

Laparoscopic abdominal cerclage in cervical insufficiency: single-centre outcomes

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Abstract

Objective: To evaluate surgical and obstetric outcomes following preconceptional laparoscopic abdominal cerclage (LAC) in women with complex cervical insufficiency. **Materials and Methods:** This retrospective cohort study included women who underwent LAC between January 2018 and December 2025; follow-up ended on 31 January 2026. Data were extracted from an institutional database and verified by medical-record review. The primary outcome was live birth after LAC. Secondary outcomes included operative time, perioperative complications, gestational age at delivery, preterm birth, birthweight, and additional transvaginal cerclage. Exploratory subgroup comparisons assessed previous and additional transvaginal cerclage. **Results:** Sixty-nine women underwent 71 LAC procedures. Mean operative time was 74.1±25.4 minutes, with no recorded intraoperative or postoperative complications. Fifty-one women (73.9%) achieved 65 post-LAC pregnancies, of which 62 (95.4%) resulted in live birth. Two twin pregnancies yielded 64 liveborn neonates. Among 60 live-birth pregnancies with gestational-age data, mean gestational age was 37.12±1.66 weeks and four (6.7%) delivered before 34 weeks. Mean birthweight was 3003±602 g among 61 neonates with available data; none weighed <1500 g. Five pregnancies (7.7%) required additional transvaginal cerclage. Exploratory subgroup comparisons showed no statistically significant differences but were limited by small groups. **Conclusion:** In conclusion, in this selected high-risk cohort, preconceptional LAC was associated with low recorded perioperative morbidity, a high proportion of pregnancies resulting in live birth, and infrequent delivery before 34 weeks. The absence of a concurrent comparison group and small clinically important subgroups require cautious interpretation. Prospective multicenter studies using standardized eligibility and outcome definitions are needed to refine patient selection and additional interventions after LAC.

Keywords: Cervical insufficiency; laparoscopic abdominal cerclage; preconceptional cerclage; preterm birth; transabdominal cerclage.

1. Introduction

Cervical insufficiency is an important cause of recurrent mid-trimester pregnancy loss and early preterm birth. It is characterized clinically by painless cervical dilatation and progressive cervical shortening in the absence of labor, potentially resulting in membrane prolapse, preterm prelabor rupture of membranes (PPROM), pregnancy loss, or

very early delivery. Because the diagnosis is primarily based on obstetric history and clinical findings rather than a single definitive diagnostic test, patient selection and preventive management remain challenging.^{1,2}

Transvaginal cervical cerclage, most commonly performed using the McDonald or Shirodkar technique, is the standard initial surgical approach for appropriately selected women with cervical insufficiency.^{1,2} However, transvaginal placement may be technically difficult or provide insufficient mechanical support in women with a markedly shortened or structurally deficient cervix, particularly after cervical conization or repeated excisional procedures. Abdominal cerclage may also be considered in women who experience pregnancy loss or very early preterm birth despite a correctly placed transvaginal cerclage.³

Laparoscopic abdominal cerclage (LAC) provides a minimally invasive alternative to open transabdominal cerclage. Evidence synthesized from observational studies suggests that laparoscopic and open abdominal approaches provide broadly comparable fetal survival and gestational-age outcomes, while the laparoscopic approach may be associated with shorter hospitalization and lower wound-related morbidity.^{4,5} A large contemporary multicenter cohort also demonstrated favorable surgical outcomes and high fetal survival following both preconceptional and postconceptional LAC.⁶

Evidence comparing abdominal and vaginal approaches is more limited but clinically important. In the MAVRIC randomized trial of women with a previous unsuccessful vaginal cerclage, transabdominal cerclage reduced delivery before 32 weeks and fetal loss compared with low vaginal cerclage, whereas high vaginal cerclage did not demonstrate a corresponding benefit over low vaginal cerclage.⁷ These findings support consideration of an abdominal approach in a carefully selected population with previous transvaginal cerclage failure but should not be extrapolated to all women with cervical insufficiency.

