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# Clinical Efficacy of Laparoscopic Uterine Isthmus Cerclage in the Treatment of Cervical Insufficiency and Its Impact on Perinatal Outcomes

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**Abstract:** *Objective:* To investigate the efficacy of laparoscopic cervical isthmus cerclage and its impact on perinatal outcomes in patients with cervical insufficiency (CIC). *Methods:* A total of 120 patients with CIC admitted from July 2016 to July 2023 were randomly assigned to two groups. Group A underwent laparoscopic cervical isthmus cerclage, while Group B received vaginal cervical isthmus cerclage. Perinatal outcomes were compared. *Results:* Group A demonstrated shorter operation and hospitalization times compared to Group B ($P < 0.05$). Intraoperative blood loss was also significantly less in Group A ($P < 0.05$). The treatment success rate in Group A was higher than that in Group B ($P < 0.05$). During pregnancy, the cervical length in Group A was greater, and the perinatal body weight was higher compared to Group B ($P < 0.05$). Additionally, the postoperative complication rate was lower in Group A ($P < 0.05$), and the SF-36 score of CIC patients in Group A was higher than that in Group B ($P < 0.05$). *Conclusion:* Laparoscopic cervical isthmus cerclage demonstrates the potential to reduce the duration of the disease, increase perinatal body weight, improve treatment success rates, and enhance the quality of life for patients with CIC.

**Keywords:** Cervical insufficiency; Laparoscopic surgery; Uterine isthmus cerclage; Perinatal outcome

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## 1. Introduction

Cervical insufficiency (CIC) refers to the pathological condition wherein the physiological anatomy and functional integrity of the cervix cannot be sustained until full-term pregnancy without uterine contractions. Particularly during the second and third trimesters, symptoms such as painless cervical dilation, cervix shortening, and even fetal membranes exposure may manifest. Premature rupture can lead to early labor and miscarriage [1]. Immediate surgical intervention is essential following the occurrence of CIC. The conventional surgical approach involves vaginal and cervical isthmus cerclage. However, this procedure poses challenges,

including incomplete exposure of the surgical field, hindering accurate execution by the surgeon, and making the process more intricate. This issue may inadvertently lead to damage to adjacent tissues, impacting fetal growth and development. With the gradual maturation of laparoscopic technology, it has found widespread application in surgical procedures. Some scholars propose completing isthmic cervical cerclage under laparoscopic guidance, avoiding the need for vaginal involvement in the surgical process. This approach can minimize surgical trauma, expand the surgeon's field of vision, and reduce procedural complexity [2]. This study utilizes 120 patients with CIC admitted between July 2016 and July 2023 to investigate the efficacy of laparoscopic surgery.

## 2. Materials and methods

### 2.1. General information

A sample of 120 patients diagnosed with CIC, admitted between July 2016 and July 2023, was randomly assigned to two groups. Group A comprised individuals aged 22–37, with an average age of 29.51 ± 1.84 years. The gestational age at surgery ranged from 18 to 22 weeks, with an average of 20.58 ± 1.51 weeks. Similarly, Group B included patients aged 22–38, with an average age of 29.48 ± 1.82 years. The gestational age at surgery ranged from 18 to 23 weeks, with an average of 20.61 ± 1.49 weeks. No significant differences were observed in the data of CIC patients between groups A and B, with $P > 0.05$.

### 2.2. Inclusion and exclusion standards

Inclusion criteria:

(1) CIC was diagnosed before surgery, characterized by cervix relaxation during non-pregnancy and passage of the No. 8 dilator.
(2) History of unexplained miscarriage.
(3) B-ultrasound indicating internal cervical os > 0.6 cm and the cervical length < 2.5 cm.
(4) Informed consent.
(5) Absence of contractions before delivery.

Exclusion criteria:

(1) Presence of uterine fibroids, endocrine disorders, or immune dysfunction causing miscarriage.
(2) Presence of chronic diseases affecting surgery.
(3) Presence of reproductive system infections.
(4) Presence of malignant tumors.

