

# Analysis of the Impact of Cervical Excision Procedure on Delivery Mode

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## Research article

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# Abstract

**Background:** Many young women with a history of prior cervical excision procedure have reproductive intention. However, the relationship between having a prior cervical excision procedure and delivery mode has not drawn enough attention from physicians. The aim of this study was to observe the delivery mode of women with a prior cervical excision procedure, and analyze the relationship between having a prior cervical excision procedure and delivery mode.

**Methods:** In this retrospective cohort study of nulliparous women with a singleton pregnancy who have given birth at Beijing Obstetrics and Gynecology Hospital, Capital Medical University between May 2016 and April 2018, delivery mode of women with a history of prior cervical excision procedure were compared with those without such a history. Bivariable analysis were performed to identify whether there was a correlation between having a prior cervical excision procedure and delivery mode, and logistic regression were used modeling on cervical excision procedure for delivery mode outcome.

**Results:** (1) The proportion of premature rupture of fetal membrane (38.3% vs 27.0%,  $p=0.034$ ), forceps delivery (12.2% vs 5.9%,  $p=0.043$ ), and Caesarean sections delivery (33.9% vs. 30.2%,  $p=0.484$ ) were higher among women with a prior cervical excision procedure. (2) The main indication for forceps delivery was to shorten the second stage of labor among women with a prior cervical excision procedure, significantly higher (50% vs 7.7%,  $p=0.033$ ) among women without such a history. There were no differences in indications for Caesarean sections delivery in two groups ( $p>0.05$ ). (3) The time interval between cervical excision procedure and pregnancy was not associated with delivery mode ( $p=0.445$ ). (4) By setting spontaneous labor as control, forceps delivery was associated with cervical excision procedure (OR=0.403, 95%CI=0.179-0.906,  $p=0.028$ ).

**Conclusions:** Our findings revealed a relationship between having a prior cervical excision procedure and delivery mode. Women with a prior cervical excision procedure were at an increased risk of forceps delivery. The time interval between cervical excision procedure and pregnancy did not affect delivery mode.

## Background

Cervical cancer remains one of the most common gynecologic tumors of women, ranking as the fourth most frequently diagnosed cancer and the fourth leading cause of cancer death, with an estimated 570,000 cases and 311,000 deaths worldwide in 2018[1]. In China, Statistical Office reported on about 98,900 new cases and 30,500 deaths in 2015. And the morbidity and mortality of cervical cancer has been rising these days[2].

Cervical squamous intraepithelial lesion (SIL) is a potential precancerous lesion[3], with a high morbidity among women, and occurs most commonly during a woman's reproductive years[4]. Currently treatment for cervical squamous intraepithelial lesion relies on cervical excision procedure[4], mainly including loop electrosurgical excision procedure (LEEP) and cold knife conization (CKC), by excising dysplastic cells

from cervical tissue[5, 6]. This kind of surgery can not only make a damage to the cervical itself, but also affect the structure and function of uterus integrally.

An authoritative report showed that the incidence of cervical squamous intraepithelial lesion among all women in China was about 1.9% and the incidence of cervical excision procedure (LEEP or CKC) was about 1.3%[7]. The data of cervical squamous intraepithelial lesion was lower in Beijing, the capital of China, with an incidence of 0.6% [8]. Many young women with a history of prior cervical excision procedure have never given birth and have reproductive intention[9]. Between May 2016 and April 2018, 149 nulliparous women with a prior cervical excision procedure have given birth at Beijing Obstetrics and Gynecology Hospital, Capital Medical University. Thus, the impact of cervical excision procedure on delivery mode should be considered.

Controversy exists surrounding the impact of a prior cervical excision procedure on delivery mode. Prior studies showed that the incidence of Caesarean section rates among women with a prior cervical excision procedure varied widely, from 6.4–42.0% [6, 10–14]. Although, most studies demonstrated that a prior cervical excision procedure did not affect Caesarean section rates[10–13], some proved that Caesarean section rates were significant higher[14] or lower[6] among the women with a prior cervical excision procedure. In addition, the incidence of forceps rates among the women with a prior cervical excision procedure has not been calculated yet. Thus, the impact of cervical excision procedure on delivery mode still remains a controversial subject of debate.

The objective of this retrospective cohort study was to observe the delivery mode of women with a prior cervical excision procedure, and analyze the relationship between having a prior cervical excision procedure and delivery mode.

## Methods

### Study groups

This is a retrospective cohort study of women who have given birth at Beijing Obstetrics and Gynecology Hospital, Capital Medical University between May 2016 and April 2018. Among 149 nulliparous women with a history of prior cervical excision procedure, 115 women met the inclusion criteria and exclusion criteria, and were compared with 222 nulliparous women without such a history. The case and control subjects were matched by pre-pregnancy body mass index (BMI), weight gain during pregnancy, gestational age at delivery, tobacco use, alcohol use, pregnancy complications, fetal birth weight, nationality and area (1:2 matching), and only 222 women without a prior cervical excision procedure were conducted as control group. Study was approved by the Ethics Committee of the Beijing Obstetrics and Gynecology Hospital, Capital Medical University.

