (%)	5663 (34.7)	3433 (55.46)	807.060	<0.001
Rate of maternity insurance (%)	6713 (41.1)	3528 (57.0)	458.448	<0.001
Rate of neuraxial labor analgesia (%)	5872 (36.0)	575 (9.3)	1560.564	<0.001
In-hospital days (day, mean±SD)	5.78±1.95	5.99±2.69	-6.460	<0.001
Gestational age at birth (week, mean±SD)	39.2±1.5	38.6±1.6	31.377	<0.001
Cost (RMB, mean±SD)	6835.9±3051.9	7433.2±3745.6	-12.287	<0.001
Marital status				
Married	16220 (99.3)	6168 (99.6)		
Single	102 (0.6)	21 (0.3)	-1.863	0.062
Divorced or separated	18 (0.1)	8 (0.1)		
Abortion number				
≥3	319 (2.0)	632 (10.2)		
2	1013 (6.2)	1018 (16.5)	2019.802	<0.001
1	3607 (22.0)	1987 (32.1)		
0	11401 (69.8)	2553 (41.2)		

Student's test and Chi-square analysis are performed. CD: cesarean delivery

Table 2 The trend of monthly rates during 2016

	CD of primiparas	CD of multiparas	Overall CD			Multiparas			ERCD		
			1-12	1-4	4-12	1-12	1-4	4-12	1-12	1-4	4-12
z	28.0±3.1	32.2±4.1	6.019	6.801	12.690	153.679	14.966	133.708	153.679	14.966	133.708
P	11401 (69.8)	2553 (41.2)	0.009	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Cochran-Armitage test for trend was carried out among them. CD: cesarean delivery; ERCD: elective repeat cesarean delivery.

Table 3 The correlation coefficient among rates of overall CD, multipara, ERCD during 2016

	①-② (95%CI)	②-③ (95%CI)	①-③ (95%CI)
r	0.759 (0.115-0.915)	0.978 (0.951-0.994)	0.589 (-0.028-0.861)
P	0.022	<0.001	0.044

Pearson correlation coefficient was used among them. ①Overall CD rate; ②Multipara rate; ③ERCD rate in overall; CD: cesarean delivery; ERCD: elective repeat cesarean delivery

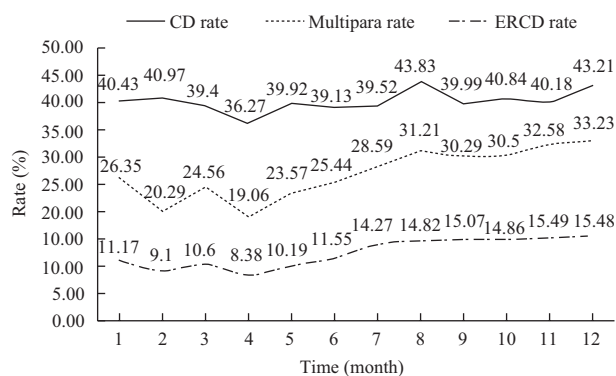


Fig. 2 CD rate, multipara rate, and ERCD rate in all women

them, 14 cases had the history of vaginal delivery before previous CD, 10 had the history of vaginal delivery after previous CD. The rate of VBAC was 1.36% (9/662) in the first 4 months and 1.80% (40/2217) in the next 8 months. There was no statistical different in the VBAC rates between in the first 4 months and in the next 8 months.

3 DISCUSSION

Over the past 30 years, the CD rate in China has increased significantly^[24, 25]. Before the 1980s, the CD rate was below 5%, which remained under 10% until 1990, and reached up to 46.2% in 2008^[12, 26]. According to relevant literature, almost half of total parturient women gave birth by CD in China^[27–29]. What caused the CD rate so high in China? The possible contributing factors mainly include in-hospital birth rate which was increased from 54% to 98%, urban population which was increased from 26% to 50%, high health insurance coverage-CD revenues, replacement of midwives by physicians, one child policy, and selection of MRCD^[30]. The high CD rate may cause risk of maternal and neonatal mortality and morbidity, bringing socioeconomic burden to individuals and healthcare systems^[12, 31, 32]. Hence, the national government and perinatal workers have paid more attention to control it^[30, 33–35]. A lot of measures have been taken to control the rate of CD, including using MRCD rate as one of the hospital's overall rating standards, promoting health education for women at reproductive age especially during pregnancy period, controlling weight, arranging 24-h obstetric anesthesia and nursing service in the delivery room, providing ambulatory neuraxial analgesia, appointing one-to-one midwife service to take care of the puerperia, and offering 5-min crash CD in the delivery room under the interdisciplinary cooperation. By 2014, the rate of CD in 14 of 17 “super cities” of China has been declined to 17.5%, which is 4.1% lower than earlier peak value^[36]. In our birth center, we had done our best to control the overall CD rate using above methods.

