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MATERNO-FETAL MEDICINE

# Obstetric outcome following cervical conization

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**Abstract**
*Objective* The purpose of the present study was to examine obstetric outcome of patients following conization and specifically the risk for preterm delivery (PTD).
*Methods* A population-based study was performed comparing pregnancies in women following conization with those who had not undergone the procedure. Stratified analysis, using a multiple logistic regression model was performed to control for confounders.
*Results* Out of 104,670 deliveries, 53 women (0.05%) had undergone conization. Most conizations were performed using loop electrosurgical excision procedure (LEEP). Using multivariable analysis, the following conditions were significantly associated with conization: advanced maternal age, PTD before the 34th week, low birth weight, and cervical incompetence with cerclage. Higher rates of perinatal mortality were noted in pregnancies of women with conization, but after controlling for PTD, the association lost its significance. The risk of PTD <34 weeks was significantly higher than the comparison group (OR 7.73 95% CI 3.77–15.85, $p < 0.001$). This association remained significant after controlling for confounders, such as cervical incompetence, smoking, maternal age, birth order and year of delivery (OR 2.8 95% CI 1.3–6.1, $p = 0.008$). When comparing pregnancy outcomes of women with and without cerclage due to cervical incompetence, no significant differences were documented.
*Conclusions* A clear association exists between conization and PTD before the 34th week. This association persists after controlling for variables considered to coexist with PTD. Carful surveillance is required in pregnancies of women following conization for early detection of preterm contractions and PTD.

**Keywords** Conization · Cold knife · Loop electrosurgical excision procedure (LEEP) · Cerclage · Premature rupture of membranes (PROM)

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## Introduction

Cervical intraepithelial neoplasia (CIN) is a precancerous condition that is most prevalent during the third decade of life. In 93% of cases, the condition is linked to prior human papilloma virus (HPV) infection [1]. The cytologic screening test, taken from the cervix, has increased early diagnosis and decreased cervical cancer by treating precancerous lesions [1]. The purpose of conization is to excise the

precancerous areas, while preserving cervical function [2]. Two common methods are available: Cold knife conization (CKC) or loop electrosurgical excision procedure (LEEP), both have the same therapeutic effect [3]. However, each has its own advantages, disadvantages and possible complications [3–5].

Several reports evaluated the influence of these procedures on patient's obstetrical future. Mathevet et al. found that there was no major difference in obstetrical outcome between both techniques and that there were no related complications during the first and second trimesters [5]. Conversely, Crane et al. [6] found that both procedures were associated with a shorter cervical length and spontaneous preterm birth before 37 weeks . LEEP, the most common procedure today [7], was found to be associated with preterm delivery (PTD) and low birth weight in one study [8] at a risk rate of almost twice when compared with another [7]. Cold knife conization was also found to be a risk factor for preterm birth and premature rupture of membranes (PROM) [11]. In contrast, other studies indicate that conization does not influence PTD, low birth weight and PROM [9, 10].

Cervical cerclage is a treatment for cervical incompetence during pregnancy. In the clinical setting, cerclage is performed preventatively before pregnancy or during the first trimester. Alternatively, it is performed after detection of cervical changes during pregnancy. Sietske et al. [12] examined the results following cerclage with bed rest among women with cervixes shorter than 25 mm and a gynecological history of PTD. They reported that the procedure extended the duration of the pregnancy and reduced the risk of neonatal death as compared to women with bed rest alone [12]. Criteria and indications to perform cervical cerclage in women following conization remain undefined. The issue remains whether preventative cerclage, performed in women who had previously undergone cervical conization, will reduce the rates of PTD. The purpose of the present study was to examine obstetric outcome of patients following conization and specifically the risk for preterm delivery (PTD).

## Materials and methods

A retrospective population-based study comparing the obstetric outcome of women following conization with those who had not undergone the procedure was performed. Deliveries occurred at the Soroka University Medical Center. The study was approved by the local ethics institutional review board. Excluded from the study were multiple gestations and patients lacking prenatal care.