Inclusion criteria were: (1) aged 20–45 years; (2) singleton pregnancy; (3) term pregnancy ( $\geq 37$  weeks and  $< 42$  weeks); (4) nulliparous women; (5) complete clinical records.

Exclusion criteria were: (1) a history of uterine or vaginal surgery; (2) malformation of uterus or vagina; (3) with invasive carcinoma of uterine cervix; (4) with a significant cerebrovascular, renal, hepatic, endocrine disease or any major disease.

## DATA

Baseline clinical data, such as maternal age, pre-pregnancy body mass index (BMI), weight gain during pregnancy, gestational age at delivery, tobacco use, alcohol use, pregnancy complications (hypertensive disorders, gestational diabetes mellitus or diabetes mellitus), premature rupture of fetal membrane (PROM), delivery mode (spontaneous labor, forceps delivery or Caesarean sections delivery), fetal birth weight, time interval between cervical excision procedure and pregnancy, and indications for forceps or Caesarean sections were abstracted from the clinical records.

Time interval between cervical excision procedure and pregnancy was calculated from the day of cervical excision procedure to the first day of last menstrual period among the women with a history of cervical excision procedure.

## Statistical analysis

All statistical analysis were performed by using the SPSS 21.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were expressed as mean  $\pm$  SD. Qualitative variables were expressed as "n (%)". Non-normal distribution data were expressed by medians, quartiles and range. Student's t-test,  $\chi^2$ -test and Fisher's exact test were used for comparisons, as appropriate. The Kruskal Wallis rank test was used to estimate different time intervals between cervical excision procedure and pregnancy in different delivery modes. Uni-variable multinomial logistic regression was used to determine whether having a prior cervical excision procedure was associated with delivery mode. All tests were 2-tailed and a  $P < 0.05$  was considered significant.

## Results

Main characteristics of patient stratified by prior cervical excision procedure were shown in Table 1. Women with a prior cervical excision procedure were older ( $32.8 \pm 3.7$  vs  $30.9 \pm 3.5$ ,  $p < 0.001$ ), and were more likely to have a PROM (38.3% vs 27.0%,  $p = 0.034$ ). The proportion of forceps delivery (12.2% vs 5.9%,  $p = 0.043$ ) or Caesarean sections delivery (33.9% vs. 30.2%,  $p = 0.484$ ) were higher among women with a prior cervical excision procedure. The pre-pregnancy BMI, weight gain during pregnancy, gestational age at delivery, tobacco use, alcohol use, pregnancy complications (hypertensive disorders, gestational diabetes mellitus or diabetes mellitus), and fetal birth weight were comparable between the two groups ( $P > 0.05$ ) (Table 1).

The main indication for forceps delivery was to shorten the second stage of labor among women with a prior cervical excision procedure, significantly higher (50% vs 7.7%,  $p = 0.033$ ) among women without

such a history. Nevertheless, no differences were found in the indications for Caesarean sections delivery between the different groups (Table 2).

The data suggested that time interval between cervical excision procedure and pregnancy was not significantly associated with delivery mode ( $p = 0.445$ ) (Table 3 Fig. 1).

Table 4 showed uni-variable multinomial logistic regression analysis of cervical excision procedure for the outcome of delivery mode. By setting spontaneous labor as control, the result indicted that forceps delivery was associated with cervical excision procedure (OR = 0.403, 95%CI = 0.179–0.906,  $p = 0.028$ ).

## Discussion

The aim of our study was to observe the delivery mode of women with a prior cervical excision procedure, and analyze the relationship between having a prior cervical excision procedure and delivery mode.

Our study found that a prior cervical excision procedure was associated with an increased risk of forceps delivery ( $p = 0.034$ ), and the main purpose of forceps delivery was to shorten the second stage of labor ( $p = 0.033$ ). The cervix, which is consisted of smooth muscle, fibroblasts, epithelium, and blood vessels, is considered to play an important role in delivery [15, 16]. Theoretically, cervical excision procedure has an impact on the structure and function of the uterus, which may affect the process of labor. Our study confirmed the theory which can be explained by three aspects below. First of all, excision leads an incomplete cervix, which can cause the dis-coordination of uterine contractions and low level of integral efficiency of uterine contractions, and uterus will exert less direct force on uterine contents. Secondly, cervix has the ability to adjust the position of fetal head, and an incomplete cervix can influence position of fetal head which is more likely to lead a cephalic presentation dystocia. In addition, women with a prior cervical excision procedure were elder in our study, who might undergo a physiologic aging process of myometrial tissues and skeletal muscle [17]. Those three reasons may prolong the duration of the second stage of labor. Because a prolonged duration of the second stage of labor may increase potential risk for both mothers and infants, active treatments, such as forceps, to complete delivery are necessarily needed [18], which increases the risk of forceps delivery.

