

A New Laparoscopic Retroperitoneal Posterior Culdoplasty Technique

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OBJECTIVE: To test the hypothesis that laparoscopic retroperitoneal culdoplasty executed with a CO₂ laser is comparable to the same operation performed with mechanical laparoscopic instruments and to extend a previously reported series of laparoscopic posterior culdoplasties.

STUDY DESIGN: A prospective, cohort, comparison, clinical study was conducted to determine relative risk on 30 subjects who met inclu-

sion criteria for this trial. Group I patients (n = 15) were subjected to laparoscopic culdoplasty with a CO₂ laser, group II subjects (n = 15) were exposed to the same intervention with 5-mm laparoscopic mechanical instruments. Both groups were observed for intraoperative, immediate postoperative and delayed complications. During the postoperative follow-up period, the following parameters were recorded: dyschesia, dyspareunia, sexual dysfunction, pelvic pain (preoperative and postoperative rating scale for pain used).

RESULTS: There was no significant difference in clinical and demographic data between the two groups. All planned laparoscopic culdoplasties for symptomatic enterocele were successfully carried out, with no conversions to laparotomy or vaginal surgery. In group I, average operating time was 1 hour, 11 minutes, and in group II it averaged 47 minutes (P = .03). There were no intra-

operative complications or blood transfusions. During the early recovery period, 26% in group I vs. 6% in group II (P = .04) reported transitional urine retention.

Two of those patients from group I developed symptoms of lower urinary tract infections. In group I, one patient (3%) (P = .10) developed a recurrence of enterocele, grade 2. In group II, one patient (3%) (P = .10) experienced difficulty during sexual intercourse following

laparoscopic culdoplasty. In all patients but two, symptoms of dyschesia, dyspareunia and sexual dysfunction related to anatomy distortion and pelvic pain were cured. **CONCLUSION:** Laparoscopic retroperitoneal posterior culdoplasty executed with mechanical instruments yielded a clinical outcome similar to that of surgery performed with a CO₂ laser. The operative time was statistically significantly longer when the operation was performed with a laser. Using a laser increases the potential for complications associated with the laser itself and increases the cost of the operation. Ninety-three percent of patients remained symptom free after surgery. (J Reprod Med 1999;44:504-510)

Keywords: enterocele, vagina, laparoscopic surgical procedures, retroperitoneal posterior culdoplasty.

Laparoscopic retroperitoneal posterior culdoplasty performed with mechanical instruments yields a clinical outcome similar to that of surgery performed with a CO₂ laser.

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Introduction

Enterocele is a detachment of the retroperitoneal anterior rectal fascia and the posterior vaginouterine musculofascial structures (the rectovaginal septum), with or without abdominopelvic organs present (small intestine, omentum or ovary¹) in the hernia sac. The enterocele incidence is estimated to be 0.1–16% in women undergoing gynecologic surgical procedures.² In 1961, Burch³ reported that a retropubic operation for stress urinary incontinence, which he pioneered, harbored the risk of enterocele formation. His observations were confirmed by other researchers,^{4–8} and they determined that the incidence of enterocele following procedures for stress urinary incontinence (bladder neck suspension or colposuspension) ranges from 3% to 17%.

Taking under consideration the anatomic location of the defect, it becomes obvious that retroperitoneal, and not peritoneal, reconstruction of these

structural defects should be performed. A search through augmented Medline and ACOGNET computerized databases and a manual analysis of the literature on this subject failed to identify a retroperitoneal approach to repairing enterocele. Therefore, this operation can be considered a new approach.

Reviewing the most commonly used transabdominal techniques of Moschcowitz⁹ and Halban¹⁰ and transvaginal methods of Torpin¹¹ and McCall¹² and their various modifications for enterocele therapy or its prevention reveals that none of these techniques uses the same fundamental surgical principles that this author¹³ described in 1992. The differences in enterocele treatment between classic transabdominal/transvaginal techniques and this author's operation, presented below, are depicted in Table I.