Professional recommendations recognize abdominal cerclage as an appropriate option for women with a previous unsuccessful transvaginal cerclage or insufficient cervical tissue for safe vaginal placement.^{2,3} Nevertheless, variation remains among professional guidelines regarding the number and gestational timing of previous losses required for intervention, the timing of abdominal cerclage placement, and management in less common anatomical situations.⁸

Despite increasing use of LAC, much of the evidence remains derived from retrospective cohorts with heterogeneous eligibility criteria, surgical techniques, outcome definitions, and follow-up strategies.^{5,6} Data from well-characterized high-risk populations—including women with previous unsuccessful transvaginal cerclage, post-conization cervical deficiency, and congenital uterine or cervical anomalies—therefore remain valuable for defining surgical safety and subsequent obstetric outcomes.

Accordingly, this study aimed to evaluate the maternal, surgical, and obstetric outcomes of women who underwent preconceptional LAC at a tertiary referral center during the predefined study period.

2. Methods

2.1. Study design and setting

This single-center retrospective cohort study included women who underwent laparoscopic abdominal cerclage (LAC) at a tertiary referral center specializing in high-risk obstetrics and minimally invasive gynecologic surgery between January 2018 and December 2025. Clinical follow-up and data collection were completed on 31 January 2026. Demographic, surgical, and obstetric data were retrospectively extracted from a prospectively maintained institutional database.

2.2. Ethics statement

The retrospective study protocol was approved by the Başkent University Institutional Review Board (Project No. KA26/143; approval date: 10 March 2026). All study data were anonymized before analysis and handled in accordance with institutional data-protection requirements. The study was conducted in accordance with the principles of the Declaration of Helsinki.

2.3. Study population

Women were eligible for inclusion if they underwent LAC during the study period because of a history consistent with cervical insufficiency or an acquired or congenital uterine or cervical abnormality associated with mechanical cervical weakness. The predefined eligibility criteria were:

- a documented history of at least one spontaneous second-trimester pregnancy loss or early preterm birth considered clinically consistent with cervical insufficiency;
- substantial structural cervical compromise, including post-conisation cervical deficiency, a markedly shortened or deficient cervix, or a history of unsuccessful transvaginal cerclage;
- a congenital uterine or cervical anomaly considered to predispose to cervical insufficiency or to preclude conventional transvaginal cerclage placement, including a unicornuate uterus or cervical agenesis; and
- suitability for laparoscopic surgery, with no contraindication to abdominal cerclage placement.

Active pelvic infection, a major medical contraindication to surgery, or an alternative cause of pregnancy loss unrelated to cervical insufficiency constituted exclusion criteria. During the study period, all women who fulfilled the institutional indications for LAC underwent the procedure and were included in the study; no eligible woman was excluded from the analysis. Because the institutional database did not systematically capture women who were referred or assessed but did not meet the indications for LAC, the total number of such referrals could not be determined.

2.4. Surgical technique and perioperative management

All LAC procedures were performed as interval procedures before conception and under general anesthesia by four consultant surgeons experienced in minimally invasive gynecologic surgery and abdominal cerclage placement. Patients were placed in the Trendelenburg position, and the uterus was manipulated using a Rubin cannula when anatomically feasible. After closed abdominal entry with a Veress needle, pneumoperitoneum was maintained at a pressure of 10–12 mmHg. A 5-mm umbilical camera port and two ipsilateral 5-mm ancillary ports were used.

The vesicouterine peritoneum was opened, and the bladder was dissected caudally to expose the cervico-isthmus junction and permit visualization of the uterine arteries. A 5-mm nonabsorbable Mersilene tape was passed bilaterally at the cervico-isthmus level, medial to the uterine arteries. Depending on uterine size and mobility, the tape was passed in either an anterior-to-posterior or posterior-to-anterior direction. The tape was tied anteriorly, and the vesicouterine peritoneum was closed over the tape using 2-0 Vicryl, completely covering the tape and knot.