We did not find an association between having a prior cervical excision procedure and Caesarean sections delivery ( $p = 0.484$ ), similar with vast previous studies [10–13]. Theoretically, having a prior cervical excision procedure can affect the coordination of uterine contractions, which is more likely to result in dystocia and increases the risk of both forceps delivery and Caesarean sections delivery. However, our results did not confirm the inference. This was probably because the physicians didn't consider fully of the impact of a prior cervical excision procedure on the integral efficiency of uterine contractions, when they were selecting the proper delivery pattern. Those who should have a Caesarean section were suggested to go through a vaginal breech delivery. Because of the low level of integral efficiency of uterine contractions with an incomplete cervix, those women had to finish the delivery with the help of forceps, which increased the risk of forceps delivery and decreased the risk of Caesarean section delivery that was supposed to be.

Our study also indicated that the time interval between cervical excision procedure and pregnancy did not affect delivery mode ( $p = 0.445$ ). It happens because cervix is a growing organ[19]; because uterus can repair itself in a short time with abundant vascularity; because during the long period of pregnancy, uterus grows slowly and has enough time to repair itself to suit pregnancy and delivery condition. However, Liverani et al[13] reported that women who became pregnant within 12 months since LEEP showed a significantly lower rate of cesarean sections (31.6% vs. 44.3%,  $P = 0.03$ ) compared with women with a longer time interval from LEEP to pregnancy. Therefore, further study is still needed to increase the sample size, layer the time interval between cervical excision procedure and pregnancy, and observe the delivery mode between different layers of the time interval.

One of the strengths of this study is that few research have focused on forceps delivery after cervical excision procedure. The results can be used as references for delivery mode selection. Physicians should pay attention to the impact of a prior cervical excision procedure on delivery mode, select the delivery pattern properly, and keep both mothers and infants safe and healthy.

## Conclusions

In conclusion, our data demonstrate that having a prior cervical excision procedure can significantly increase the risk of forceps delivery compared with the general population. When physicians are selecting a proper delivery mode, having a prior cervical excision procedure should also be considered as an important indicator.

## Abbreviations

SIL  
cervical squamous intraepithelial lesion  
LEEP  
loop electrosurgical excision procedure  
CKC  
cold knife conization  
BMI  
body mass index

## Declarations

Ethics approval and consent to participate: The study was approved by the Ethics Committee of the Beijing Obstetrics and Gynecology Hospital, Capital Medical University. All individual participants in the study were over age 18 and were competent to give their own consent. All participants gave written informed consent to take part in the study.

Consent for publish: Not applicable.

Availability of data and materials: The data sets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests: The authors declare no competing interests.

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Authors' Contributions: YM collected the data, analyzed the data and wrote the manuscript. WJ edited the manuscript. ZC, YF and WZ collected the data. DY contributed to design and manuscript editing. All authors have read and approved the final version of the manuscript.

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20. **COVER LETTER.**
21. Dear editors.
22. **Please find attached. the manuscript "Analysis of the Impact of Cervical Excision Procedure on Delivery Mode" by YUAN et al. for consideration as an Original Article in BMC Pregnancy and Childbirth.**
23. **We focused on observing the delivery. mode of women with a prior cervical excision procedure, which was rarely mentioned in other articles.**
24. **In our paper, we found that women with a prior cervical excision procedure were at an increased risk of forceps delivery compared with general population. And we presented the idea that the a prior excision procedure can cause low level of integral efficiency of uterine contractions, which may prolong the second stage of labor and increase the risk of forceps delivery.**
25. **The idea of. "integral efficiency of uterine contractions" is A WHOLE NEW THEORY which is inspired by Alexander Romanovich Luria, a soviet psychologist and neuropsychologist, who has presented the integrity of brain function theory. We believe that our theory-integral efficiency of uterine contractions, will arouse the awareness of physicians and should be considered as an important indicator for delivery mode selection among women with a prior cervical excision procedure.**
26. **The research should. appeal to a broad audience interested in delivery mode of women with a prior cervical excision procedure. We thus believe that the manuscript is appropriate for the readership of BMC Pregnancy and Childbirth.**
27. **We. remain at your disposal for any further questions.**
28. **With. kind regards.**
29. **Min YUAN. and DAI Yinmei.**

## Tables

Due to technical limitations, table 1, 2 & 3 is only available as a download in the Supplemental Files section.

## Figures

