

Laparoscopic Non-Mesh Cerclage Pectopexy with Uterine Preservation for Pelvic Organ Prolapse

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Abstract

Pelvic organ prolapse (POP) affects millions of women globally and carries a significant socioeconomic burden. Adequate apical support is essential for treating POP. Recent research has increasingly validated the efficacy and safety of laparoscopic pectopexy (LP) for addressing apical POP. However, the cost of synthetic mesh and associated complications restrict the widespread use of this technique. Our team previously published a study describing a novel, non-mesh procedure called laparoscopic non-mesh cerclage pectopexy (LNMCP), demonstrating successful outcomes with satisfactory objective and subjective success rates. Many patients express a preference for retaining their uterus during prolapse surgery due to considerations related to sexuality, partnership, and body image.

The present research introduces a novel approach known as laparoscopic non-mesh cerclage pectopexy with uterine preservation (**LNMCPUP**) for POP, wherein the uterus is suspended to the iliopectineal ligament through the round ligament using permanent cerclage sutures. We successfully performed this procedure in 14 cases at our hospital, six of whom still had menstruation, and the remaining eight were postmenopausal, with a mean operation time of 54.43 min ($\pm$ 10.18 min) and an average bleeding volume of 53.57 mL ($\pm$ 48.77 mL). The mean follow-up duration was 19.71 ± 15.87 months. The objective success rate of **LNMCPUP** was 100%, with a subjective success rate of 92.86%. No significant complications were observed during or after surgery. **LNMCPUP** integrates cervical cerclage and shortening of the round ligament, as well as LP without using mesh, thereby eliminating the risk of mesh erosion and lowering healthcare costs. Moreover, this novel technique is relatively easy to master, making it accessible even in rural and underdeveloped areas where

synthetic mesh is unavailable. Therefore, it is worthwhile to adopt LNMCPUP in POP patients who desire the preservation of their uterus.

Introduction

Pelvic organ prolapse (POP) significantly impacts the well-being of a substantial portion of parous women over 50 years old¹. With an increasing average lifespan, a higher number of women will require POP surgery. The gold standard for treating uterine prolapse is laparoscopic sacrocolpopexy (LS), in which the vaginal apex is attached to the sacrum over the third and fourth sacral vertebrae using mesh, boasting a success rate exceeding 95% and long-term durability². However, LS is a challenging procedure commonly associated with postoperative defecation problems³. Additionally, LS may not be suitable for obese patients. Laparoscopic pectopexy (LP), in which the iliopectineal ligaments are used for a bilateral mesh fixation of vaginal vault or cervical stump, has emerged as a viable alternative to LS for addressing apical prolapse, due to comparable clinical efficacy and a lower incidence of defecation disorders⁴.

However, the usage of synthetic mesh for apical support in LS and LP causes mesh-related complications, increasing patient suffering and medical expenses⁵. Our team has published a new procedure called laparoscopic non-mesh cerclage pectopexy (LNMCP), embedding permanent cervical cerclage sutures in the round ligament until the iliopectineal ligament. This was successfully performed with high objective and subjective success rates⁶. Recent evidence suggests that many women with prolapse issues desire to preserve their uterus, which is paramount for maintaining self-confidence, self-esteem, and a sense of femininity⁷.

The current research reports the development of a novel approach known as laparoscopic non-mesh cerclage pectopexy with uterine preservation for POP (**LNMCPUP**) for addressing apical prolapse. This novel technique involves embedding cervical cerclage sutures in the round ligament until the iliopectineal ligament, resulting in a firm uterine suspension. In addition, without using synthetic mesh, this procedure obviates mesh erosion while reducing medical costs. Moreover, this procedure ensures that the uterus is preserved, thereby minimizing perioperative risks associated with hysterectomy and eliminating significant alterations in POP surgery outcomes⁸.