The overall CD rate slightly decreased in the first 4 months and then sharply increased. The overall CD rate of 36.27% in April was the lowest level of the year. The rate of multiparas and rate of ERCD showed similar trend as that of overall CD rate. There was a positive relationship among the rate of overall CD, rate of multiparas and rate of ERCD. Like most birth centers in China^[37], the VBAC rate in our hospital was very low (1.67%). Nearly all pregnant women who had undergone CD history previously chose ERCD in 2016. On the other hand, the monthly rate of CD for both primiparas and multiparas had no change, where the CD rate in primiparous women was 34.66% and that in multiparous women was 55.46%. From those data analysis, it can be concluded that an increasing number of multiparas who had undergone CD chose ERCD to realize termination of pregnancy under the influence of the universal two-child policy. The increase of second order birth rate eventually led to the increase of the overall CD rate.

After 30 years of implementing “one-child” policy, the selective 2-child policy was announced in November 2013, which means that if one of the couples is the only child in her or his family, the couples will have the chance to have two children. China's universal two-child policy was released in October of 2015, allowing all couples to have 2 children. These policies have impact on the overall CD rate. Liao *et al*^[38] collected hospital-level aggregate data on 93 745 delivery cases and individual-level data on 27 977 delivery cases from 6 hospitals in Hubei and Gansu province of China from 2013 to 2016, finding that the overall CD rate decreased from 45.1% during 1-child policy period to 40.4% during selective 2-child policy period, and further to 38.9% during universal 2-child policy period. Liang *et al*^[39] examined data on 6 838 582 births (at 28 completed gestational weeks or more) in 438 large hospitals in China from 2012 to 2016 and found the overall hospital-based rate was 41.1% in 2016. However, our study revealed that the overall CD rate slightly dropped in the first 4 months during selective 2-child policy period and then sharply increased from 36.27% (April) to 43.21% (December) during universal 2-child policy, which is inconsistent with those study. The reason causing such inconsistency may be due to following reasons. First, to our knowledge, universal 2 child policy was released in October 2015, and it generally takes at least nine months for a woman to have a baby from conception to childbirth. In theory, the impact of the universal two-child policy began in June 2016, but in fact, the increase in the proportion of parturient women began in May 2016. This is probably due to that parts of multiparous women with gestational 1–2 months who had originally intended to accept artificial abortion turned to continue pregnancy

because of such policy. Second, before the release of universal 2-child policy, we had already tried our best to reduce the MRCD rate and our overall CD rate was low (40.43%, 40.97%, 39.40%, 36.27%) during the first 4 months. At last, those studies were multicenter study but our study was based on data from only one single large birth center. We all know that the overall CD rate varies significantly from region to region and from one hospital level to another hospital level.

In our study, the multiparous women generally had older maternal age by 4.2 years and had higher rate of early abortion as compared with primiparous women. Moreover, compared with primiparous women, multiparous women exhibited higher CD rate, longer hospitalization days and higher hospital cost, which was mainly due to high rate of ERCD for multiparous women who had undergone CD previously. There was a shorter gestational week at birth for multiparous women, which was also due to high rate of ERCD. The rate of maternity insurance was higher in multiparas, which may be due to the fact that multiparous women normally are more economically capable and more willing to investment in insurance as they grow older. The rate of neuraxial labor analgesia was lower in multiparas, which was due to that the progress of labor was quick and smooth in part of multiparous women, and they had no need to choose analgesia.

How to control the high overall CD rate in China after the release of universal 2 child policy? Relevant measures must be taken. First of all, the VBAC rate should be improved in pregnant women who have had CD previously. Secondly, according to much Chinese literature, few of multiparous women who had undergone CD chose trial of labor after cesarean (TOLAC), so we should try our best to attract more of them to try TOLAC. The key issue of TOLAC is to avoid the TOLAC- induced uterine rupture, of which the occurrence rate is about 0.7–1.0%^[40]. To our knowledge and information about childbirth, many women have turned from ERCD to TOLAC in Hong Kong^[41]. Qu *et al* observed totally 614 TOLAC cases from July 2013 to June 2016, wherein the TOLAC rate was 29.62% (614/2 073), and the VBAC rate was 82.6% (507/614). The CD rate was reduced by 3.147% (507/16 112) and the rate of uterine rupture was 0.2%^[42]. Therefore, with the increase of multiparous women, what we should do is to carry out TOLAC with safe mode in China. The safe mode of TOLAC will be discussed in our next study.

The study aimed to observe the change trend of CD both in primiparous and ultiparous women in one big birth center, so the reasons causing high CD rate are clear, and we will know how to control the high CD rate according to specific reason. However, the data were selected from only one hospital, which cannot reflect the change trend of CD in hospitals from

different places and different levels.

At present, appropriate strategies should be developed to control the high rate of CD. First, we should control the MRCD rate. Second, with the increase of multiparous women after the release of China's universal two-child policy, we should create conditions to carry out TOLAC and improve the success rate of VBAC.

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Conflict of Interest Statement

The authors declare that they have no competing interests.

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