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Preconceptional laparoscopic transabdominal cervical cerclage: A single-center experience

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Abstract

This study seeks to reveal the indications, surgical techniques, and the impact of laparoscopic cervical cerclage on obstetric outcomes associated with a minimally invasive approach. This study is a retrospective review of patients who underwent laparoscopic transabdominal cervical cerclage procedures performed in a single center from January 2021 to April 2024. This included patients' demographics and relevant obstetric & gynecological history, previous cervical cerclage, operative complications, operative times, average estimated blood loss, and subsequent obstetric outcomes. The study included 20 patients. These patients' surgery indications were: 15 patients (75%) had failed transvaginal cerclage, 3 (15%) had anatomical constraints that prevented placement, and 2 (10%) had cervical damage after vaginal delivery. Six patients (30%) became pregnant postoperatively. One person (16.6%) who became pregnant after surgery had an abortion. Our study defined success as 34 weeks of gestation and a healthy baby. We calculated 100% success using this criterion. Four (80%) of the patients who delivered delivered after 37 weeks, while 1 (20%) delivered between 34 and 37 weeks. Laparoscopic abdominal cerclage offers a good minimally invasive option for patients with a history of failed transvaginal cerclage or cervical insufficiency where transvaginal cerclage is not possible due to anatomic reasons or cervical damage. Laparoscopic abdominal cerclage appears to be a safe procedure when performed by individuals with the requisite skills and expertise in laparoscopy.

Keywords: Cervical incompetence, laparoscopic abdominal cerclage, minimally invasive gynecology, preterm birth

Introduction

Preterm birth (PTB) is one of the leading and most significant causes of perinatal morbidity and mortality worldwide [1]. Cervical incompetence (CI) is a major risk factor for PTB [2]. The main surgical treatment for CI is cervical cerclage [3].

Cerclage is traditionally placed vaginally. We recommend transabdominal cervical cerclage (TAC) for patients who have anatomical difficulties with transvaginal cerclage placement or who have a history of failed vaginal cerclage in a previous pregnancy [4]. By placing the suture in the internal orifice of the cervix, TAC enhances the structural support of the cervix. Additionally, the absence of a foreign body in the vagina may reduce the risk of infection and, therefore, of preterm birth or membrane rupture [5].

However, TAC is a more complex procedure compared to transvaginal cerclage, as it requires abdominal access and dissection and carries potentially increased risks of bleeding [6]. On the other hand, TAC typically necessitates a cesarean section and exposes the patient to another abdominal surgery. For this reason, TAC is not recommended as a first-line treatment for patients with cervical incompetence.

A significant new study from 2020 named MAVRIC (Multicenter Abdominal vs. Vaginal Randomized Intervention of Cerclage) compared TAC and vaginal cerclage. The results strongly supported the idea that the abdominal approach is better for people with cervical insufficiency who have had failed vaginal

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cerclage before. This study showed that TAC is better than reinserted transvaginal cerclage for improving birth outcomes and lowering the risk of preterm birth and fetal loss [7].

TAC has been underutilized in the past due to its associated morbidities, including the need for a cesarean section, the risk of intraoperative blood loss from uterine vessels, poor postoperative pain control, overnight hospitalization, and delayed return to normal activities. In comparison, laparoscopy offers several advantages over laparotomy, such as smaller incisions, faster postoperative recovery, reduced risk of wound infection, less blood loss, and a quicker return to baseline function [8]. According to multiple observational studies, neonatal survival rates with laparoscopic abdominal cerclage are comparable to or better than those achieved with open procedures, ranging from 75% to 100%" [8-10].

Laparoscopic cerclage may be safer than open TAC in the management of cervical insufficiency because the rate of fetal loss, blood loss, and hemorrhage was statistically significantly lower in the laparoscopic cerclage group. Clinically, this evidence may support the preference of the laparoscopic approach over the open approach in appropriate patients; however, it is debatable whether this benefit is limited to cerclages placed before pregnancy, in the first trimester, or both [11-13].