Data were collected from 40 medical records of women who had undergone conization (and details on their 57 deliveries), as well as from a computerized perinatal database that consists of information recorded directly following delivery by the treating obstetrician. All data entered into the database is first examined by a skilled medical secretary. Coding is performed after assessing the medical prenatal care records as well as the routine hospital documents. These procedures assure maximal completeness and accuracy of the database.

The following demographic and clinical characteristics were collected: maternal age, gravidity, parity and gestational age at delivery. The following obstetric conditions were examined: the indication for performing conization, the type of conization performed, fertility treatments, previous cesarean sections (CS), hypertensive disorders, gestational diabetes mellitus, recurrent abortions (two or more consecutive spontaneous abortions), PROM and placenta previa. The following labor characteristics and perinatal outcomes were assessed: vacuum extraction, CS, labor induction, failed labor induction, Apgar scores at 1 and 5 min under 7, fetal distress (non-reassuring fetal heart rate), congenital malformations, perinatal mortality and birth weight.

Statistical analysis was performed using SPSS software (SPSS, Chicago, IL). Statistical significance was ascertained using the $\chi^2$ test, or Fisher's exact test for differences in qualitative variables and $t$ test for differences in continuous variables. A multivariable logistic regression model, with backward elimination, was constructed to identify independent risk factors associated with PTD and to control for confounders. Odds ratios (OR) and their 95% confidence interval (CI) were computed. $P < 0.05$ was considered statistically significant. Stratified analysis using Mantel–Haenszel technique, was performed to assess any association between conization and perinatal mortality, controlling for PTD.

## Results

During the study period, 104,670 deliveries were recorded in our medical center; of those, 53 deliveries (0.05%) were in women following conization. When the medical records were examined, 57 deliveries were found. The discrepancy between these two databases is because the delivery record database had a recording gap. According to the data collected from the medical records database (Table 1), the most common conization procedure was LEEP; 11 women (27.5%) had abortions following conization, of which 64.3% ($n = 9$) were spontaneous. High rates of cerclage for cervical incompetence were seen among these patients, with a mean gestational age during the procedure of 12.5 weeks. CS was performed in 24.6% of labors and 8.77% of the deliveries ended in neonatal death. Figure 1

**Table 1** Clinical characteristics of women who undergo conization

| Characteristics | *n* | % |
|---|---|---|
| Conization type | | |
| Cold knife | 7 | 17.1 |
| LEEP | 18 | 43.1 |
| Laser | 2 | 4.9 |
| Other | 14 | 34.1 |
| Conization > 1 | 1 | 2.5 |
| Histology of cervical biopsy | | |
| CIN1 | 1 | 2.5 |
| CIN2 | 3 | 7.5 |
| CIN3 | 25 | 62.5 |
| HPV | 1 | 2.5 |
| Unknown | 10 | 25 |
| Miscarriage after conization | | |
| Total | 14 | 64.3 |
| Spontaneous | 9 | 28.6 |
| Initiated | 4 | 7.1 |
| Unknown | 1 | |
| Smoking during pregnancy | | |
| Smoker | 24 | 42.1 |
| Non smoker | 25 | 43.96 |
| Unknown | 8 | 14 |
| Cesarean section | 14 | 24.6 |
| Reason for CS | | |
| Malpresentation | 4 | 7 |
| PROM | 2 | 3.5 |
| Placenta previa | 1 | 1.7 |
| Previous CS | 2 | 3.5 |
| Other | 5 | 8.8 |
| Cerclage | | |
| Total | 18 | 31.6 |
| Mean week | 12.5 | |
| Perinatal mortality | | |
| APD | 2 | 3.5 |
| PPD | 1 | 1.7 |
| IPD | 2 | 3.5 |

shows the distribution of conization according to procedure type. The most widely performed procedure was LEEP (43.1%).

Clinical characteristics of all enrolled is presented in Table 2. Several significant differences were found between women who underwent conization and those who had not: treated patients were older (32.22 ± 4.58 vs. 29.52 ± 5.53, $p < 0.001$); they delivered earlier (37.31 ± 4.09 vs. 39.07 ± 2.32, $p < 0.001$) had lower birth weight, and had higher rates of adverse obstetrical history, fertility treatments, cervical incompetence, and perinatal mortality. The association between conization and perinatal mortality lost its significance while controlling for PTD using the Mantel–Haenszel technique (weighted OR 1.24, 95% CI 0.32–4.86).