Protocol

The Institutional Review Board of the hospital approved the protocol (IRB Approval Number 2021-040). Informed consent for publication was obtained from each participant. Inclusion criteria encompassed women diagnosed with uterine prolapse at Pelvic Organ Prolapse Quantification (POP-Q) stage 2 or higher with related symptoms who were eligible for surgical treatments and were able to read Chinese. Assessment for eligibility was performed by a gynecologist at the hospital. All patients had a standardized preoperative POP assessment using the POP-Q system in lithotomy position as well as via ultrasonography. Patients with co-existing anterior/posterior defects or concomitant incontinence surgery were also included. Women with contraindications for laparoscopic surgery, established genital malignancy, previous surgical treatment of vault prolapse, language issues and those not available for

follow-up were excluded. Patients agreed to return the questionnaires and visit the follow-up appointments. See **Table of Materials** for details about equipment and other materials used in this protocol.

1. Planning for prolapse surgery

1. Inform the patients about the risks and potential complications, including the possibility of switching to open laparotomy, excessive bleeding, wound infection, and postoperative recurrence.
 2. After obtaining informed consent, administer enoxaparin sodium injection (100 AXaIU/kg) for perioperative thrombosis prophylaxis.
 3. Have an anesthesiologist administer endotracheal general anesthesia and monitor vital signs. Administer perioperative prophylactic antibiotics intravenously 30 min before surgery; use cefuroxime (1.5 g) unless there is an allergic history.
 4. Following field skin disinfection, establish pneumoperitoneum using the Veress needle technique for insufflation via the umbilicus⁹.
 1. Place a 10 mm trocar via the umbilicus for an optical device, and introduce three 5 mm trocars (see **Table of Materials**) under direct visualization in the lower abdomen.
 2. Maintain gas intake flow at 20 L/min, and intraperitoneal pressure at 12 mmHg.
- the round ligament (**Figure 1**), attaching it to the cervical isthmus.
2. Open the vesico-uterine recursion peritoneum to expose the uterine artery.
 3. Expose the iliopectineal ligament near the landmarks-the round ligament and the obliterated umbilical artery-make an incision in the peritoneum and detach the surrounding soft tissue between the lateral umbilical ligament and round ligament, below which the iliopectineal ligament is located. Avoid contact with the external iliac vessel and obturator nerve in the target surgical region.
 4. To perform cervico-isthmus cerclage, start at 4 o'clock on the right side and go counterclockwise (**Figure 2A**), use a permanent suture (size 2, see **Table of Materials**) in the uterine isthmus to suture, ligate, and attach a round ligament to the cervical isthmus. Complete one round until the starting point is reached, performing peripheral movements with the needle around the cervix (**Figure 2B**). Tighten and secure the stitch after completing the cervical cerclage (**Figure 2C**).
 5. Embed the permanent suture into the round ligament, ending at the iliopectineal ligament (**Figure 3A,B**).
 6. Insert the stitch through the iliopectineal ligament (**Figure 4A,B**), and ensure suspension without tension (**Figure 5**).
 7. Repeat steps 2.1-2.6 on the other side of the pelvis.
 8. Perform peritoneal closure with an absorbable synthetic polyglactin braided suture (size 2-0, see **Table of Materials**).
 9. Perform anterior and/or posterior colporrhaphy if patients suffering from symptomatic POP $\geq$ stage 2 including anterior and/or posterior vaginal wall defect. Separate

2. Laparoscopic Non-Mesh Cerclage Pectopexy with Uterine Preservation (LNMCPUP) approach

1. Perform laparoscopic bilateral salpingo-oophorectomy in postmenopausal patients. Electrocoagulate and sever

the vaginal wall from cervix and pouch sutured for 1 to 2 rounds in the outer bladder/rectal fascia to repair the cystocele/rectocele. Suture arcus tendinous fascia pelvis/arcus tendinous musculi levator ani in a U-shape and closed anterior and/or posterior vagina wall.

10. Perform anti-incontinence surgery inside-out tension-free vaginal tape-obturator (TVT-O) before **LNMCPUP** if patients are diagnosed with serious Stress Urinary Incontinence (SUI) based on preoperative urodynamic examination. If patients were diagnosed with middle SUI, counsel them about the risk of postoperative SUI condition aggravation, and perform TVT-O at the patients' discretion.

NOTE: The LNMCPUP technique is shown in a schematic diagram (**Figure 6**).