For several reasons, we believe that laparoscopic TAC performed before pregnancy is ideal. A non-pregnant uterus is smaller and can more easily accommodate the uterine manipulator. These factors allow the surgeon to better visualize the anatomy for appropriate cerclage placement. In a pregnant uterus, surgeons encounter additional challenges such as increased paracervical vascularity, blood flow, and tissue softness [14]. Prepregnancy TAC placement is associated with lower rates of recurrent spontaneous pregnancy loss and preterm birth, as well as reduced surgical and pregnancy-related morbidity compared to placement during pregnancy [15]. Studies have shown that prepregnancy cerclage placement does not affect fertility [16].

The development of minimally invasive surgical approaches for TAC placement over the past 10 to 15 years has increased availability and popularity. Researchers have described conventional laparoscopy, robotic surgery, and single-incision laparoscopy for TAC placement [17-18]. Researchers have suggested different changes about when to do the procedure (before or after conception), which type of suture to use (Mersilene or Prolene), where to place knots (in the front, back, or inside blood vessels), the use of tools to help, and where and how to place the sutures.

This study aims to present a retrospective analysis of laparoscopic cervical cerclage procedures performed in our clinic. Its goal is to find out when laparoscopic cervical cerclage should be used, how it should be done, and how it affects the outcomes of a minimally invasive approach to childbirth. Additionally, the study aims to share our clinic's experiences in addressing the scientific questions raised on this topic.

Material and Methods

The Ondokuz Mayıs University Clinical Research Ethics Committee approved this study on 24.04.2024, assigning it the number OMÜ KAEK 2024/190. This study looks back at 20 cases of laparoscopic cervical cerclage done at Ondokuz Mayıs University Faculty of Medicine from January 1, 2021, to March 30, 2024, and it was conducted at one location. Hospital automation records provided the study data.

The data collected included the patient's age, smoking status, body mass index, comorbidities, medications used, surgical history, obstetric history (which encompasses the number of previous deliveries, number of abortions, history of ectopic pregnancies, and history of threatened preterm labor), presence of uterine anomalies, operation durations, mean estimated blood loss, postoperative discharge times, presence of intraoperative or postoperative complications, additional procedures performed during the operation, and pregnancy status at the time of surgery (including abortion rate, mode of delivery, gestational age, birth weight, and whether sutures were removed at delivery). We obtained data not available from hospital records by contacting the patients. We collected data from patients who gave birth at other centers by reaching out to both the patients and the relevant hospitals.

The study involved patients who had previously experienced failed transvaginal cerclage, had physical issues that made it impossible to place a transvaginal cervical cerclage, or had significant cervical damage. We obtained detailed medical histories from the patients and conducted abdominal and pelvic examinations prior to the operation. We also evaluated the patients using necessary imaging techniques, such as ultrasonography and magnetic resonance imaging.

Fifteen of these patients were operated on due to a history of failed transvaginal cerclage, three were operated on because transvaginal cervical cerclage was not feasible due to anatomical reasons, and two were operated on due to extensive cervical damage.

Operation Technique

Patients were prepared in the lithotomy position under general anesthesia. Patients were given 2 g of cefazolin sodium prophylactically before the operation. The surgical field was sterilized with povidone-iodine solution and covered sterilely. Before the operation was started, a uterine manipulator was placed in the uterus to provide uterine exclusion. The Clermont-Ferrand-type uterine manipulator was used in our cases.

The abdomen was accessed with a 10-mm trocar below the umbilicus, and pneumoperitoneum was created with 4 liters of CO2. Subsequently, the patient was positioned in the Trendelenburg position, and additional access was obtained with a 10-mm trocar above the symphysis and 5-mm trocars inserted in the right and left paramedian regions.

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The vesicouterine peritoneum was dissected caudally using a harmonic scalpel. Minimal dissection of the peritoneum at the cervix junction of the sacrouterine ligament posterior to the uterus was also performed with the harmonic scalpel. Straightening the Mersilene tape needle was the first step. Mersilene sutures were placed from the right and left uterosacral junctions, guided by the projection of the uterine artery, and sutured from posterior to anterior at the level of the internal os (Figure 1A-1B). At the anterior cervix, the Mersilene tape was sutured using an intracorporeal knot technique, with five square knots tied. Finally, the upper vesicouterine peritoneum was continuously closed with a size 1 self-locking suture (Figure 1C-1D).