The purpose of this article is: (1) to determine differences between laparoscopic culdoplasty tech-

Table I Differences Between Classic and Ostrzenski Culdoplasty for Enterocele

Surgical technique	Concept of surgical technique	Anatomic structure used for reconstruction	Comment
Moschcowitz ⁹	To obliterate the cul-de-sac with multiple, concentric purse-string nonabsorbable sutures	Peritoneum and sigmoid colon serosa and peritoneal part (superficial layer) of the uterosacral ligaments	<ol style="list-style-type: none"> 1. Endopelvic or rectal fascia or paravaginal fascia is not incorporated into reconstruction process 2. Deep layer (retroperitoneal) of uterosacral ligaments are not used
Halban ¹⁰	To obliterate the cul-de-sac with multiple nonabsorbable sutures placed in the sagittal direction	Peritoneum, sigmoid colon serosa and posterior uterine serosa	<ol style="list-style-type: none"> 1. Endopelvic or rectal fascia or paravaginal fascia is not incorporated into reconstruction process 2. Deep or superficial layer (retroperitoneal) of the uterosacral ligaments is not used.
Torpin ¹¹	To narrow the cul-de-sac and vaginal apex by vaginal and posterior cul-de-sac wedge excision	Peritoneal part (superficial layer) of uterosacral ligament, cul-de-sac peritoneum and posterior vaginal wall	<ol style="list-style-type: none"> 1. Endopelvic or rectal fascia or paravaginal fascia is not incorporated into reconstruction process 2. Deep layer (retroperitoneal) of uterosacral ligaments is not used
McCall ¹²	To narrow the cul-de-sac by plicating the uterosacral ligaments and suspending the vaginal apex from the stumps of the uterosacral ligaments	Peritoneum, peritoneal part (superficial layer) of uterosacral ligaments and vaginal apex in midline	<ol style="list-style-type: none"> 1. Endopelvic or rectal fascia or paravaginal fascia is not incorporated into reconstruction process 2. Deep layer (retroperitoneal) of uterosacral ligaments is not used
Ostrzenski ¹³	Retroperitoneally, to reconstruct the cul-de-sac and rectovaginal septum	Deep layer of uterosacral ligaments (retroperitoneal connective tissue of ligament), rectal fascia and uterovaginal fascia	<p>Fundamental differences between existing surgical techniques and Ostrzenski operation:</p> <ol style="list-style-type: none"> 1. Retroperitoneal concept of surgery 2. Retroperitoneal repair of defects 3. Retroperitoneal connective tissue, and not peritoneum, utilized for cul-de-sac and rectovaginal septum reconstruction 4. Neither vaginal length nor width is compromised

niques executed with a CO₂ laser and techniques using laparoscopic mechanical instruments, (2) to evaluate the use of a laparoscopic approach for the

The operative time was statistically significantly longer when the operation was performed with a laser.

treatment of enterocele, and (3) to extend the previously reported series of laparoscopic retroperitoneal posterior culdoplasties for symptomatic enterocele.¹³

Materials and Methods

A prospective cohort comparison clinical study was conducted to evaluate outcomes of laparoscopic posterior culdoplasty performed with and without a CO₂ laser and to determine the relative risk of the operation. Relative risk was calculated by dividing the rate of unsatisfactory outcomes of the operation in group I by the rate in group II. Thirty consecutive subjects (n = 30) enrolled in this clinical trial, and the operation was performed at the Howard University Hospital and Institute of Video Endoscopy and Laser from 1992 to 1997. Those subjects were divided into two groups: group I was composed of 15 women who were subjected to the new laparoscopic, retroperitoneal culdoplasty operation performed with a CO₂ laser; group II contained 15 patients on whom the same operation was executed with laparoscopic 5-mm mechanical (traditional) instruments. Women with or without a uterus were assigned to either group I or II on a nonrandom basis. Laparoscopic culdoplasty for pulsion enterocele was applied to all subjects.

The nature of the enterocele was determined by the clinical, site-specific, quantitative description of the posterior vaginal apex or fornix support and its anatomic relationship to the hymen. The grade of prolapse was determined by using the Baden¹⁴ classification. If "complex" prolapse was clinically suspected, in selected cases a defecography combined with a barium-filled small intestine study and/or fluoroscopic stress cystogram was performed.¹⁵ When a clinical suggestion of innervation of pelvic floor musculature disorder¹⁶ was present, electromyography was performed and recorded.¹⁶

For laparoscopic culdoplasty executed with a CO₂ laser, a no. 4-0 polydioxanone (PDS) suture was used, and a no. 0 PDS Endoknot suture was used when the operation was performed without a laser.