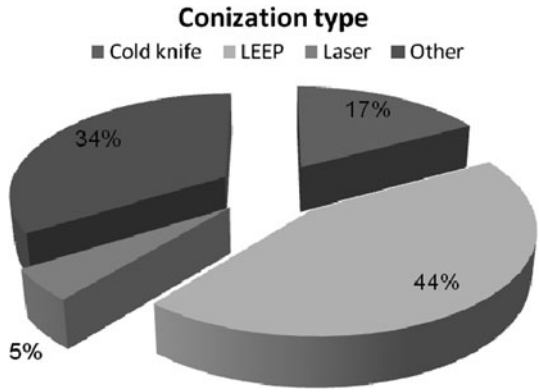


**Fig. 1** Distribution of conization type as it was recorded in the files

Table 3 presents comparisons between patients within the conization group with and without cerclage. There were no statistically significant differences comparing obstetric characteristics and perinatal outcomes between both groups.

Women following conization were at an increased risk of PTD. Using multivariable analysis with backward elimination conization was found to be an in depended risk factor for PTD even after controlling for confounders (Table 4). Women after conization were almost three times more likely to suffer from PTD as compared to women without conization (OR 2.8, 95% CI 1.3–6.1).

## Discussion

The major finding of our study is the association between conization and PTD, even after controlling for variables considered to coexist with PTD. Conization is a procedure mainly performed in young women, while they are still fertile. Controversy exists in the literature regarding the obstetric outcome following the procedure. In most studies, similar characteristics were examined; PROM [2, 6–8, 11], PTD [2, 8, 11–14] and low birth weight [2, 8]. In some cases, researchers compared different types of conization [2, 4–6], while others examined a single method [7–10].

The major finding in our study was that conization is an independent risk factor for PTD before the 34th week of gestation. This remained significant even after controlling for confounders that are directly connected to PTD.

A statistically significant lower birth weight was found in pregnancies of women following conization. This finding is supported by the results from previous studies [2, 6, 8, 11] basically due to the earlier gestational age at delivery. Accordingly, this increased the risk of pregnancy

**Table 2** A characteristics comparison between women with and without conization

| Characteristics | Conization ($n$ = 53) (%) | No conization ($n$ = 104,617) (%) | OR | 95% CI | $P$ value |
|---|---|---|---|---|---|
| Maternal age (years ± SD) | 32.22 ± 4.58 | 29.52 ± 5.53 | | | <0.001 |
| Gestational age (weeks ± SD) | 37.31 ± 4.09 | 39.07 ± 2.32 | | | <0.001 |
| Birth weight (mean ± SD) | 2,983.29 ± 798.0 | 3,179.48 ± 580.3 | | | 0.014 |
| Birth week <34 | 17.0 | 2.6 | 7.73 | 3.77–15.85 | <0.001 |
| Adverse obstetrical history | 13.2 | 2.6 | 5.78 | 2.60–12.80 | <0.001 |
| Recurrent abortions | 5.7 | 4.6 | 1.25 | 0.39–4.00 | 0.736 |
| Fertility treatments | 11.3 | 4.1 | 3 | 1.28–7.04 | 0.020 |
| Cervical incompetent with cerclage | 34 | 0.8 | 62.63 | 35.33–111.03 | <0.001 |
| PROM | 15.1 | 7.7 | 2.12 | 1.0–4.5 | 0.064 |
| Abruptio placenta | 3.8 | 0.7 | 5.45 | 1.32–22.44 | 0.055 |
| Epidural analgesia | 39.6 | 22.1 | 2.32 | 1.34–4.02 | 0.002 |
| Cesarean delivery | 24.5 | 15.9 | 1.71 | 0.92–3.20 | 0.088 |
| Perinatal mortality | 5.7 | 1.1 | 5.58 | 1.74–17.93 | 0.019 |

Data are presented as percentages, odds ratio (OR), 95% confidence intervals (CI) and $P$ values for statistical significance

