

Original article

OUTCOME OF PREGNANCIES AFTER CO₂ LASER VAPORIZATION FOR CERVICAL INTRAEPITHELIAL NEOPLASIA: A RETROSPECTIVE COHORT STUDYИСХОД ОД БРЕМЕНОСТ ПО СО₂ ЛАСЕРСКА ВАПОРИЗАЦИЈА КАЈ ЦЕРВИКАЛНА ИНТРАЕПИТЕЛНА НЕОПЛАЗИЈА: РЕТРОСПЕКТИВНА КОХОРТНА СТУДИЈА

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Abstract

Introduction. To evaluate obstetric and neonatal outcomes among women who conceived after CO₂ laser vaporization for cervical intraepithelial neoplasia (CIN), compared with women with normal cervical cytology.

Methods. Ninety-four women who underwent CO₂ laser vaporization for biopsy-confirmed CIN and subsequently achieved pregnancy were compared with 100 age- and parity-matched controls with normal cytology and no prior cervical procedures.

CO₂ laser vaporization performed under colposcopic guidance using standardized parameters (spot size 1 mm, depth 7-8 mm). Conception rate, miscarriage, preterm birth (<37 weeks), cervical insufficiency, mode of delivery, neonatal birth weight, and NICU admission.

Results. Women in the treated group had similar conception rates to controls (86.2% vs. 88.0%, $p=0.73$). Miscarriage occurred in 9.6% vs. 8.0% ($p=0.69$). Preterm birth <37 weeks was slightly more frequent after CO₂ laser vaporization (11.7% vs. 5.0%, OR 2.51, 95% CI 0.92-6.85). Cervical insufficiency was observed in 4.3% vs. 1.0% ($p=0.18$). Mean birth weight was 3120±460 g vs. 3250±440 g ($p=0.07$). Neonatal outcomes and cesarean section rates did not differ significantly.

Conclusion. CO₂ laser vaporization for CIN was not associated with significant impairment of fertility or major adverse obstetric outcomes. A small, nonsignificant trend toward preterm delivery warrants cautious antenatal surveillance.

Keywords: cervical intraepithelial neoplasia, CO₂ laser vaporization, pregnancy outcome, preterm birth, cervical insufficiency.

исход кај жени кои забремениле по СО₂ ласерска вапоризација кај пациентки со цервикална интраепителна неоплазија (CIN), т.е. цервикална сквамозна интраепителна лезија (SIL), во споредба со жени со нормална цервикална цитологија.

Методи. Деведесет и четири жени кои биле третирани со СО₂ ласерска вапоризација за биопсија-потврдена CIN лезија и кои подоцна забремениле беа споредени со 100 контролни жени кои имаат нормална цитологија и немаат претходни цервикални интервенции.

СО₂ ласерска вапоризација изведена под колпоскопска контрола со стандардизирани параметри (големина на точката 1 мм, длабочина 7-8 мм). Стапка на забременување, спонтан абортус, предвремено раѓање (<37 недели), цервикална инсуфициенција, начин на породување, неонатална тежина при раѓање и хоспитализација на Оддел за неонатална интензивна нега (NICU).

Резултати. Жените кои биле третирани имале слични стапки на забременување како и контролните (86,2% наспроти 88,0%, $p=0,73$). Спонтан абортус се случил во 9,6% против 8,0% ($p=0,69$). Предвремено раѓање <37 недели било нешто почесто по СО₂ ласерска вапоризација (11,7% наспроти 5,0%, OR 2,51, 95% CI 0,92-6,85). Цервикална инсуфициенција била забележана кај 4,3% наспроти 1,0% ($p=0,18$). Средната тежина при раѓање била 3120±460 г наспроти 3250±440 г ($p=0,07$). Неонаталниот исход и стапките на царски рез не се разликувале значително.

Заклучок. СО₂ ласерска вапоризација кај CIN не била поврзана со значително оштетување на фертилноста или сериозни неповолни обстетрички исходи. Мала, незначителна тенденција кон предвремено породување бара внимателна антенатална контрола.