### 2.3. Treatment methods

To prepare for surgery, patients were advised to abstain from sexual intercourse for 3–7 days. Patients are guided to undergo a comprehensive preoperative assessment, including blood routine, urine routine, electrocardiogram, coagulation function, and liver and kidney function tests. Those deemed unsuitable for surgery were omitted.

In Group A, patients were placed under general anesthesia and positioned under lithotomy. A uterine lifting device supported the vagina while elevating the uterus, with careful consideration to avoid unnecessary pressure on pregnant women's uteri. Three puncture points were established at the umbilicus and lower abdominal area. The laparoscope and operating instruments were introduced through these puncture points. Utilizing a monopolar electric hook, the peritoneum of the bladder was incised, and the bladder was gently pushed down to expose the uterine isthmus and bilateral blood vessels. A needle was inserted into the non-vascular area

within the blood vessels, approximately 2–3 mm away from the bilateral blood vessels. The needle was then directed through the muscle layer and removed between the uterosacral ligament or uterine artery. The suture was completed without knotting at this stage. After removing the uterine elevator, laparoscopy was employed to ensure the suture had not penetrated the cervical canal. If no issues were identified, the suture was flattened, the tie ring was tightened and knotted behind the cervix, and the operation concluded. Postoperatively, the tightness was verified to ensure resistance to the passage of the No. 6 uterine dilation rod through the cervical opening. A laparoscopy was performed again to confirm the smoothness of the fallopian tube. Prophylactic anti-infective drugs were administered.

In Group B, epidural anesthesia was administered after bowel preparation. A vaginal retractor facilitated full exposure of the posterior vaginal fornix and cervix. Cervical forceps were used to grasp the front lip. Using No. 10 silk thread, a needle was inserted between 11 o'clock and 10 o'clock, ensuring it did not penetrate the cervical mucosa but reached the 2/3 area of the cervix base. The same technique was applied to areas such as 8 and 7 o'clock, 5 and 4 o'clock, 2 and 1 o'clock, followed by approximately 2 cm suturing extended to the edge of the cervix. The procedure concluded by tying a knot in the fornix area.

### 2.4. Observation indicators

(1) Surgical indicators: Document the operation time, hospitalization time, and intraoperative blood loss.
(2) Treatment success rate: Record the occurrences of miscarriages, premature births, and full-term births.
(3) Pregnancy indicators: Document cervical length and perinatal weight during pregnancy.
(4) Complications: Record instances of vaginal bleeding, vaginitis, and heavy bleeding.
(5) Quality of life: The SF-36 score is positively correlated with the quality of life of CIC patients.

### 2.5. Statistical research

CIC patient data were processed using SPSS 21.0. Percentages were recorded for CIC patient count data, and means with standard deviation (SD) were recorded for CIC patient measurement data. Statistical differences were assessed using the chi-squared test for count data and the *t*-test for measurement data. A significance level of $P < 0.05$ was considered indicative of a statistical difference.

## 3. Results

### 3.1. Surgical indicators

Group A exhibited shorter operation and hospitalization times compared to Group B, with less intraoperative blood loss ($P < 0.05$), as shown in **Table 1**.

**Table 1.** Comparison of surgical indicators in patients with CIC (mean ± SD)

| Group | Operation time (min) | Length of stay (d) | Intraoperative blood loss (mL) |
|---|---|---|---|
| Group A ($n = 60$) | 40.88 ± 1.28 | 5.87 ± 1.14 | 13.28 ± 1.84 |
| Group B ($n = 60$) | 47.81 ± 2.16 | 15.21 ± 2.08 | 28.44 ± 2.06 |
| $t$ | 21.3797 | 30.5016 | 42.5143 |
| $P$ | 0.0000 | 0.0000 | 0.0000 |

### 3.2. Treatment success rate

**Table 2** shows that the treatment success rate for CIC in Group A surpassed that in Group B ($P < 0.05$).

**Table 2.** Comparison of treatment success rates for CIC patients [*n* (%)]

| Group | Abortion | Premature birth | Full term | Success rate |
|---|---|---|---|---|
| Group A (*n* = 60) | 1 (1.67) | 5 (8.33) | 54 (90.00) | 59 (98.33) |
| Group B (*n* = 60) | 8 (13.33) | 7 (11.67) | 45 (75.00) | 52 (86.67) |
| $\chi^2$ | - | - | - | 5.8859 |
| *P* | - | - | - | 0.0153 |

## 3.3. Pregnancy indicators

During pregnancy, Group A showcased a longer cervical length and a higher perinatal weight compared to Group B ($P < 0.05$), as shown in **Table 3**.