The following inclusion criteria were adopted for the study:

1. Pulsion enterocele¹ clinically documented.
2. Symptoms associated with enterocele present ("bearing down," pressure or fullness in the rectum, the sensation of a bulging mass in the vagina, pelvic pressure, pelvic pain, low back pain, deep dyspareunia or difficulty during sexual intercourse, and dyschesia).
3. Grade 2–4 enterocele prolapse identified.¹⁴
4. Preoperatively, other forms of pelvic relaxation ruled out.
5. Preoperatively, written informed consent obtained from a patient. (Full explanation was given about the nature of the new surgical technique and differences between alternative surgical techniques were presented; risks and benefits were described.)

Exclusion criteria included:

1. Other type of enterocele (congenital, traction, iatrogenic).
2. Other than pulsion enterocele forms of pelvic organ relaxation present.
3. Patient choosing a different surgical technique.
4. Direct contraindication to a laparoscopic approach.¹⁷
5. Pelvic floor nerve damage.

Thirty consecutive patients were operated on for symptomatic pulsion enterocele who met all the inclusion parameters. In both groups the operative time, intraoperative, and immediate, postoperative and delayed complications were recorded. The operative time was measured from Veress needle insertion to skin closure in both groups. All patients were followed at intervals of 1 month for the first 3 months and then every 6 months for a full 24 months by either the referring physician or this author.

During the follow-up period, the following parameters were evaluated and recorded:

1. Recurrent postoperative enterocele and its grade.
2. Sensation of bearing down, pressure or fullness in the rectum.
3. Feeling of a bulging mass in the vagina.
4. Pelvic pressure.

5. Pelvic pain.
6. Low back pain.
7. Deep dyspareunia or difficulty during sexual intercourse.
8. Dyschesia.
9. Preoperative and postoperative pain, ranked on scale of 1–10 and evaluated according to Revill et al¹⁸ norms.

Surgical Technique with Laparoscopic Mechanical Instruments

The systematic steps in the laparoscopic approach and the CO₂ laser technique were published in 1992. When laparoscopic retroperitoneal culdoplasty was performed with mechanical instruments, the sequence of the operation was changed as follows:

1. Posterior retroperitoneal culdoplasty was initiated by identifying the ureters bilaterally by provoking and observing ureter contractions. (If any doubt remained, the retroperitoneal space was opened so that both ureters were traced down.) In hysterectomized patients, the ureters change position and lie more medially.
2. When a uterus was present, the peritoneal hernia sac was incised and opened with 5-mm laparoscopic scissors below and between the uterosacral ligaments just above the rectovaginal space.

In a posthysterectomy woman, the technique differed in the following respects:

1. The vesicovaginal junction was identified, and the peritoneum was cut into and divided with 5-mm laparoscopic scissors.
2. This incision was continued until the endopelvic fascia was identified.
3. The peritoneum was separated from the posterior vaginal wall and the anterior rectal surface by hydrodissection and/or by a sharp dissection with scissors.
4. The entire hernia sac was freed, elevated and then excised (Figure 1).

Retroperitoneally, the deep layer of connective tissue in the uterosacral ligament was identified, and a no. 0 PDS Endoknot laparoscopic suture was used to approximate the deep layer of the right uterosacral ligament, anterior rectal fascia, left retroperitoneal deep layer of the uterosacral ligament and apex of the hernia in the rectovaginal space. (Okabayashi²⁰ recognized two superficial [peritoneal part] and deep [connective tissue] functional layers within the uterosacral ligaments.) The same suture emerged on the right uterosacral liga-

ment in the vicinity of the initial entry of the suture (Figure 2). Approximately three to six such single-type sutures were required to close the defect. The number of sutures depended upon the size of the enterocele. In order to tie, an extracorporeal, sliding square knot was made and enhanced with an intracorporeal, two-turn, flat square knot.

The abdominal cavity and pelvic areas were irrigated with normal saline solution, hemostasis rechecked, peritoneal cavity deflated and abdominal incisions closed. Before removing the laparoscopic trocar sleeves, cystoscopy was performed to establish whether the ureters were patent.