3. Management after LNMCPUP surgery

1. Record necessary data, including the operation time of **LNMCPUP**, total blood loss, and associated complications.
2. Advise all postmenopausal patients to use low-dose transvaginal estrogen for 6 weeks after surgery.
3. Advise all patients to engage in pelvic floor exercises starting 8 weeks after surgery.
4. Perform follow-up of patients 6 weeks, 6 months, and 1 year after surgery.
 1. Conduct a gynecological examination using POP-Q system for assessing prolapse, an important reference point is the hymen. Grade genital prolapse stages 1-4 according to achieved optimal POP-Q scores.
 2. Ask patients to complete Patient Global Impression of Improvement (PGI) questionnaire to evaluate

the postoperative condition relative to the condition before the surgical intervention. Use a single question to rate the condition; the answer will be on a scale from "1. Very much better" to "7. Very much worse"¹⁰.

3. Ask the patients to complete the Prolapse Quality of Life (P-QOL) questionnaire and the Pelvic Organ Prolapse Urinary Incontinence Sexual Questionnaire (PISQ-12).

NOTE: The PISQ-12 is a self-administered questionnaire that evaluates the sexual function of women with pelvic organ prolapse or urinary incontinence¹¹.

5. Calculate the subjective and objective success rates. Define objective success as the absence of prolapse of the vault beyond the hymen, with optimal POP-Q stage ≤ 1 . Define subjective success as the absence of bothersome bulge symptoms (vaginal bulging and protrusion according to the validated questionnaire), without repeat surgery or pessary use for recurrent vault prolapse¹².

NOTE: We considered an objective success rate of our medical care if POP-Q measurements Ba, Bp, and C ≤ 0 (optimal POP-Q stage ≤ 1) and a subjective success rate of our medical care if the PGI was ≤ 2 . Systematic assessment was done for complications such as *de novo* SUI, reoperation for SUI or recurrent POP, and *de novo* dyspareunia.

Representative Results

We successfully performed Laparoscopic Non-Mesh Cerclage Pectopexy with Uterine Preservation (**LNMCPUP**) in 14 patients over the past 2 years, six of whom were premenopausal, and the remaining eight were

postmenopausal. Their average $\pm$ Standard deviation (SD) age was 52.93 ± 9.94 years, with a mean $\pm$ SD Body mass index (BMI) of 23.46 ± 1.95 . The average $\pm$ SD bleeding volume during surgery was 53.57 ± 48.77 mL, and the mean $\pm$ SD operation time was 54.43 ± 10.18 min. The mean $\pm$ SD follow-up duration was 19.71 ± 15.87 months, during which no perioperative complications were observed (see Table 1). One patient reported experiencing a temporary issue with blood flow during menstruation in the first month

after surgery, which resolved shortly thereafter. The results indicated an objective success rate of 100% and a subjective success rate of 92.86% (see Table 1, Table 2, and Table 3). As the 14 patients had anterior and/or posterior defects, we performed anterior and/or posterior colporrhaphy at the same time. Seven of the 14 patients also had mild Stress Urinary Incontinence (SUI); however, none of them underwent anti-incontinence surgery.



Figure 1: Cutting of the round ligament. The right round ligament was electrocoagulated and severed. [Please click here to view a larger version of this figure.](#)