**Table 3.** Comparison of pregnancy indicators in patients with CIC (mean ± SD)

| Group | Cervical length during pregnancy (cm) | Perinatal body weight (g) |
|---|---|---|
| Group A (*n* = 60) | 4.41 ± 1.21 | 3,000.44 ± 361.25 |
| Group B (*n* = 60) | 3.52 ± 1.05 | 2,551.61 ± 308.52 |
| *t* | 4.3032 | 7.3182 |
| *P* | 0.0000 | 0.0000 |

## 3.4. Postoperative complications

**Table 4** shows that the incidence of postoperative complications in Group A was lower than that in Group B ($P < 0.05$).

**Table 4.** Comparison of postoperative complications in patients with CIC [*n* (%)]

| Group | Vaginal bleeding | Vaginitis | Heavy bleeding | Incidence |
|---|---|---|---|---|
| Group A (*n* = 60) | 1 (1.67) | 0 (0.00) | 0 (0.00) | 1 (1.67) |
| Group B (*n* = 60) | 4 (6.67) | 2 (3.33) | 0 (0.00) | 6 (10.00) |
| $\chi^2$ | - | - | - | 5.8859 |
| *P* | - | - | - | 0.0153 |

## 3.5. Quality of life

Following surgery, the SF-36 score for CIC patients in Group A exceeded that of Group B ($P < 0.05$), as shown in **Table 5**.

**Table 5.** Comparison of SF-36 scores in CIC patients before and after surgery (mean ± SD)

| Group | Good health (points) | | Mental health (points) | | Social functions (points) | | Physiological functions (points) | |
|---|---|---|---|---|---|---|---|---|
| | Before | After | Before | After | Before | After | Before | After |
| Group A (*n* = 60) | 62.81 ± 3.25 | 78.41 ± 4.18 | 63.11 ± 3.36 | 79.22 ± 4.21 | 62.48 ± 3.42 | 78.58 ± 4.82 | 61.28 ± 3.31 | 79.25 ± 4.91 |
| Group B (*n* = 60) | 62.79 ± 3.23 | 71.64 ± 3.25 | 63.13 ± 3.39 | 72.08 ± 4.07 | 62.43 ± 3.39 | 71.88 ± 3.68 | 61.31 ± 3.33 | 71.65 ± 3.88 |
| *t* | 0.0338 | 9.9041 | 0.0325 | 9.4449 | 0.0804 | 8.5581 | 0.0495 | 9.4071 |
| *P* | 0.9731 | 0.0000 | 0.9742 | 0.0000 | 0.9360 | 0.0000 | 0.9606 | 0.0000 |

## 4. Discussion

CIC is associated with multiple miscarriages, multiple pregnancies, and a decline in cervical function. As pregnancies progress into the middle and late stages, the cervix's inability to maintain its length increases the risks of premature birth and miscarriage [3]. Additionally, congenital uterine structural abnormalities in some women can also contribute to CIC. Currently, clinical treatment for CIC involves the use of vaginal cervical cerclage. However, issues such as incomplete exposure of the surgical field and significant intraoperative bleeding pose challenges, jeopardizing the safety of both the mother and the baby in the later stages of pregnancy and potentially affecting the overall outcome [4].

In recent years, there has been a gradual adoption of laparoscopy-assisted uterine isthmus cervical cerclage for treating CIC. With laparoscopic assistance, a laparoscope is inserted through the abdominal cavity to complete the uterine isthmus surgical operation, eliminating the need for a vaginal procedure and enhancing safety. Through a clinical analysis, it has been observed that laparoscopically assisted uterine isthmus surgery, characterized by a small incision, reduces intraoperative bleeding. This minimally invasive approach ensures high precision and minimizes the risk of damage to adjacent tissues [5]. Furthermore, under laparoscopic guidance, surgeons can expand the surgical field, optimize procedural steps, fully expose the anatomical structure of the uterus, and shorten the surgical duration. Precision during the operation enhances suture firmness, creating a conducive environment for fetal growth [6]. However, given that both surgical procedures are performed at the cervix, there remains a risk of postoperative complications, such as vaginal bleeding and vaginitis.