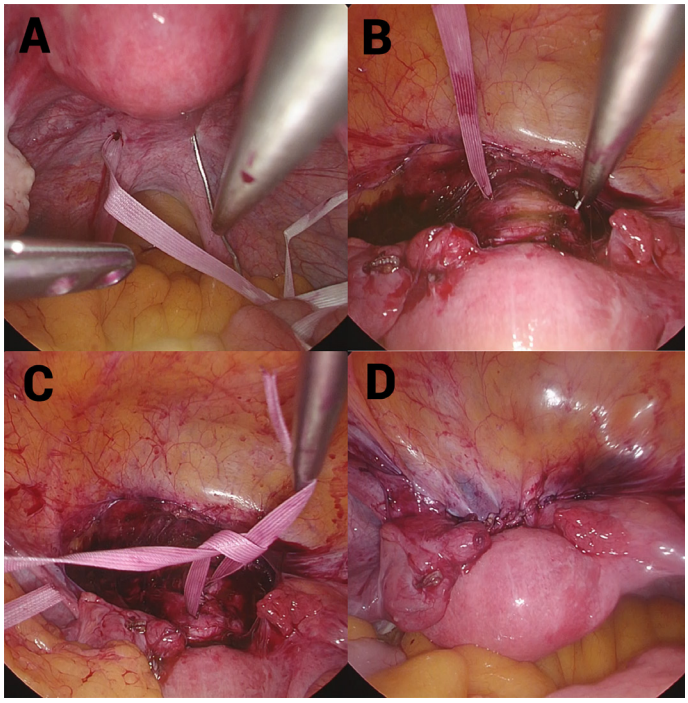

Figure 1. A-B. Mersilene sutures were placed from the right and left uterosacral junctions, guided by the projection of the uterine artery, and sutured from posterior to anterior at the level of the internal os. **C-D.** At the anterior cervix, the Mersilene tape was sutured using an intracorporeal knot technique, with five square knots tied. Finally, the upper vesicouterine peritoneum was continuously closed with a size 1 self-locking suture.

Collection of Operative Data

Operative Duration: The duration of the operation was defined as starting from the creation of the first trocar incision after the patients received general anesthesia. The end time was defined as the closure of the last trocar site.

Postoperative Discharge Time: The postoperative discharge time is defined as the interval from when the patients leave the operating room to when the discharge documents are entered into the system.

Intraoperative Data (Intraoperative complications, need for additional surgery, additional surgical procedure): Intraoperative data were obtained from the operation notes recorded in the hospital system.

Mean Estimated Blood Loss (ml): The GROSS formula was used to calculate the estimated blood loss [19]. The estimated blood volume in the GROSS formula was determined using the NADLER formula [20].

Statistical analysis

Data analysis was performed using SPSS v21 (IBM Corp., NY, USA). Using descriptive statistics, we assessed the demographic characteristics of the patients (e.g., age, height, weight, BMI, duration of operation, estimated blood loss, time to same-day discharge, gestational age, and birth weight). For numerical data, we calculated the mean (M), median, standard deviation (SD), minimum, maximum, and interquartile range (IQR) values. Frequencies and percentages were computed for categorical data.

Result

A retrospective review of laparoscopic cervical cerclage cases performed at the Department of Obstetrics and Gynecology, Ondokuz Mayıs University Faculty of Medicine Hospital, identified 20 cases. The mean age of the patients was 32.15+5.05 (22-41) years. The smoking rate among the patients was 30%. The mean body mass index (BMI) was 29.03±5.71 (21.30-43.60) kg/m2. The mean gravida of the cases was 3.4±1.6, parity was 1.3±0.7, and abortion was 2.2±1.01. Regarding comorbidities, the highest percentage is 25% for thyroid disorders, followed by 20% for coagulation disorders. The highest percentage of medication users is 25% for levothyroxine and 15% for aspirin. 75% of patients had a surgical history that included transvaginal cerclage, with 30% having a cesarean section (C/S) and 30% having a hysteroscopy (H/S) (Table 1).