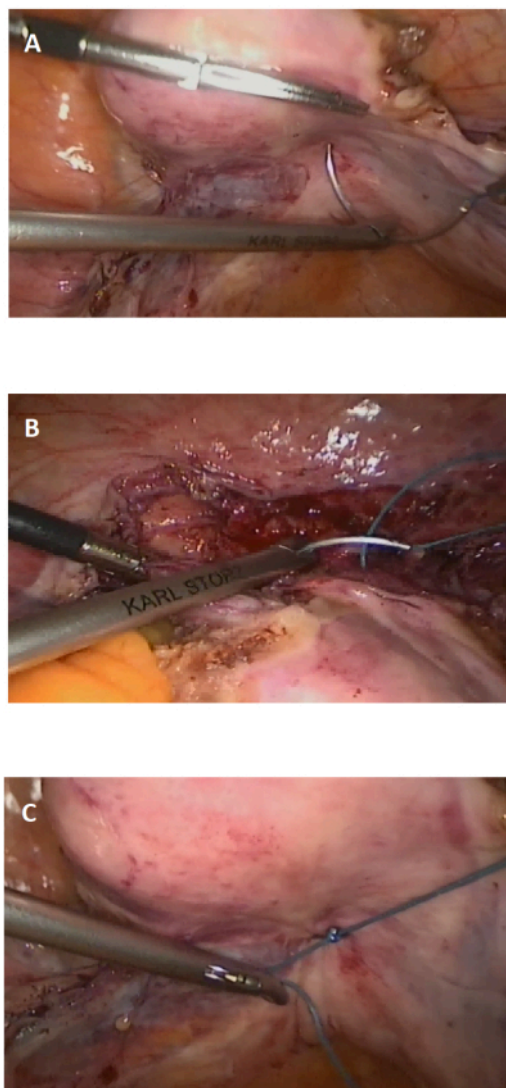


Figure 2: Surgical steps of cervico-isthmic cerclage. A permanent suture was used to tighten uterine isthmus around the cervix. [Please click here to view a larger version of this figure.](#)

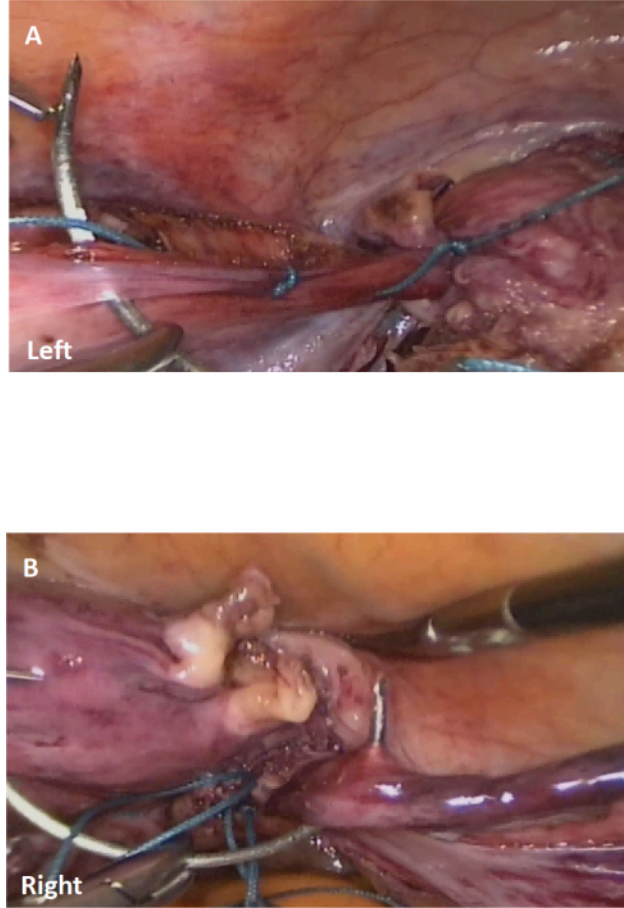


Figure 3: Embedding the suture in the round ligament. A permanent suture was penetrated to the round ligament. [Please click here to view a larger version of this figure.](#)