Statistical Analysis

Means and standard deviations were calculated for demographic data. Differences between the rate of satisfactory and unsatisfactory outcomes of the operations in both groups were appraised by the *t* test for continuous variables and Fisher's exact test for categorical parameters. A test for trends among proportions was used to determine the association between the rate of unsatisfactory outcomes in both groups.

Evidence-Based Medicine for Strength of Recommendation and Quality of Evidence

The *United States Preventive Service Task Force: Guide to Clinical Preventive Services*¹⁹ was used to endorse the application of laparoscopy for the surgical treatment of pulsion enterocele.



Figure 1 Well-delineated incisional borders between the posterior vaginal wall and anterior rectal surface.

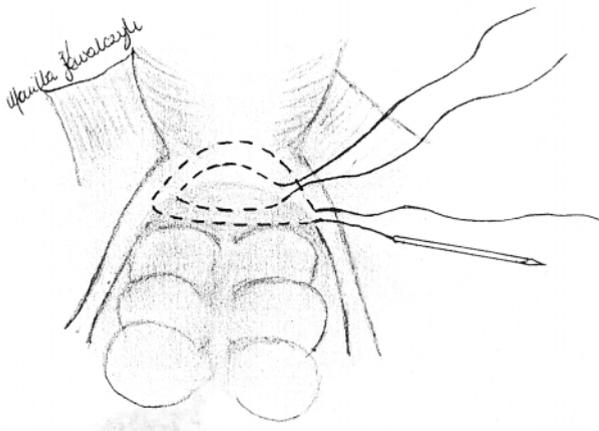


Figure 2 Retroperitoneal reconstruction of the cul-de-sac. Suture is brought through the right, deep layer of the uterosacral ligament, rectal fascia, left deep layer of the uterosacral ligament and uterovaginal fascia and emerges in the vicinity of the suture entry.

Results

Subjects consisted of 21 white women and 9 black. In group I there were 11 white subjects and 4 black, and in group II, 10 white subjects and 5 black. Two subjects in group I and one in group II had uteri. The mean (\pm SD) age was 57 ± 6 years. The mean parity was 3 ± 3 . The mean time since the operation at this writing was 51 ± 9 months. There were no significant differences in clinical characteristics or demographic data between the two groups.

Patients clinically presented with symptomatic pulsion enterocele and met the inclusion criteria. All patients had been subjected to previous urogynecologic or pelvic reconstruction procedures or both. In 26 patients (87%) (12 subjects in group I and 14 in group II), the prolapses were classified as grade 4. Three patients (10%), all in group I, presented with grade 3, and one patient (3%) in group II demonstrated grade 2. Twenty-seven women (90%) had been previously subjected to hysterectomy (20 abdominal and 7 vaginal). Also, 27 women (90%) had previously undergone retropubic colposuspension (13 subjects in group I and 14 in group II). Twenty-one women had Burch and six patients had Marshall-Marchetti-Krantz procedures performed abdominally (laparoscopic Burch operation performed on 18 and 3 women in groups I and II, respectively, via the classic laparotomy approach). In each of these cases, anterior-posterior colporrhaphy with perineoplasty had been performed for stress

urinary incontinence and unspecified forms of pelvic relaxation. Nineteen women who had undergone hysterectomy were also subjected to concomitant retropubic Burch colposuspension. All of these women presented with grade 4 prolapses. All planned laparoscopic culdoplasty for symptomatic enterocele was successfully carried out, with no conversion to laparotomy or vaginal surgery.

In group I, the operative time ranged from 1 hour, 5 minutes, to 1 hour, 17 minutes (average, 1 hour, 11 minutes). In group II it ranged from 38 to 55 minutes, averaging 47 ($P = .03$). There were neither intraoperative complications nor blood transfusions. Immediately during the postoperative period, in early recovery, four women in group I and one in group II (26% vs. 6%, $P = .04$) suffered transient urine retention, which resolved spontaneously within five hours after catheterization. Three days later, those two patients developed symptoms of lower urinary tract infections that responded to sulfa drugs. In group I, within one year of follow-up, one patient (3%) ($P = .10$) developed recurrence of enterocele, grade 2, and was reoperated on by the same technique; however, nonabsorbable sutures were used. This patient was followed for three years, seven months, after the second laparoscopic culdoplasty, and no enterocele formation was noted.