Клучни зборови: Цервикална интраепителна неоплазија, СО₂ ласерска вапоризација, исход на бременост, предвремено раѓање, цервикална инсуфициенција

Апстракт

Вовед. Да се процени обстетричкиот и неонатален

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Introduction

Cervical intraepithelial neoplasia (CIN) or Squamous Intraepithelial Lesion (SIL) according to the actual nomenclature, represents the premalignant spectrum of cervical epithelial changes associated with persistent high-risk human papillomavirus (HPV) infection. Management aims to eradicate dysplastic epithelium while preserving cervical integrity, particularly in reproductive-aged women. Excisional methods such as loop electrosurgical excision procedure (LEEP) or cold-knife conization are associated with subsequent obstetric complications, including cervical insufficiency and preterm birth [1-5].

Ablative techniques such as CO₂ laser vaporization have been proposed as fertility-preserving alternatives, as they destroy abnormal tissue without excision, theoretically minimizing cervical trauma [1,2]. Nevertheless, the depth and circumferential area of tissue destruction might still compromise cervical strength or mucus production, affecting conception or pregnancy maintenance. While reproductive outcomes after excisional techniques have been extensively studied [3-5], fewer studies have evaluated CO₂ laser vaporization specifically. Earlier reports suggest minimal adverse reproductive impact [1,2], but the literature remains inconsistent, partly due to heterogeneity in laser depth, follow-up duration, and confounding obstetric variables.

This retrospective cohort study aimed to assess fertility, obstetric, and neonatal outcomes among women who conceived after CO₂ laser vaporization for CIN, compared with women of similar reproductive background and normal cervical cytology. We hypothesized that CO₂ laser vaporization would not significantly impair conception or obstetric outcomes compared to untreated controls.

Materials and Methods

Study Population

Two groups were identified from electronic medical records:

1. Treated group (n=94): women aged 20-40 years with biopsy-confirmed CIN I-III who underwent CO₂ laser vaporization and subsequently achieved at least one pregnancy during follow-up.
2. Control group (n=100): age- and parity-matched women with normal cervical cytology, no history of cervical surgery or pathology, and at least one pregnancy during the same period.
3. Exclusion criteria included multiple gestation, known uterine anomalies, preexisting hypertension or diabetes, and smoking >10 cigarettes/day.

Procedure Details

Laser vaporization was performed under colposcopic guidance using a continuous-wave CO₂ laser (10.6 μm wavelength). Ablation depth was 7-8 mm, consistent with established fertility-sparing parameters [1,2]. Hemostasis was achieved with minimal thermal coagulation. Patients were advised to avoid conception for at least six months post-procedure.

Data Collection

Demographic, gynecological, and obstetric data were extracted from electronic records. Outcomes assessed included:

1. Conception rate (within 24 months of attempting pregnancy)
2. Miscarriage (<20 weeks gestation)
3. Preterm birth (<37 weeks gestation)
4. Cervical insufficiency (painless cervical dilation requiring cerclage)
5. Mode of delivery
6. Neonatal outcomes: birth weight, Apgar score at 5 min, NICU admission

Statistical Analysis

Continuous variables were expressed as mean ±SD; categorical variables as number and percentage. Between-group comparisons were performed using the Student t-test or χ^2 test as appropriate. Logistic regression was used to calculate odds ratios (ORs) with 95% confidence intervals (CIs), adjusting for age, parity, and previous miscarriage [1-5].

Results

Baseline Characteristics

Baseline characteristics were comparable between groups (Table 1). Mean age at conception was 31.4±4.3 years in the treated group vs. 30.9±4.6 years in controls (p=0.48). Mean time to conception did not differ significantly (10.3±5.6 months vs. 9.8±5.4 months, p=0.57). The proportion of nulliparous women was similar (63.8% vs. 61.0%, p=0.70).

HPV-related Outcomes

Among the 94 women included in the study, 23 were diagnosed with persistent CIN I ectocervical lesions, while 72 presented with CIN II ectocervical lesions. HPV genotyping showed that 42 women were infected with HPV type 16 and 16 with HPV type 18, whereas the remaining participants had other high-risk HPV types, 12 of whom had multiple infections.