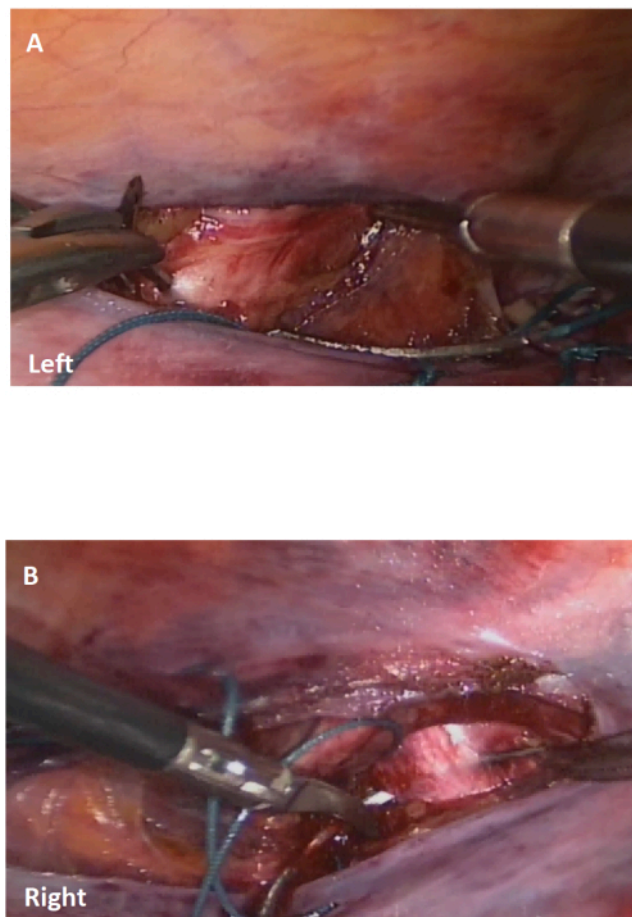


Figure 4: Surgical steps in pectopexy. The right iliopectineal ligament was exposed and passed through by the permanent suture. [Please click here to view a larger version of this figure.](#)

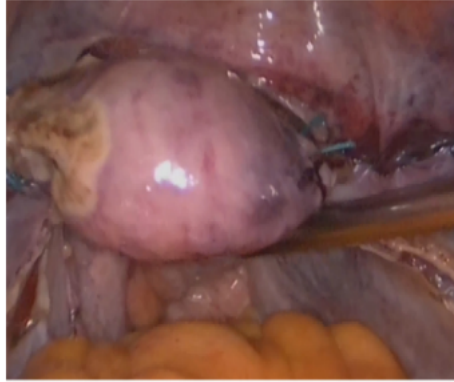


Figure 5: Tension-free anchoring. The cervix was elevated to Pelvic Organ Prolapse Quantification (POP-Q) stage 0 to ensure suspension without tension. [Please click here to view a larger version of this figure.](#)

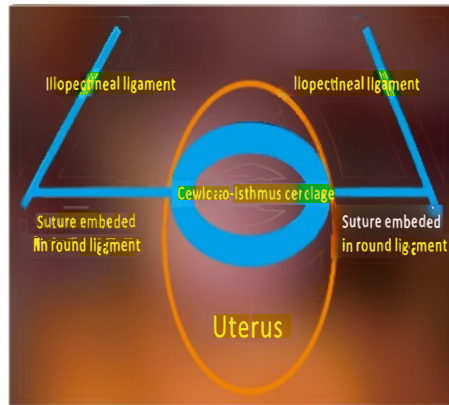


Figure 6: Schematic diagram of the LNMCPUP approach. The LNMCPUP procedure included cervico-isthmus cerclage, embedding suture in the round ligament, and non-mesh pectopexy. [Please click here to view a larger version of this figure.](#)

	Basic parameters and surgical outcomes
Age	52.93 ± 9.94 years
BMI	23.46 ± 1.95
Parity	2.43 ± 1.02
POP-Q stage	2–4
Ba	1.86 ± 2.18 cm
Bp	-1.36 ± 2.21 cm
C	1.36 ± 2.24 cm
Operation time	54.43 ± 10.18 min
Estimated blood loss	53.57 ± 48.77 mL
Duration of follow-up	19.71 ± 15.87 months
Complications	None
Subjective success rate (PGI ≤ 2)	92.86%
Objective success rate	100%

Table 1: Basic parameters of the participants and surgical outcomes of the LNMCPUP approach in 14 cases.

Evaluation items of surgical outcomes included operation time, total blood loss, associated complications, and subjective and objective success rate. Abbreviations: BMI = body mass index, PGI = Patient Global Impression; Ba, Bp, and C refer to the POP-Q scoring system.

Objective Success Rate	
POP-Q Stage	Number of Patients
POP-Q Stage ≤ 1	14
POP-Q Stage ≥ 2	0
Objective Success Rate (POP-Q Stage ≤ 1)	100%

Table 2: Evaluation of objective success rate. Objective success rate was calculated by dividing the number of patients with postoperative POP-Q measurements Ba, Bp, and C less than or equal to 0 (optimal POP-Q stage ≤ 1) by the total number of patients. All the patients were anatomically successful with postoperative POP-Q stage 0 or stage 1.

Subjective Success Rate	
PGI Scale	Number of Patients
PGI $\leq$ 2	13
PGI > 2	1
Subjective Success Rate (PGI $\leq$ 2)	92.86%

Table 3: Evaluation of subjective success rate. Subjective success rate was calculated by dividing the number of patients with the Patient Global Impression of Improvement (PGI) $\leq$ 2 by the total number of patients. The patient experiencing a temporary issue with blood flow during menstruation after surgery gave the answer "3. slightly better" on the PGI questionnaire survey, the remaining 13 patients were satisfied with the procedure and gave the answer "1. Very much better" or "2. Much better" on the PGI questionnaire survey.