All patients received 2 g of intravenous cefazolin for perioperative antibiotic prophylaxis. A complete blood count was obtained postoperatively. Patients were observed overnight, discharged on the first postoperative day, and scheduled for routine postoperative assessment 10 days after surgery. The cerclage tape was generally left in situ during subsequent pregnancies and cesarean deliveries. In two women who underwent pregnancy termination, the tape was removed and a repeat LAC was subsequently performed before a later pregnancy.

2.5. Data collection and outcome definitions

Core clinical and operative variables were recorded in a prospectively maintained standardized institutional database. For the present retrospective analysis, database records were supplemented by a detailed review of electronic medical records. Baseline variables included maternal age at LAC, gravidity, parity, reproductive history, indication for LAC, previous transvaginal cerclage, previous cervical surgery, and congenital uterine or cervical anomalies. Previous pregnancy losses were categorized according to gestational age as occurring before 16 weeks, between 16 and 20 weeks, or after 20 weeks.

Surgical and perioperative variables included the number of LAC procedures, operative time, conversion to laparotomy, intraoperative organ or vascular injury, requirement for blood transfusion, postoperative complications, and length of hospital stay. Operative time was defined as the interval between the recorded start and completion of the surgical procedure. Estimated blood loss was not included as a quantitative variable because it was not routinely measured or recorded.

Each pregnancy occurring after LAC was evaluated separately. Pregnancy-level variables included mode of conception, categorized as spontaneous or assisted conception using in vitro fertilization or intracytoplasmic sperm injection (IVF/ICSI); gestational age at delivery; live birth; pregnancy loss or termination; preterm birth before 37 and before 34 weeks; neonatal birthweight; and the requirement for an additional transvaginal cerclage. For deliveries before 37 weeks, the documented cause or associated obstetric condition was determined through review of the medical records. For pregnancies requiring an additional transvaginal cerclage, the available case-level data included gestational age at intervention, cervical length when documented, ultrasonographic findings such as funneling or membrane protrusion, physical examination findings when available, and the documented clinical rationale for intervention.

The primary outcome was live birth following LAC. Secondary outcomes were operative time, gestational age at delivery, preterm birth before 37 and before 34 weeks, neonatal birthweight, pregnancy loss or termination, requirement for an additional transvaginal cerclage, and intraoperative or postoperative complications. When outcome information was incomplete, structured telephone follow-up was performed to reduce missing data and confirm pregnancy outcome status. Before analysis, all entries were independently cross-checked by two investigators. No undocumented clinical information was inferred.

2.6. Statistical analysis

Continuous variables were summarized as mean $\pm$ standard deviation or median with interquartile range and range, as appropriate. Categorical variables were presented as frequencies and percentages. Denominators were reported explicitly when data were unavailable, and analyses were performed using the available observations for each outcome. Ninety-five percent confidence intervals for proportions were calculated using the Wilson score method.

Two exploratory subgroup comparisons were performed. Women with and without a history of prior transvaginal cerclage were compared at the patient level. Pregnancies requiring an additional transvaginal cerclage after LAC were compared with pregnancies managed with LAC alone at the pregnancy level. Continuous variables were compared using the Mann–Whitney U test, and categorical variables were compared using Fisher's exact test because of the small subgroup sizes and sparse outcome counts. Absolute risk differences with 95% confidence intervals were reported for binary outcomes where appropriate.

Because some women contributed more than one post-LAC pregnancy, pregnancy-level subgroup comparisons were considered exploratory. Multivariable regression

analysis was not performed because the groups without prior transvaginal cerclage and with additional transvaginal cerclage included only nine women and five pregnancies, respectively, and the small number of adverse outcomes would have resulted in statistically unstable and potentially overfitted models. All tests were two-sided, and a P value <0.05 was considered statistically significant. Statistical analyses were performed using Python, version 3.12 (Python Software Foundation, Wilmington, Delaware, USA).

3. Results

3.1. Study population

Between January 2018 and December 2025, 69 women underwent a total of 71 LAC procedures. In two women, the abdominal cerclage was removed at the time of pregnancy termination, and a repeat LAC was subsequently performed before a later pregnancy. Patient-level characteristics were analyzed using 69 women as the denominator, whereas procedure-related outcomes were evaluated across 71 LAC procedures.