Table 1. Demographic characteristics of study population

Patient characteristics		Mean ± SD
Age (year)		32.15±5.05 (22-41)
BMI (kg(m2)		29.03±5.71 (21.3-43.6)
Smoking (%)	Yes	30
	No	70
Gravida		3.4±1.6
Parity		1.3±0.7
Abortion		2.2±1.01
History of failed TVC, n (%)	Yes	15 (75)
	No	5 (25)
Preterm delivery, n (%)	Yes	16 (80)
	No	4 (20)

Data are given as mean + standard deviation or percentage; TVC: Transvajinal cerclage; BMI: Body mass index

There was a history of cerclage in 75% of the cases and a history of preterm labor in 80%. Table 2 presents the characteristics of the operative procedures performed on the patients. The mean operative time was 64.5±13.85 minutes. The mean blood loss was 431.29±173.95 ml. No complications were observed. The mean discharge time was 26.4±7.39 hours. After the procedure, 30% of the women became pregnant and there was only one first

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trimester miscarriage. According to the literature, first-trimester losses are unlikely to be related to cervical incompetence or cerclage placement and are therefore often excluded from the success calculation. Consequently, this patient was excluded when calculating the success rate of the cerclage in our study. We considered the completion of the 34th gestational week of pregnancy and the birth of a healthy baby as the success status, resulting in a success rate of 100%. All pregnant women delivered by cesarean section at an average of 37 weeks. The mean newborn weight was 3168±184.14 grams. In 10% of cases, the operation included additional procedures such as uterine septum resection and fallopian tube ligation. Among these patients, the rate of cerclage suture removal during C/S was 20%.

Table 2. The table shows the operation characteristics and postoperative obstetric outcomes in patients

Operation characteristics		Mean ± SD
Operation times (min)		64.5±13.85
Estimated blood loss (ml)		43.29±173.95
Complication		0
Postoperative discharge times, (hour)		26.4±7.39
Pregnancy after surgery, n(%)		6(30)
First trimester spontaneous abortion, n(%)		1(16.6)
Mode of delivery, n(%)	Vajinal Delivery	0
	Cesarean Section	6(100)
Gestasyonel age (week)		37±0.71
Birth weight (gram)		3168±184.14

Data are given as mean + standard deviation or percentage

Discussion

There are articles in the literature about transabdominal cerclage application after failed transvaginal cervical cerclage. The majority of the articles were applied during pregnancy or focused on abdominal or laparoscopic methods. However, laparoscopic cerclage application before pregnancy was not considered. Our study showed that laparoscopic cerclage application after failed transvaginal cervical cerclage had similar or even better results than those applied during pregnancy.

In a meta-analysis of 33 studies, laparoscopic and laparotomical TAC reduced fetal loss. However, laparoscopy was superior to abdominal. In this study, surgery was performed in the first trimester and the reported blood loss was lower than ours. However, our study differs from this study in that laparoscopic cerclage was performed before pregnancy [13].

In a meta-analysis, the mean birth weight after laparoscopic cerclage was found to be 2800 grams and the mean pregnancy loss was reported as 8.6%. In our study, a higher mean birth weight of 3168 grams was achieved and our pregnancy loss was almost non-existent except for the first trimester [12].

There is ongoing debate about the indications and effectiveness of cervical cerclage in preventing preterm birth (PTD) in patients with cervical incompetence. Identifying patients at risk of PTD is crucial for determining which groups should undergo cerclage procedures and for distinguishing those who require closer monitoring and follow-up. This approach enables targeted counseling and more intensive surveillance for patients undergoing cerclage, ensuring appropriate care and potentially improving outcomes.

Despite the clear obstetric advantages of TAC over transvaginal cerclage (TVC) in high-risk populations, transabdominal cerclage is not commonly performed [21]. This disadvantage may be due to the requirement of two surgical procedures: one for the cerclage and another for the cesarean delivery. Two specific groups of patients typically prefer abdominal cerclage due to its complexities and associated morbidities. The first group includes women who experience recurrent miscarriage despite TVC, representing those at the highest risk for preterm delivery [22]. The second group consists of women with a congenitally or surgically insufficient cervix who cannot undergo the vaginal technique [21]. These indications make the procedure relatively rare, and published data on outcomes are limited. In our study, the indications for cerclage were as follows: 15 patients (75%) had a history of previous unsuccessful transvaginal cerclage, 3 patients (15%) were unable to undergo transvaginal cervical cerclage due to anatomical reasons, and 2 patients (10%) were operated on because of extensive cervical damage. The patients with extensive cervical damage had a history of difficult deliveries.