Table 1. Baseline Characteristics of Study Participants

Variable	CO ₂ Laser Group (n = 94)	Control Group (n = 100)	p-value
Age at conception (years, mean ± SD)	31.4 ± 4.3	30.9 ± 4.6	0.48
Nulliparous, n (%)	60 (63.8)	61 (61.0)	0.70
BMI (kg/m ² , mean ± SD)	24.1 ± 3.5	23.7 ± 3.8	0.54
Previous miscarriage, n (%)	9 (9.6)	10 (10.0)	0.93
Interval from procedure to conception (months, mean ± SD)	14.2 ± 6.7	—	—
CIN grade (I / II / III), n (%)	35 / 41 / 18	—	—

Obstetric Outcomes

Conception rates within two years were comparable between the treated and control groups (86.2% vs. 88.0%, $p=0.73$). Miscarriage occurred in 9.6% vs. 8.0% ($p=0.69$). Preterm birth <37 weeks occurred in 11.7% of pregnancies following CO₂ laser vaporization compared with 5.0% in controls (adjusted OR 2.51, 95% CI

0.92-6.85, $p=0.07$) [1,2,4,5,7]. Cervical insufficiency was diagnosed in 4.3% of treated women and 1.0% of controls ($p=0.18$) [1,2,7,8]. Two women in the treated group required prophylactic cerclage for cervical shortening at 18-20 weeks; both delivered at term. Cesarean delivery rates did not differ significantly (32.9% vs. 29.0%, $p=0.59$), with indications predominantly fetal distress and previous cesarean section [1-5,7].

Table 2. Obstetric Outcomes

Outcome	CO ₂ Laser Group (n = 94)	Control Group (n = 100)	OR (95% CI)	p-value
Conception within 2 years, n (%)	81(86.2)	88(88.0)	0.84 (0.37-1.90)	0.73
Miscarriage, n (%)	9(9.6)	8(8.0)	1.22 (0.46-3.27)	0.69
Preterm birth <37 wks, n (%)	11(11.7)	5(5.0)	2.51 (0.92-6.85)	0.07
Cervical insufficiency, n (%)	4(4.3)	1(1.0)	4.47 (0.49-40.2)	0.18
Cesarean delivery, n (%)	31(32.9)	29(29.0)	1.20 (0.65-2.20)	0.59

Neonatal Outcomes

Neonatal outcomes, including NICU admission and Apgar scores, were comparable [1,2,7]. Mean birth weight was slightly lower in the treated group (3120±460

g vs. 3250±440 g, $p=0.07$). Mean Apgar score at 5 minutes was 8.9±0.7 vs. 9.0±0.5 ($p=0.46$). NICU admission occurred in 4.3% vs. 3.0% ($p=0.63$). There were no cases of neonatal death or congenital malformation in either group.

Table 3. Neonatal Outcomes

Outcome	CO ₂ Laser Group (n=94)	Control Group (n=100)	p-value
Birth weight (g, mean ± SD)	3120 ± 460	3250 ± 440	0.07
Apgar score at 5 minutes (mean ± SD)	8.9 ± 0.7	9.0 ± 0.5	0.46
NICU admission, n (%)	4 (4.3)	3 (3.0)	0.63
Neonatal death, n (%)	0 (0%)	0 (0%)	—

Discussion

This retrospective cohort study found that women who conceived after CO₂ laser vaporization for CIN experienced obstetric and neonatal outcomes comparable to women with normal cervical cytology. Fertility was not impaired, miscarriage and cesarean rates were similar, and while there was a nonsignificant trend toward increased preterm birth and cervical insufficiency, the overall pregnancy outcomes were reassuring [1-5,7,8].

Our findings align with prior studies indicating that ablative treatments pose far less obstetric risk than excisional procedures [1,2,4-8]. Preterm birth rates (11.7%) are consistent with literature showing low-to-moderate risk after superficial cervical procedures [1,2]. In contrast, excisional depth >10 mm correlates with higher preterm delivery risk [4-8]. Hagen B *et al.* (1993) and Kyrgiou *et al.* (2016) demonstrated that ablative methods, including CO₂ laser vaporization, are less likely than excisional techniques (LEEP, cold knife) to increase preterm birth risk [9,10].

Conversely, multiple large meta-analyses (e.g., Kyrgiou *et al.* BMJ 2016;) confirm that excisional depth >10 mm correlates with higher preterm delivery risk [9].

Laser vaporization destroys epithelium while preserving stromal collagen, reducing the risk of cervical shortening seen after excisional techniques [1,2]. Healing is more uniform, with minimal scarring compared with LEEP [1,2].

CO₂ laser vaporization remains a viable fertility-sparing option for reproductive-aged women requiring CIN treatment. Women should be informed of a small potential increase in preterm delivery risk, and obstetric care should include cervical length monitoring during pregnancy [1-8].

Conflict of interests: None declared.

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