The median maternal age at the first LAC procedure was 30 years (range, 21–42 years). The mean gravidity was 3.06 (median, 2; range, 0–11). The mean parity was 1.24 (median, 1; range, 0–5); parity data were available for 67 women.

Five women (7.2%) had congenital uterine or cervical anomalies: two had an isolated unicornuate uterus, one had isolated cervical agenesis, one had cervical agenesis associated with a unicornuate uterus, and one had combined cervical and vaginal agenesis. One additional woman (1.4%) had severe cervical deficiency following previous cervical conization, which precluded safe transvaginal cerclage placement. Baseline characteristics are presented in Table 1.

Table 1. Baseline characteristics of the study population (n = 69)

Characteristic	Value
Maternal age at first LAC, median (range), years	30 (21–42)
Gravidity, mean (median; range)	3.06 (2; 0–11)
Parity, mean (median; range)*	1.24 (1; 0–5)
Previous transvaginal cerclage	60 (87.0%)
No previous transvaginal cerclage	9 (13.0%)
└ Post-conisation cervical deficiency	1
└ Congenital uterine or cervical anomaly	4
└ Declined transvaginal cerclage after counseling	4
Congenital uterine or cervical anomaly, overall	5 (7.2%)
└ Isolated unicornuate uterus	2
└ Isolated cervical agenesis	1
└ Cervical agenesis with unicornuate uterus	1
└ Combined cervical and vaginal agenesis	1
Women undergoing repeat LAC	2 (2.9%)

Data are presented as n (%) unless otherwise indicated. Maternal age refers to age at the first LAC procedure. LAC, laparoscopic abdominal cerclage.

Previous transvaginal cerclage had been attempted in 60 of 69 women (87.0%), whereas nine women (13.0%) had not undergone a previous transvaginal cerclage. Among these nine women, one had post-conization cervical deficiency, four had congenital uterine or cervical anomalies, and four had declined transvaginal cerclage after counseling. Of the five women with congenital uterine or cervical anomalies in the overall

cohort, one woman with a unicornuate uterus had previously undergone transvaginal cerclage following an early preterm birth and subsequently underwent LAC after failure of the vaginal cerclage.

3.2. Surgical and perioperative outcomes

All 71 procedures were completed laparoscopically without conversion to laparotomy. The mean operative time was 74.1 ± 25.4 minutes, with a median of 70 minutes (interquartile range, 60–90 minutes; range, 30–140 minutes). No intraoperative or postoperative complications, organ or vascular injuries, or requirements for blood transfusion were recorded. All women were hospitalized overnight, underwent postoperative complete blood-count assessment, and were routinely discharged on the first postoperative day.

3.3. Pregnancy loss before LAC

A history of pregnancy loss before LAC was common. Twenty-five of 69 women (36.2%) had experienced at least one pregnancy loss before 16 weeks of gestation. Among these women, the median number of losses was 1 (range, 1–3). Thirty-four women (49.3%) had experienced at least one loss between 16 and 20 weeks; the median number of losses among affected women was 1 (range, 1–4). In addition, 48 women (69.6%) had experienced at least one pregnancy loss after 20 weeks, with a median of 1 loss among affected women (range, 1–5). The distribution of pregnancy losses before LAC is presented in Table 2.

Table 2. Prior pregnancy losses before LAC (n = 69)

Gestational-age category	Women with ≥ 1 loss, n (%)	Losses among affected women, median (range)
<16 weeks	25 (36.2%)	1 (1–3)
16–20 weeks	34 (49.3%)	1 (1–4)
>20 weeks	48 (69.6%)	1 (1–5)

Percentages were calculated using all 69 women as the denominator. Median and range values were calculated among women with at least one loss in the corresponding gestational-age category. Categories were not mutually exclusive because an individual woman could have experienced losses in more than one gestational-age category. Blank database entries were verified as indicating no loss and were coded as zero.

3.4. Post-cerclage pregnancies

Following LAC, 51 of 69 women (73.9%) achieved at least one pregnancy, resulting in 65 post-LAC pregnancies. Of these pregnancies, 51 (78.5%) were conceived spontaneously and 14 (21.5%) through IVF/ICSI.