**Table 3** A characteristics comparison between women with or without cerclage after conization

| Characteristics | Cerclage ($n$ = 18) (%) | No cerclage ($n$ = 35) (%) | OR | 95% CI | $P$ value |
|---|---|---|---|---|---|
| Maternal age (years ± SD) | 31.05 ± 4.82 | 32.83 ± 4.41 | | | 0.18 |
| Gestational age (weeks ± SD) | 36.30 ± 4.14 | 37.82 ± 4.02 | | | 0.20 |
| Birth weight (mean ± SD) | 2,984.67 ± 754.45 | 2,982.54 ± 830.26 | | | 0.99 |
| Preterm delivery | 38.9 | 14.3 | 3.82 | 1.0–14.57 | 0.08 |
| Abruptio placenta | 5.6 | 2.9 | 2.0 | 0.12–33.97 | 1.0 |
| PROM | 11.1 | 17.1 | 0.60 | 1.11–3.35 | 0.70 |
| Neonatal death | 5.6 | 5.7 | 0.97 | 0.082–11.48 | 1.0 |
| Low birth weight | 11.1 | 17.1 | 0.60 | 1.11–3.35 | 0.70 |

Data are presented as percentages, odds ratio (OR), 95% confidence intervals (CI) and $P$ values for statistical significance

**Table 4** Multiple logistic regression with backward elimination of risk factors associated with preterm delivery ($n$ = 104,655)

| Characteristic | Odds ratio | 95% CI | $P$ value |
|---|---|---|---|
| Conization | 2.82 | 1.31–6.08 | 0.008 |
| Cervical Incompetent with cerclage | 5.95 | 4.86–7.28 | <0.001 |
| Smoking | 1.49 | 1.21–1.82 | <0.001 |
| Maternal age (years) | 1.04 | 1.03–1.05 | <0.001 |
| Birth order | 0.85 | 0.83–0.88 | <0.001 |
| Year of delivery | 1.03 | 1.02–1.04 | <0.001 |

complications affected the obstetric outcome. A higher rate of perinatal mortality, which again was attributed to PTD [2].

Several studies have attempted to explain the reason for PTD following conization. In a study by Salder, a correlation was found between the height of the removed conization cone and the risk of PTD. It was suggested that the more tissue you remove the more likely it would affect the function of the cervix [7, 9]. Krygiou et al. [2] analyzed 27 different studies in a meta-analysis and found that the removal of more than 10 mm of cervical tissue increased the risk of PTD. Early diagnosis of pre-cancerous lesions can reduce the amount of tissue taken from the cervix which has been proven to have a direct influence on future obstetric outcomes [2]. Unfortunately, we could not retrieve such information from the files and, therefore, could not relate to this point. Interestingly, Himes et al. [13] found that women who conceived within 2–3 months of LEEP were at greater risk of PTD. This finding was based on a small cohort of five patients and, therefore, larger studies are needed to validate this correlation and such a connection may influence the optimal timing for conceiving after conization to prevent PTD and its complications. In our study, no women conceived within 2–3 months from conization.

Cervical cerclage is the treatment of choice for cervical incompetence in pregnancies. LEEP was the most common

type of conization performed (43.1%), similar to data from previous studies [2, 7]. The procedure may be performed at different stages for prevention as well as for treatment. The question whether cerclage will improve obstetric outcome has not been addressed, as the subject was not examined for cervical shortening following conization [12]. In our study, cerclage was performed due to cervical incompetence in one-third of the pregnancies after conization. There were no significant differences comparing the obstetrics characteristics and perinatal outcomes between those with and without cerclage. A possible explanation is that women who were in need of cerclage had cervical incompetence in early weeks of their pregnancy (mean of 12.5 weeks), which successfully prevented obstetric complications and made the delivery outcomes equal to those of women who did not suffer from it.

In conclusion, a significant association exists between conization and PTD before the 34th week. This association persists after controlling for variables considered to coexist with PTD. Careful surveillance is required in pregnancies of women following conization, for early detection of possible complications, mainly PTD.

**Conflict of interest** None.

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