Within three months, one patient (3%) ($P = .10$) in whom enterocele recurred had the symptoms before surgery gradually manifest. In group II, one patient (3%) ($P = .10$) experienced difficulty during sexual intercourse following laparoscopic culdoplasty. In all patients but two, symptoms of dyschesia, dyspareunia, sexual dysfunction related to anatomic distortion and pelvic pain were cured.

The fact that this laparoscopic surgical method can be effortlessly executed not only laparoscopically but also transvaginally or via laparotomy makes this operation very attractive.

Discussion

This clinical study documented no statistically significant differences in the clinical outcome of this new surgical technique executed either with or without a laser. Statistically significant differences were observed in longer operating times and in minor complications of urine retention in the early postoperative period in group I (in which surgery was performed with a laser). There are several identifiable reasons for the longer time needed when a laser was used:

1. Testing the function of a laser unit after coupling it with a laparoscope.
2. Reinforcing a laser safety policy for the patient and operating room personnel.
3. Smoke evacuation and CO₂ replacement.
4. With laser tissue vaporization or excision process, decreased visibility from smoke.
5. Using backstop instruments.
6. Disconnection of the laser unit from the laparoscope.

Postoperative urine retention led to lower urinary tract infection in two cases. The most likely explanation is as follows: (1) thermoconvection injury to the surrounding tissue of the bladder may play a role in delaying bladder function, and (2) a necrotic zone is created as a result of tissue exposure to photo energy. Urine retention was noticed only among women who underwent hysterectomy; therefore, the bladder was in the vicinity of the operating field in which the CO₂ laser was employed.

Overall, the rate of complications of this operation was low in both groups. In group I, the initial surgery failed in one patient (3%). Retrospectively, critically the case was analyzed from videotapes available from the initial surgery, and the conclusion was made that two factors could have played a role: (1) a technical error in performing too superficial a vaporization of the tissue before approximation, and (2) use of 4-0 PDS suture. The fundamental role of laser vaporization of tissue in this operation is to create a base for scar formation, and a 4-0 PDS suture was used to bring tissue surfaces together and keep them together during scar formation. Upon close review, it appeared that small-caliber suture was causing very fine tissue tearing. In comparing the facts in this case from videotape to those on other patients whose surgery was successful, the case was determined to be the only one in which tearing tissue was noticeable; however, it was overlooked during surgery. Smoke accumulation played an unquestionable role in this event.

In one case from group II, sexual difficulty persisted after the operation; however, it was documented before laparoscopic culdoplasty that the vaginal length was significantly compromised (4 cm) from seven previous reconstructive pelvic operations performed at different medical centers. Preoperatively the patient was advised about such a possible outcome of surgery, and difficulty during intercourse was still present almost five years after laparoscopic culdoplasty.

Enterocoele involves anatomic defects in the

retroperitoneal area of the pelvis. It appears feasible to repair this defect retroperitoneally; however, until now either transvaginal or transabdominal reconstruction was executed by narrowing/obliterating the peritoneum and/or peritoneal part (superfi-

Using a CO₂ laser increases the potential for complications associated with the laser itself and also increases the cost of the operation.

cial layer) of the uterosacral ligaments in the cul-de-sac.¹⁰⁻¹² The purpose of the above culdoplasty operation was to restore anatomic defects where they occurred. A question arises as to whether there are strong-enough anatomic structures retroperitoneally that can be used to restore anatomic integrity. Such structures are present: the deep uterosacral ligament layer, rectal fascia and uterovaginal (paravaginal) fascia. Access to them is easy, and they are stronger connective tissue than the peritoneum itself.

Conclusion

1. Laparoscopic retroperitoneal posterior culdoplasty performed with mechanical instruments yields a clinical outcome similar to that of surgery performed with a CO₂ laser.
2. The operative time was statistically significantly longer when the operation was performed with a laser.
3. Using a CO₂ laser increases the potential for complications associated with the laser itself and also increases the cost of the operation.
4. During the course of the study, 97% of patients remained symptom free.

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