Sixty-two of the 65 pregnancies (95.4%) resulted in live birth. Three pregnancies (4.6%) did not result in live birth: one elective termination following the prenatal diagnosis of trisomy 21, one termination at 21 weeks because of chorioamnionitis, and one pregnancy loss at 21+6 weeks following PPRM. Two live-birth pregnancies were twin gestations; therefore, the 62 pregnancies resulting in live birth yielded 64 liveborn neonates.

Gestational age at delivery was available for 60 of the 62 pregnancies resulting in live birth. The mean gestational age at delivery was 37.12 ± 1.66 weeks. Preterm birth before 37 weeks occurred in 21 of 60 evaluable deliveries (35.0%), including four deliveries (6.7%) before 34 weeks. Among the 21 preterm deliveries, 14 followed spontaneous preterm labor, four followed PPRM, two were indicated because of severe fetal growth restriction with fetal distress, and one was indicated because of severe preeclampsia.

Birthweight data were available for 61 of the 64 liveborn neonates. The mean neonatal birthweight was 3003 ± 602 g. Low birthweight (<2500 g) was observed in 13 of 61 neonates (21.3%), and no neonate had a birthweight below 1500 g.

Four deliveries occurred before 34 weeks, with a mean gestational age of 33.36 ± 0.58 weeks; birthweight data were available for four neonates, with a mean of 2053 ± 202 g. Seventeen deliveries occurred between 34 and 36+6 weeks, with a mean gestational age of 35.67 ± 0.82 weeks; this group included 18 liveborn neonates with available birthweight data, with a mean birthweight of 2636 ± 492 g. Thirty-nine deliveries occurred at or beyond 37 weeks, with a mean gestational age of 38.14 ± 0.67 weeks; birthweight data were available for 39 neonates, with a mean of 3270 ± 478 g.

3.5. Additional vaginal cerclage after LAC

Five of the 65 post-LAC pregnancies (7.7%) required an additional transvaginal cerclage. All pregnancies were monitored using serial transvaginal ultrasonography, including cervical-length measurement and assessment of the relationship between the membranes, cervix, and abdominal cerclage. The decision to place an additional transvaginal cerclage was based on progressive cervical funneling extending beyond the level of the abdominal cerclage rather than on a single predefined cervical-length threshold.

Table 3. Pregnancy and neonatal outcomes after laparoscopic abdominal cerclage (65 post-LAC pregnancies)

Outcome	n/N (%) or mean $\pm$ SD	95% CI
Pregnancy outcomes		
Mode of conception		
-Spontaneous	51/65 (78.5%)	67.0–86.7
-IVF/ICSI	14/65 (21.5%)	13.3–33.0
Pregnancies resulting in live birth	62/65 (95.4%)	87.3–98.4
Pregnancies not resulting in live birth	3/65 (4.6%)	1.6–12.7
Liveborn neonates	64	—
Gestational age at delivery*		
Mean gestational age, weeks	37.12 ± 1.66	36.69–37.55
<34 weeks	4/60 (6.7%)	2.6–15.9
34–36+6 weeks	17/60 (28.3%)	18.5–40.8
≥ 37 weeks	39/60 (65.0%)	52.4–75.8
Neonatal birthweight†		
Mean birthweight, g	3003 ± 602	2849–3157
Low birthweight (<2500 g)	13/61 (21.3%)	12.9–33.1
Very low birthweight (<1500 g)	0/61 (0%)	0–5.9
Additional transvaginal cerclage		
Additional transvaginal cerclage required	5/65 (7.7%)	3.3–16.8
└ Term live birth (≥ 37 weeks)	3/5 (60.0%)	23.1–88.2
└ Late-preterm live birth	1/5 (20.0%)	3.6–62.4
└ Termination at 21 weeks due to chorioamnionitis	1/5 (20.0%)	3.6–62.4

Data are presented as n/N (%) or mean $\pm$ standard deviation. Confidence intervals for proportions were calculated using the Wilson score method. Confidence intervals for means refer to the 95% confidence interval of the mean. *Gestational age at delivery was available for 60 of the 62 pregnancies resulting in live birth. Percentages for gestational-age categories were calculated using these 60 evaluable deliveries as the denominator. †Birthweight data were available for 61 of the 64 liveborn neonates. Two pregnancies resulting in live birth were twin gestations; therefore, 62 pregnancies yielded 64 liveborn neonates. CI, confidence interval; LAC, laparoscopic abdominal cerclage; SD, standard deviation.