Scibetta et al. were the first to propose modifications in the laparoscopic TAC technique, followed by numerous other authors [23-27]. These changes involve when the surgery is done (before or after conception), the type of suture material used (Mersilene or Prolene), where the knots are placed (in the front, back, or inside the vagina), whether a manipulator is used, and different ways to place and use the sutures.

According to available data and observed favorable outcomes, preconceptional placement is recently the preferred timing choice for surgery [28]. A study looked at patients who had laparoscopic TAC either before getting pregnant (96 patients) or during the first trimester (65 patients); in the first trimester group, there were 2 cases of bladder injury, 1 case of bowel injury, and half of the patients experienced significant bleeding (more than 500 ml). The group that underwent surgery prior to conception did not experience any complications. The preconception group did not experience any such complications [29]. Preconceptional placement offers significant technical advantages: the uterus is smaller and less vascularized, and there is also an opportunity to use a manipulator to mobilize the uterus while placing the tape. In our study, all patients underwent the preconceptional procedure. No complications were observed in our cases, and estimated blood loss was below 500 ml in 75% of patients, which was considered within tolerable limits. Additionally, this procedure provided us with technical ease.

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Six out of 20 patients (30%) showed signs of pregnancy after the procedure. One (16.6%) of the postoperative pregnancies resulted in an abortion. In our study, we considered the completion of the 34th gestational week of pregnancy and the birth of a healthy baby as indicators of success, resulting in a success rate of 100%. Researchers have described three different knot locations: anterior, posterior, and intravaginal [30]. In a 6-year study on preconceptional cerclage, problems like rectovaginal fistula were seen when the knot was placed at the back. Over the past two years, most patients have shown a shift toward anterior knot placement [31]. We used the anterior knot technique for all patients in our study. Most cases of laparoscopic TAC can be managed on an outpatient basis with oral analgesics at home. This approach reduces the resource consumption associated with postoperative hospitalization [32]. In our study, all patients were discharged within 24-48 hours.

The most important factor differentiating TVC and TAC is that TAC involves two transabdominal procedures (one for the placement of the sutures and another for their removal, or during a cesarean delivery). Performing two surgeries leads to increased risk and morbidity; however, recent advancements in minimally invasive surgery should be considered for their benefits, including reduced postoperative pain, fewer complications, and faster recovery. In addition, patients with in situ TAC may wish to become pregnant again.

These situations allow the cerclage suture to remain in place and be used in future pregnancies. Ades et al. did a study on women who had laparoscopic cervical cerclage left in place during their next pregnancies and found that most babies survived after 34 weeks, even in third pregnancies. The study included 22 patients and demonstrated a neonatal survival rate of 86% in the second pregnancy and 100% in the third pregnancy [33]. In our study, only one patient who didn't want to get pregnant again had the cerclage suture removed.

Published laparoscopic case series report very low complication rates of a minor nature, such as uterine perforation during surgery or pelvic infection postoperatively [34-36]. Ades et al. reported laparoscopic repair of bladder injuries [37]. Reports have identified mesh erosion as a potential complication [38]. We observed no intraoperative or postoperative complications in our study.

The limitations of this study include the low level of scientific evidence due to its retrospective design, the small sample size, and the lack of a control group. The collection of all cases from a single tertiary hospital results in a relatively small sample size from a specific region, which is another significant limitation. Therefore, our results may not be generalizable to the community.

Conclusion

Laparoscopic TAC offers hope to women with recurrent pregnancy loss due to cervical insufficiency for whom TVC has proven ineffective. It appears to be a safe procedure when advanced laparoscopic skills and laparoscopic expertise, including intracorporeal suturing, are available. To improve pregnancy results, more large studies are needed to find the best method (like which way to approach the uterine artery), the most effective type of mesh (such as Mersilene or Prolene), and the ideal timing (before conception or early in the first trimester). However, the rarity of the procedure and the difficulty in finding an appropriate control group pose challenges for conducting randomized studies.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
The study was approved by the Ondokuz Mayıs University Clinical Research Ethics Committee (date: 24.04.2024 / number: OMÜ KAEK 2024/190).

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