Discussion

A significant number of elderly women worldwide experience Pelvic Organ Prolapse (POP), which involves the descent of at least one pelvic organ. As society ages, the demand for POP surgery is expected to rise dramatically¹³. Laparoscopic Sacrocolpopexy (LS) is the primary surgical technique for addressing apical prolapse. However, the high incidence of postoperative defecation problems associated with LS cannot be overlooked¹⁴. Laparoscopic Pectopexy (LP) an alternative method for apical repair, utilizes bilateral iliopectineal ligament suspension, which minimizes defecation disorders due to the preservation of the posterior pelvic space¹⁵.

However, LS and LP both involve the usage of synthetic mesh, which is costly and can lead to mesh erosion, limiting its widespread application¹⁶. In response, we have developed a new approach called Laparoscopic Non-Mesh Cerclage Pectopexy with Uterine Preservation (**LNMCPUP**), which showed excellent efficacy, comparable to that of LP¹⁷. A high proportion of women undergoing POP surgery express a

desire to preserve their uterus to retain self-confidence, self-esteem, and femininity. Traditional POP surgeries typically involved hysterectomy, but the rationale for this approach has been questioned¹⁸. Surgeries that preserve the uterus may offer long-term benefits and reduce the risk of potential complications⁸. The uterus is crucial for pelvic floor stability, as the cervix plays a significant role in pelvic suspensory system by providing attachment for uterosacral and cardinal ligaments. Uterine preservation surgeries are increasingly performed to meet the physical and psychological needs of POP patients¹⁹.

The key features of **LNMCPUP** include the following:

Cervico-isthmic cerclage

We selected a circular suture medial to uterine arteries around the cervical isthmus based on its firm anchoring to the cervix without compromising uterine blood flow and preventing laceration of the cervical tissue, a critical step in preserving uterine health during **LNMCPUP**. Tying the cerclage knot too tight may cause poor menstrual blood flow or amenorrhea. One patient in our study complained of obstructed menstrual

blood flow in her first period after surgery; 3 months later, this condition resolved on its own. We adopted an efficient method to avoid this problem. In this method, we utilized uterine manipulator in the form of No. 6 Hegar dilator in premenopausal patients during the procedure, to prevent possible blockage of the endocervical canal, which was then removed after securing the knot.

Confirmation of the iliopectineal ligament

Careful identification and confirmation of the iliopectineal ligament, located between the lateral umbilical ligament and round ligament, are essential to avoid damage to nearby structures such as the corona mortis and obturator nerve²⁰, ensuring the safety and efficacy of **LNMCPU**.

Embedding a permanent suture in the round ligament

Bowels and bladder adjacent to the round ligament may be damaged by the naked permanent suture with high tension, as a high tensile strength is reinforced by suspension between the cervical isthmus and the iliopectineal ligament. To prevent pelvic organ laceration from stitches with tension, we adopted the most efficient technique of embedding the permanent suture in the round ligament.

Suspension without tension

The cervix was elevated to Pelvic Organ Prolapse Quantification (POP-Q) stage 0 to ensure suspension without tension, avoiding overcorrection.

In conclusion, this pilot study demonstrates the promising potential of **LNMCPU** as a novel method for correcting POP. This procedure combines cervical cerclage and laparoscopic pectopexy, resulting in a firm uterine suspension while also preserving the uterus to meet patients' physical and psychological needs. The outcomes of **LNMCPU** mirrors outstanding efficacy and safety, with satisfactory objective

and subjective success rates comparable to those of laparoscopic pectopexy. Moreover, without using synthetic mesh, this procedure obviates the risk of mesh erosion and reduces medical costs. Thus, **LNMCPU** can be performed even in rural and underdeveloped areas where synthetic mesh may not be readily available. However, this study's limitation lies in its small sample size. Multicenter investigations are necessary to validate the efficacy and safety of **LNMCPU** in clinical settings.

Disclosures

No conflicts of interest were declared by the authors.

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