Additional transvaginal cerclage was performed at 13+4, 17+0, 17+0, 21+4, and 26+1 weeks of gestation. The pregnancy treated at 13+4 weeks resulted in live birth at 38+3

weeks. Of the two pregnancies treated at 17+0 weeks, one resulted in live birth at 35+4 weeks following spontaneous preterm labor. The other subsequently developed PPRM and chorioamnionitis and was terminated at 21 weeks. The pregnancies treated at 21+4 and 26+1 weeks resulted in live births at 38+0 and 37+3 weeks, respectively. Thus, three of the five pregnancies resulted in term live birth, one in late-preterm live birth, and one in second-trimester termination. Overall pregnancy and delivery outcomes, including outcomes following additional transvaginal cerclage, are summarized in Table 3.

3.6. Exploratory subgroup analyses

At the patient level, 45 of 60 women with a history of prior transvaginal cerclage (75.0%) and six of nine women without prior transvaginal cerclage (66.7%) achieved at least one post-LAC pregnancy ($P = 0.687$). The absolute risk difference was 8.3 percentage points (95% confidence interval [CI], -16.2 to 40.9). At least one live birth occurred in 44 of 60 women (73.3%) with prior transvaginal cerclage and five of nine women (55.6%) without prior transvaginal cerclage ($P = 0.431$; absolute risk difference, 17.8 percentage points; 95% CI, -10.6 to 48.2). An additional transvaginal cerclage after LAC was required in five of 60 women (8.3%) with a history of prior transvaginal cerclage and none of the nine women without such a history ($P = 1.000$).

Table 4. Exploratory subgroup analyses of outcomes after laparoscopic abdominal cerclage

Outcome	First subgroup	Comparison subgroup	Absolute risk difference, percentage points (95% CI)	P value
Patient-level comparison according to previous transvaginal cerclage	Previous TVC (n = 60)	No previous TVC (n = 9)		
Achieved ≥ 1 post-LAC pregnancy	45/60 (75.0%)	6/9 (66.7%)	8.3 (-16.2 to 40.9)	0.687
Achieved ≥ 1 live birth after LAC	44/60 (73.3%)	5/9 (55.6%)	17.8 (-10.6 to 48.2)	0.431
Pregnancy-level comparison according to additional transvaginal cerclage	Additional TVC (n = 5)	No additional TVC (n = 60)		
Pregnancy resulting in live birth	4/5 (80.0%)	58/60 (96.7%)	-16.7 (-59.2 to 1.6)	0.217
Preterm delivery <37 weeks*	1/4 (25.0%)	20/56 (35.7%)	-10.7 (-35.0 to 35.6)	1.000
Preterm delivery <34 weeks*	0/4 (0%)	4/56 (7.1%)	-7.1 (-17.0 to 42.0)	1.000
Gestational age at delivery, median (IQR), weeks*	37.7 (37.0–38.1)	37.6 (36.0–38.4)	—	0.994

Data are presented as n/N (%) unless otherwise indicated. Patient-level analyses compared women with and without a history of transvaginal cerclage. Pregnancy-level analyses compared pregnancies requiring an additional transvaginal cerclage after LAC with those managed without an additional cerclage. Absolute risk differences were calculated as the first subgroup minus the comparison subgroup. Categorical variables were compared using Fisher's exact test, and gestational age was compared using the Mann-Whitney U test. All analyses were exploratory and unadjusted and should not be interpreted as tests of comparative effectiveness or equivalence.