Based on the data analysis presented in this article, the operation time (40.88 ± 1.28 minutes) and hospitalization time (5.87 ± 1.14 days) in Group A were shorter than those in Group B, with intraoperative blood loss (13.28 ± 1.84 mL) lesser than that of Group B ($P < 0.05$). These findings suggest that laparoscopic-guided cervical isthmus cerclage can effectively shorten the duration of the patient's illness. Examining the reasons behind this, laparoscopic surgery simplifies the procedural steps by eliminating the need for repeated needle insertion and withdrawal operations, resulting in a shorter operation time. Simultaneously, avoiding vaginal surgery reduces bladder and vaginal irritation during the operation, thereby minimizing wound complications and reducing surgical bleeding, further contributing to decreased operation time [7].

Another dataset revealed that the treatment success rate for CIC in Group A was significantly higher at 98.33% compared to Group B at 86.67% ($P < 0.05$). This data supports the notion that laparoscopic surgery can enhance the success rate of CIC treatment. Analyzing the reasons, the ability to successfully carry the fetus to term is closely linked to cervical length. Sufficient cervical length provides crucial physical support for fetal development. Laparoscopic surgery, by extending the cervical length, can optimize pregnancy outcomes [8].

An additional set of data demonstrated that during pregnancy, the cervical length of Group A was longer than that in Group B, and the perinatal body weight was higher ($P < 0.05$). This suggests that laparoscopic surgery can effectively elongate the patient's cervix and increase perinatal body weight. Analysis of the reasons indicates that in normal physiological conditions, the lower uterine segment continues to lengthen during the middle and late stages of pregnancy, supporting fetal growth and development. If the cervical tightness is insufficient to withstand the pressure of fetal growth, it increases the risk of premature delivery and miscarriage [9]. In addition, fetal growth and development depend on nutrients supplied by the mother. A better uterine environment, characterized by increased oxygen and nutrient supply from the mother, results in higher fetal body weight. Therefore, fetal body weight is a critical indicator for assessing growth and development status. In general, higher body weight signifies better fetal growth and development, while lower body weight indicates reduced nutrient supply and a higher risk of miscarriage. This article demonstrates that laparoscopic surgery on CIC patients leads to an

extended cervix and higher perinatal weight compared to conventional surgery. Compared with conventional surgery, laparoscopic surgery allows accurate access to the internal opening of the cervical isthmus and suturing under direct vision of the laparoscope. This precision improves suture firmness, enhancing the bearing capacity of the cervical isthmus and stabilizing the uterine cavity environment, thereby providing a favorable foundation for fetal growth and development [10].

In the final dataset, the postoperative complication rate of CIC in Group A was notably lower at 1.67% than in Group B at 10.00% ($P < 0.05$). Additionally, the SF-36 score of CIC patients in Group A was higher than that in Group B ($P < 0.05$). These findings suggest that laparoscopic surgery for CIC patients can reduce surgical complications and improve the patient's quality of life. Analyzing the reasons, while laparoscopic surgery may not pass through the vagina, there are still wounds in the cervical area, posing a risk of vaginitis and vaginal bleeding after surgery. However, the meticulous nature of laparoscopic surgery reduces surgical complications. Moreover, puncture and suturing under laparoscopic guidance, along with the use of polypropylene cerclage bands passing through bilateral uterine arteries and uterine walls of the isthmus, knotted in front or behind the uterine isthmus, ensures precise cerclage of the internal cervical os, maintaining consistency with the patient's physiological anatomical structure.

In summary, CIC patients treated with laparoscopic cervical isthmus cerclage experience reduced intraoperative bleeding, a shortened course of the disease, fewer postoperative complications, and an improved treatment success rate. These findings hold significant value for promotion and implementation.

## Disclosure statement

The author declares no conflict of interest.

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