*Preterm-birth and gestational-age analyses were restricted to pregnancies resulting in live birth for which gestational age was available: four pregnancies in the additional-TVC group and 56 pregnancies in the group without additional TVC.

CI, confidence interval; IQR, interquartile range; LAC, laparoscopic abdominal cerclage; TVC, transvaginal cerclage.

At the pregnancy level, four of five pregnancies requiring an additional transvaginal cerclage resulted in live birth, compared with 58 of 60 pregnancies managed without an additional cerclage (80.0% vs 96.7%; $P = 0.217$). The absolute risk difference was -16.7 percentage points (95% CI, -59.2 to 1.6). Among live-birth pregnancies with known gestational age, preterm delivery before 37 weeks occurred in one of four pregnancies (25.0%) in the additional-cerclage group and 20 of 56 pregnancies (35.7%) in the LAC-only group ($P = 1.000$). Delivery before 34 weeks occurred in none of four and four of 56 pregnancies, respectively (0% vs 7.1%; $P = 1.000$). Median gestational age at delivery was 37.7 weeks

(interquartile range, 37.0–38.1 weeks) in the additional-cerclage group and 37.6 weeks (interquartile range, 36.0–38.4 weeks) in the LAC-only group ($P = 0.994$). These exploratory comparisons did not demonstrate statistically significant differences in obstetric outcomes; however, the estimates were imprecise because of the small subgroup sizes. The subgroup comparisons are presented in Table 4.

Table 5. Clinical characteristics and outcomes of pregnancies requiring additional transvaginal cerclage after LAC

Case	GA at additional TVC	Ultrasonographic finding and indication	GA at delivery/termination	Pregnancy outcome
1	13+4 weeks	Progressive funneling beyond LAC	38+3 weeks	Term live birth
2	17+0 weeks	Progressive funneling beyond LAC	35+4 weeks	Late-preterm live birth
3	17+0 weeks	Progressive funneling beyond LAC	21 weeks	PPROM and chorioamnionitis; pregnancy termination
4	21+4 weeks	Progressive funneling beyond LAC	38+0 weeks	Term live birth
5	26+1 weeks	Progressive funneling beyond LAC	37+3 weeks	Term live birth

4. Discussion

In this retrospective cohort of 69 women undergoing 71 preconceptional LAC procedures, 62 of 65 post-LAC pregnancies (95.4%) resulted in live birth. Among 60 live-birth pregnancies with gestational-age data, mean gestational age at delivery was 37.12 weeks and 6.7% delivered before 34 weeks. The 62 live-birth pregnancies yielded 64 liveborn neonates, with a mean birthweight of 3003 g. No major perioperative complications were recorded. These findings support the feasibility of preconceptional LAC in a carefully selected high-risk population.

Our obstetric outcomes are consistent with contemporary abdominal-cerclage evidence. Abdulrahman et al. reported high fetal survival and frequent delivery at or beyond 34 weeks after LAC across several high-risk indications.⁶ In the systematic review by Hulshoff et al., 3398 women undergoing laparoscopic or open abdominal cerclage had an overall fetal survival rate of 91.2% and a mean gestational age at delivery of 36.6 weeks.⁵ Direct comparison remains difficult because studies differ in eligibility criteria, definitions of fetal or neonatal survival, and inclusion of early pregnancy losses.

The absence of a contemporaneous transvaginal cerclage group precludes direct comparison between approaches. In the MAVRIC randomized trial of women with a previous failed vaginal cerclage, delivery before 32 weeks occurred in 8% after transabdominal cerclage and 33% after low vaginal cerclage; fetal loss occurred in 3% and 21%, respectively.⁷ A subsequent meta-analysis also associated transabdominal cerclage with lower perinatal mortality than transvaginal cerclage, although studies were heterogeneous and included both laparoscopic and open abdominal procedures.⁹ Retrospective comparisons have reported similar findings but remain vulnerable to confounding by indication.¹⁰ Our results therefore provide contextual support for LAC but do not independently establish superiority over transvaginal cerclage.

Although delivery before 34 weeks was uncommon, preterm birth before 37 weeks occurred in 35.0% of evaluable live-birth pregnancies. Fourteen preterm deliveries followed spontaneous preterm labor and four followed PPRM; three were medically indicated because of severe fetal growth restriction with fetal distress or severe preeclampsia. LAC addresses mechanical cervical insufficiency but cannot prevent preterm birth through other obstetric pathways. No neonate weighed below 1500 g, although birthweight was unavailable for three neonates and long-term neonatal outcomes were not assessed.

All 71 procedures were completed laparoscopically without conversion, organ or vascular injury, blood transfusion, or recorded postoperative complication. Median operative time was 70 minutes, and all women were discharged on the first postoperative day. These findings are compatible with evidence that laparoscopy provides obstetric outcomes comparable to open abdominal cerclage while permitting shorter hospitalization and lower wound-related morbidity.^{5,6} LAC has consequently been proposed as a minimally invasive option for refractory cervical insufficiency requiring abdominal placement.¹¹ However, blood loss was not routinely quantified, and this cohort was insufficient to exclude uncommon adverse events.

Five pregnancies (7.7%) required additional transvaginal cerclage because serial ultrasonography showed progressive funneling beyond the abdominal cerclage. Four resulted in live birth; one developed PPRM and chorioamnionitis and was terminated at 21 weeks. With only five treated pregnancies, no untreated group with comparable ultrasound findings, and no uniform cervical-length threshold, these observations cannot establish efficacy or define a treatment criterion. They describe circumstances in which individualized intervention was considered at our center.

An abdominal cerclage may remain in situ for subsequent pregnancies, and favorable consecutive pregnancy outcomes have been reported.¹² In our cohort, the tape was generally retained during subsequent pregnancies and cesarean deliveries. In two women it was removed during pregnancy termination, followed by repeat LAC before a later pregnancy; these cases account for the difference between 69 women and 71 procedures.

Nine women underwent LAC without previous transvaginal cerclage because of post-conization cervical deficiency, congenital uterine or cervical anomalies, or declining vaginal cerclage after counseling. Exploratory analyses found no statistically significant differences in post-LAC pregnancy or live birth according to previous transvaginal cerclage. Current recommendations permit abdominal cerclage without a previous failed vaginal procedure when insufficient cervical tissue makes vaginal placement unsuitable.^{3,8} However, our no-prior-cerclage group was small and heterogeneous, and its wide confidence intervals preclude conclusions about equivalence or broader indications.

Pregnancies requiring additional transvaginal cerclage also did not differ significantly from those managed with LAC alone in live birth, preterm birth, or gestational age. This analysis included only five additional-cerclage pregnancies and was not adjusted for the cervical changes prompting intervention. Given the very small additional-cerclage group, these exploratory findings should be considered hypothesis-generating only and should not be interpreted as evidence of comparative effectiveness or equivalence between management strategies.

Strengths include the relatively large single-center experience, a consistent surgical approach, explicit separation of patient- and pregnancy-level denominators, verified pregnancy outcomes, and reporting of operative outcomes, preterm-birth causes, birthweight, and additional-cerclage cases.

Limitations include the retrospective single-center design, incomplete documentation, selection bias, and limited generalizability from a specialized referral center. Women referred but not meeting institutional indications were not systematically recorded, and no contemporaneous transvaginal or expectantly managed control group was available. Exploratory subgroups and adverse-event counts were small, precluding stable multivariable analysis. Within-woman correlation from repeated pregnancies was not modeled. Gestational age was unavailable for two live-birth pregnancies, birthweight for three neonates, and detailed cervical and examination findings were not uniformly available for additional-cerclage cases. Blood loss and long-term maternal and neonatal outcomes were not assessed.

In conclusion, preconceptional LAC was associated with low recorded perioperative morbidity, a high proportion of pregnancies resulting in live birth, and infrequent delivery before 34 weeks in this selected cohort. The absence of a concurrent comparison group and small clinically important subgroups require cautious interpretation. Prospective multicenter studies using standardized eligibility and outcome definitions are needed to refine patient selection and additional interventions after LAC.

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